Master of Engineering

Annual Program Report

Year:	2022-2023 (updated July 24, 2023)
Program:	Master of Engineering (ME)
Contact Person (include email & phone#)	Dr. Jenny Zhou, jenny.zhou@lamar.edu, 409-880 7830

Summary of Continuous Improvement Efforts since Last Report

Provide a brief description of how assessment results have been used for program improvement. Point to a specific example of how an assessment provided the program with data it could use for improvement and what that improvement was, if possible, also show evidence of the improvement. You may look at data from the two previous academic years to support this case.

Respond here:

The Master of Engineering (ME) is a 30-semester-hour non-thesis program specifically designed to cater to the needs of practicing engineers in Chemical engineering, Civil engineering, Electrical engineering, Industrial engineering, and mechanical engineering. As the Master of Engineering (ME) and Master of Engineering Science (MES) programs share many common courses, there is some overlap between this document and the report for the Master of Engineering Science (MES) program.

The following improvements have been implemented to the Master of Engineering program.

1. During this evaluation cycle, several new course modules were developed and integrated into the existing courses, with the primary aim of enhancing students' capacity to design engineering systems that fulfill desired needs, while taking into account critical aspects such as economic, environmental, sociopolitical, safety, and global factors (Outcome 3). Despite these efforts, the assessment data did not strongly support the anticipated improvement, which might be attributed to the substantial increase in the number of graduates (three times higher). Further investigation will be necessary to better understand the underlying factors influencing the assessment outcomes and to refine the approach for future cycles.
2. In response to the students' demand for a curriculum aligned with the dynamic needs of the engineering industry, we have developed and integrated several new graduate courses into the program. These additions have been incorporated to enhance the educational experience and provide students with the necessary skills and knowledge to excel in their future careers. This ongoing effort is focused on improving all student learning outcomes.
3. The departments have made improvements to the frequency and breadth of elective offerings, creating a more diverse range of educational pathways for students entering the program. This enhancement ensures that students have the flexibility to tailor their academic journey according to their individual interests and career aspirations, fostering a more inclusive and enriching learning experience.
4. The master level courses syllabi have been reviewed and revised to increase the academic rigor of the program. This effort has been started since Summer 2022 and is an ongoing project. This effort is to improve all 3 student learning outcomes. Examples can be found in Appendix 2.
5. Graduate faculty review student feedback and make recommendations for improvement. This effort is intended to improve all learning outcomes. Examples can be found in Appendix 3.

Program Highlights Since Last Report

Identify and briefly discuss any programmatic curriculum changes made since the last report (e.g. new courses, course changes, SLO changes, course deletions).

Respond here:

1. In the 2022-2023 academic year, a total of 122 students graduated from the ME program. This number reflects a significant increase, being three times higher than the number of graduates in the previous three years.

2. New courses have been developed and added to the program. The list of new additions is as follows.

    1) CHEN 5341 Mass Transfer Operations
    2) ELEN 5303 Python Programming
    3) ELEN 5366 - Image Processing
    4) ELEN 5371 - Computational Electromagnetics
    5) ELEN 5372 - Printed Antennas & RF Circuits
    6) MEEN 5341 Modeling of Supercritical Fluids
    7) MEEN 5342 Mechanism Design and Analysis

3. Several new course modules have been developed and integrated into existing courses to improve student learning outcomes and bridge the gap between classroom learning and real-world problems. A list of new course modules with course titles follows. The development of most of the course modules on the list is sponsored by the CMMS Center.

	Course Module Title	**Course Number**	**Course Title**
1)	Application of Electrochemistry in Corrosion Prevention	CHEN5371	Materials Science and Engineering
2)	Fundamentals of Turbomachinery Applied to Midstream Industry	MEEN 5350	Turbomachinery
3)	Course Module Development and Implementation for Teaching Artificial Neural Network	CHEN 5301	Industrial Process Modeling and Optimization
4)	Course Module Development and Implementation for Teaching Principal Component Analysis	CHEN 5301	Industrial Process Modeling and Optimization
5)	Materials under Harsh Environment: Corrosion Fundamentals, Measurements, and Prevention	MEEN 5365	Advanced Materials Science
6)	Introduction of Project Management in Oil and Gas Projects	CVEN5320	Engineering Project Management
7)	Introduction to Transportation of Oil and Natural Gas	CVEN 5364	Transportation Engineering and Traffic Analysis
8)	DeltaV DCS Systems and Software for the Midstream Industry	INEN 5396	Automated Engineering Systems
9)	GIS Applications in Oil and Natural Gas Industry	CVEN5370	GIS Application in Engineering
10)	Cost estimate and control for oil and gas projects	CVEN5320	Engineering Project Management
11)	Scheduling and Resource Analysis	CVEN5320	Engineering Project Management
12)	Acquisition, Cleaning and Microscopic Analysis of Spatial Data -- Applied to Midstream Industries	CVEN5370	GIS Application to Engineering
13)	Integrity and Reliability of Thick- and Thin-Walled Pressurized Vessels	MEEN 5329	Advanced Solid Mechanics
14)	Introduction to Finite Element Analysis using ANSYS Workbench	MEEN 5325	FEA with ANSYS

4. The departments have improved the recruiting and admission process. For example, the Department of Chemical and Biomolecular Engineering has implemented holistic recruiting and application review criteria for ME-CHEN applicants. This will likely lead to increased enrollment numbers and a more well-rounded applicant pool, thus improving graduate student population quality and performance.
5. The Department of Chemical and Biomolecular Engineering department developed a survey that has been submitted to industrial partners to evaluate our current offerings in process control and provide feedback on recommended updates. As we pride ourselves on producing students well-versed in the challenges and intricacies of process control, we realize the need to maintain an evergreen educational focus in that area.
6. Some departments previously have not consistently performed continuous monitoring of master graduate students with respect to the criteria described. Moving forward, we have implemented a continuous monitoring plan that will evaluate students in both degree programs at the time they are completing their final exam (either comprehensive exam or thesis examination). This will allow better and more dynamic departmental changes to address identified deficiencies.

Table 1. Assessment Results and Analyses for Current Cycle.

STAGE 1: PLAN				STAGE 2: DO		STAGE 3: STUDY
Departmental Student Learning Goal	**Program Student Learning Outcome**	**Assessment**	**Assessment Method/Location**	**Benchmark Expectations**	**Data Results**	**Actions/Goals Based on Data Results*** What do the data tell you? How will you use this data? How were data from the last cycle used to make changes during this cycle, and What were the results of those changes?
The Master of Engineering program is a non-thesis, 30-semester-hour program designed to suit the needs of the practicing engineers in chemical engineering, civil engineering, electrical engineering, industrial engineering, and mechanical engineering.	***Outcome #1*** *An ability to apply mathematics, science, and engineering principles to solve engineering problems.*	Outcome #1 (SLO 1) is assessed by the following performance indicators (PIs). **1.1** Math, Science and Engineering Concepts **1.2** Math and Engineering Reasoning **1.3** Strategy/ Procedures The assessment rubrics can be found in Appendix 1.	The outcome is evaluated through the Comprehensive Exam, which takes place during the student's last semester of study. The Comprehensive Exam committee is responsible for conducting and completing the assessment.	We aim to achieve a minimum threshold of 70% (equivalent to 2.8 out of 4) for all performance indicators related to SLO #1.	During the evaluation cycle, a total of 122 students graduated from the ME program, and assessments were conducted for all graduates. The program met the target threshold with an overall score of 3.46, composed of individual scores of 3.41, 3.47, and 3.49 for the three PIs. However, a decline was observed in all three PIs compared to previous evaluation cycles, which could potentially be attributed to the significant increase (3 times higher) in the number of graduates. For a detailed data comparison between this cycle and previous cycles, please refer to Table A below.	The following continuous improvements are planned for the next assessment cycle: • Recognizing that all outcomes were assessed using a single assessment tool, a new assessment method will be added to provide a more comprehensive evaluation. To achieve this, we will thoughtfully select five courses, each representing one of the following different engineering disciplines: Chemical, Civil, Electrical, Industrial, and Mechanical engineering. These chosen courses will be tailored to specifically address the outcome, allowing for a more targeted and diverse assessment approach. • The rubric for the performance indicators related to the outcome will be updated to align with the newly added assessment method. • An assessment map for outcomes vs. assessment methods in current and upcoming cycles can be found in Table B below.

	Outcome #2: *An understanding of professional responsibility, ethics and methods of communication in the practice of engineering.*	Outcome #2 is assessed by the following performance indicators (PIs). 2.1 Understand professional responsibility. 2.2 Understand ethical responsibility. 2.3 Clarity and effectiveness of communication The assessment rubrics can be found in Appendix 1.	The outcome is evaluated through the Comprehensive Exam, which takes place during the student's last semester of study. The Comprehensive Exam committee is responsible for conducting and completing the assessment.	We aim to achieve a minimum threshold of 70% (equivalent to 2.8 out of 4) for all performanc e indicators related to SLO #2.	During the evaluation cycle, the ME program witnessed a total of 122 students graduating, and assessments were conducted for all graduates. The program successfully met the target threshold with an overall score of 3.56, comprising individual scores of 3.52, 3.55, and 3.61 for the three PIs. However, it was observed that all three PIs experienced a decline compared to previous evaluation cycles, which could potentially be attributed to the significant increase in the number of graduates. For a detailed data comparison between this cycle and previous cycles, please refer to Table A below.	The following continuous improvement is planned for the next assessment cycle: (1) Due to its limited measurability, this outcome will be removed in the upcoming assessment cycle. (2) The current outcome will be replaced by the following new outcome, which will be implemented in the upcoming cycle. New Outcome: “An ability to use modern engineering tools to produce engineering analysis in a systematic manner.” (3) For the upcoming cycle, in addition to the Comprehensive Exam, a new assessment method will be added to provide a more comprehensive evaluation. To achieve this, we will thoughtfully select five courses, each representing one of the five different engineering disciplines. (4) The rubric for the performance indicators related to the outcome will be developed and updated to align with newly added outcome and assessment method. (5) An assessment map for outcomes vs. assessment methods in current and upcoming cycles can be found in Table B below.

	Outcome #3*: An ability to design an engineering system that meets desired needs with appropriate consideration of economic, environmental, sociopolitical, safety and global factors.*	Outcome #3 is assessed by the following performance indicators (PIs). 3.1 Apply engineering principles to meet the needs of designed engineering system. 3.2 Apply design skills to achieve high quality engineering work. 3.3 Perform design with consideration of economic, environmental, sociopolitical, and global factors	The outcome is evaluated through the Comprehensive Exam, which takes place during the student's last semester of study. The Comprehensive Exam committee is responsible for conducting and completing the assessment.	We aim to achieve a minimum threshold of 70% (equivalent to 2.8 out of 4) for all performanc e indicators related to SLO 3.	During the evaluation cycle, the ME program witnessed a total of 122 students graduating, and assessments were conducted for all graduates. The target threshold was met with an overall score of 3.50 (3.51, 3.54 and 3.47 on three PIs). However, it was observed that all three PIs experienced a decline compared to previous evaluation cycles, which could potentially be attributed to the significant increase in the number of graduates. For a detailed data comparison between this cycle and previous cycles, please refer to Table A below.	The following continuous improvements are planned for the next assessment cycle: • Recognizing that all outcomes were assessed using a single assessment tool, a new assessment method will be added to provide a more comprehensive evaluation. To achieve this, we will thoughtfully select five courses, each representing one of the following different engineering disciplines: Chemical, Civil, Electrical, Industrial, and Mechanical engineering. These chosen courses will be tailored to specifically address the outcome, allowing for a more targeted and diverse assessment approach. • The rubric for the performance indicators related to the outcome will be updated to align with the newly added assessment method. • An assessment map for outcomes vs. assessment methods in current and upcoming cycles can be found in Table B below.

Table 2. Continuous Improvement Results Since Last Report

Stage 4: ACT		
Actions/Goals Based on Data Results **Copy last cycle's actions/goals and report on progress toward continuous improvement on those here.*	**Status** *C=Complete* *P=Progressing* *N=No Action Taken*	**Discussion of Status** *If C, describe efforts that led to accomplishment of actions/goals.* *If P, provide update on progress made toward accomplishing actions/goals and what tasks remain* *If N, discuss why action toward accomplishing actions/goals has been delayed and what work will be initiated toward accomplishment.*
Course addition and deletion - In response to students' demands for a dynamic curriculum, new graduate courses are developed and added, while outdated courses are reviewed and removed. These efforts ensure an up-to-date and relevant curriculum, meeting the evolving demands of the engineering field. Additionally, ongoing work will focus on incorporating engineering math and science courses to further enrich the program.	P	Numerous courses have been both added and removed from the catalog, with this process being an ongoing effort. Several course addition requests are currently under consideration and in progress. This continuous review and adjustment of the course offerings ensure that our curriculum remains dynamic and responsive to the changing needs of our students and the engineering industry.
Review and modify the existing syllabi and change course prerequisites	P	Some existing syllabi have been reviewed and revised. More course syllabi will be reviewed and revised by the departments. This is an ongoing project.
Several new course modules were developed and seamlessly into the existing courses, with the primary aim of enhancing students' capacity to design engineering systems that fulfill desired needs, while taking into account critical aspects such as economic, environmental, sociopolitical, safety, and global factors (Outcome 3).	P	Despite these efforts, the assessment data did not strongly support the anticipated improvement, which might be attributed to the substantial increase in the number of graduates (three times higher). Further investigation will be necessary to better understand the underlying factors influencing the assessment outcomes and to refine the approach for future cycles. This is an ongoing project.

Table A: Detailed Data for This Cycle and the Previous cycles (2022-2023)

	AY 2022-23	AY 2021-22	AY 2020-21	AY 2019-20
Number of students graduated and assessed	122	36	40	52
SLO 1	3.41	3.55	3.78	3.6
	3.47	3.79	3.94	3.4
	3.49	3.86	3.71	3.5
SLO 2	3.52	3.48	3.78	3.5
	3.55	3.62	3.61	3.4
	3.61	3.86	3.61	3.4
SLO 3	3.51	3.83	3.8	3.4
	3.54	3.86	3.6	3.6
	3.47	3.69	3.6	3.3

Table B - Assessment Map: Outcomes vs. Assessment Methods in Current and Upcoming Cycles

Outcomes	**2022-2023** Assessment Method	**2023-2024** Assessment Method	**2026-2027** Assessment Method	**2027-2028** Assessment Method
Outcome 1				
SLO 1 An ability to apply the knowledge of mathematics, sciences, and engineering to solve scientific and engineering problems of complex natures.	• Comprehensive Exam	• Comprehensive Exam • Five courses (one course in each of five different disciplines)	• Comprehensive Exam • Five courses (one course in each of five different disciplines)	• Comprehensive Exam • Other five courses (one course in each of five different disciplines)
Outcome 2				
Current SLO 2 An understanding of professional responsibility, ethics and methods of communication in the practice of engineering	• Comprehensive Exam	Note: Due to its limited measurability, this outcome will be removed in the upcoming assessment cycle.	NA	NA
Future SLO 2 An ability to use modern engineering tools to produce engineering analysis in a systematic manner.		• Comprehensive Exam • Five courses (one course in each of five different disciplines)	• Comprehensive Exam • Five courses (one course in each of five different disciplines)	• Comprehensive Exam • Other five courses (one course in each of five different disciplines)
Outcome 3				
SLO 3 An ability to design an engineering system that meets desired needs with appropriate consideration of economic, environmental, sociopolitical, safety and global factors.	• Comprehensive Exam	• Comprehensive Exam • Five courses (one course in each of five different disciplines)	• Comprehensive Exam • Five courses (one course in each of five different disciplines)	• Comprehensive Exam • Other five courses (one course in each of five different disciplines)

Appendix 1: Master of Engineering Assessment Rubrics

Outcome #1: An ability to apply mathematics, science, and engineering principles to solve engineering problems.

PI	**4-Exemplary**	**3-Acceptable**	**2-Marginal**	**1-Unacceptable**
Math, Science and Engineering Concepts	Explanation shows good understanding of the math and engineering concepts used to solve the problem(s).	Explanation shows some understanding of the math and engineering concepts used to solve the problem(s).	Explanation shows little understanding of the math and engineering concepts needed to solve the problem(s).	Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s)
Math and Engineering Reasoning	Clear evidence of effective math and engineering reasoning.	Some evidence of math and engineering reasoning.	Little evidence of math and engineering reasoning.	No evidence of math and engineering reasoning.
Strategy/ Procedures	Clear evidence of using effective strategies to solve the problem(s).	Some evidence of using strategies to solve the problem(s), but not doing it consistently.	Rarely uses an effective strategy to solve problems.	Never uses an effective strategy to solve problems.

Outcome #2*:* An understanding of professional responsibility, ethics and methods of communication in the practice of engineering.

Dimension	**4-Exemplary**	**3-Acceptable**	**2-Marginal**	**1-Unacceptable**
Understand professional responsibility	Describe the professional impact of a solution in details with pertinent facts. Ascertain exactly what decision must be decided upon.	Identify the professional impact, including pertinent facts, and ascertain possible decisions for consideration.	Have a vague idea of the professional impact and is uncertain what must be decided upon.	Do not recognize the professional impact and does not identify what must be done.
Understand ethical responsibility	Describe the ethical impact of a solution in details with gathered pertinent facts. Ascertain exactly what action must be taken.	Identify the ethical impact, including pertinent facts, and ascertains various possible solutions.	Have a vague idea of the ethical impact and is uncertain what must be done.	Do not recognize the ethical impact and does not identify what decision must be made.

Clarity and effectiveness of communication	Communication is clear, organized, effective and accurate.	Communication is somewhat lacking in one of the following: clarity, organization, effectiveness, and accuracy.	Communication is weak in two or three of the critical areas: clarity, organization, effectiveness, and accuracy.	Communication is weak in all the following areas: clarity, organization, effectiveness, and accuracy.

Outcome #3: An ability to design an engineering system that meets desired needs with appropriate consideration of economic, environmental, sociopolitical, safety and global factors.

Dimension	**4-Exemplary**	**3-Acceptable**	**2-Marginal**	**1-Unacceptable**
Apply engineering principles to meet the needs of designed engineering system	Correctly apply engineering principles to meet the needs in one or more engineering systems.	Apply proper engineering principles for analysis and design, but the application is limited in completion.	Understand engineering principles but lack of consideration in analysis and design, not fully utilize the engineering principles.	Do not understand the engineering principles in the analysis/design and lack of application in any engineering works.
Apply design skills to achieve high quality engineering works	Effectively apply design skills to achieve a high-quality work in engineering within all constraints considered.	Familiar with design skills to complete a required engineering work, but the skills do not show broad applications.	Understand the importance of design skills but cannot complete a required task, with limited consideration of applications.	Lack understanding, design skills; have no knowledge on how to use them to accomplish engineering tasks.
Perform design with consideration of economic, environmental, sociopolitical, and global factors	Demonstrate understanding and perform the design with consideration of 3 or more factors.	Demonstrate some understanding and perform the design with consideration of 2 factors.	Demonstrate minimal understanding and perform the design with consideration of 1 factor.	Show no understanding of the design process without consideration of any factor.

Appendix 2: Example of Syllabus Revision and New Course Development

DEPARTMENT OF ELECTRICAL ENGINEERING
Summary of the Proposed Changes and New Graduate Courses

Current From University Catalog	Suggested Modification	Modifications			
		Title	Description	Pre-Req	New
ELEN 5307 - Computer Networks I Addresses computer networks and data communications from a top-down approach. Discusses networks based applications and layered network architectures. Develops fundamental concepts of computer networks and shows how these concepts are embodied in advanced network architectures such as TCP/IP. Offered: Other	**ELEN 5307 - Computer Network Analysis & Design** This course primarily discusses computer networks from the perspective of analysis and design. Topics include network-based applications, layered network architectures, ARQ and analysis, performance analysis, packet switching, shortest path routing algorithms, design of the Internet architecture, and its widely used core protocols. Prerequisite: MATH 3370 or equivalent with a minimum grade of C.	X	X	X	
ELEN 5311 - Comp Network Security Principles and practices of cryptography, network security and secure software. Offered: Fall	**ELEN 5311 - Cyber Physical System & Security** In this course, we discuss cyber-physical systems and security, and the principles and practices of cryptography and network security. Following an introduction and review of the basics of cyber security, the course presents cyber-physical systems and security, security of wireless sensor networks, control systems, industrial control systems, power grids, embedded systems and RFID, cryptographic methods, key distribution, protocols for	X	X	X	

Current From University Catalog	Suggested Modification	Modifications			
		Title	Description	Pre-Req	New
	authenticated and confidential communications, and IPSec. Prerequisite: ELEN 3431 or equivalent with a minimum grade of C.				
ELEN 5312 - Power Electronics The course starts with switched-mode DC-DC converters. First, basic circuit operation, including steady-state converter modeling and analysis, switch realization, discontinuous conduction mode, and transformer-isolated converters will be covered. Next, converter control systems are covered, including AC modeling of converters using averaged methods, small-signal transfer functions, and classical feedback loop design. Prerequisite: ELEN 3322.	**ELEN 5312 - Power Electronics** The course introduces the switched-mode converters. Includes steady-state converter modeling and analysis, switch realization, discontinuous conduction mode and transformer-isolated converters. Ac modeling of converters using averaged methods, small-signal transfer functions, feedback loop design and transformer design. Prerequisites: ELEN3322 or equivalent with a minimum grade of C.		X		
ELEN 5314 - Introduction to Robotics This course is concerned with fundamentals of robotics, including kinematics, dynamics, motion planning, computer vision, and control. The goal is to provide complete introduction to the most important concepts in these subjects as applied to industrial robot manipulators, mobile robots, and other mechanical systems. A complete treatment of the discipline of robotics would require several courses. Nevertheless, at the present time, the majority of robot applications deal with industrial robot arms operating in structured environments so that a first introductory course must include a rigorous treatment of such robots.	**ELEN 5314 - Robotics Systems** This course reviews the interplay between control and robotics through introducing theory and demonstrating applications. It aims to provide an in-depth coverage of control design for robotic manipulators and mobile robots. We focus primarily on fundamental theory, control design methods, and their application on practical robotic systems. Topics may include modeling of robotic systems, linear control of robotic systems, Course projects will emphasize modeling, simulation and implementation of control systems for robot applications. Prerequisite ELEN	X	X	X	

Current From University Catalog	Suggested Modification	Modifications			
		Title	Description	Pre-Req	New
	4351 or equivalent with a minimum grade of C.				
ELEN 5316 - Digital Comm I Introduction to communication systems with emphases on the analysis of baseband/bandpass digital transmission systems including probability theory. Offered: Other	**ELEN 5316 - Digital Communications** This course primarily discusses digital communication systems with an emphasis on the analysis of baseband/bandpass digital transmission systems with and without channel noise. Topics include transmission impairments, Shannon capacity, Nyquist method, baseband communications, carrier communications, FDM, sampling theory, pulse code modulation, digital representation of signals, theory of probability/random processes and its applications in digital communications, digital transmission in the presence of noise, digital modulations, optimal design of transmitter and receiver, and M-ary communications. Prerequisite: MATH 3370, ELEN 3431 and ELEN 3313, or equivalent with a minimum grade of C.	X	X	X	
ELEN 5317 - Programmable Logic Controllers This course is to teach electrical engineering students the fundamental concepts, methods of analysis and design of programmable logic controllers and systems. Topics include programmable logic controllers, ladder logic programming and advanced PLC operations. May be taken up to twice for credit.	**ELEN 5317 - PLC Systems & Programming** This course is designed to provide an in depth understanding of the PLC Networking, Analog systems, advanced instruction set features, communications, diagnostics, modem and internet connections, remote I/O, Ethernet, motion control. Formal methods are introduced during this course to encourage the students to design a control algorithm. Formal	X	X	X	

Current From University Catalog	Suggested Modification	Modifications			
		Title	Description	Pre-Req	New
	methods are also important to verify and validate the control algorithm before implementing it. Prerequisites: ELEN 3431 or equivalent with a minimum grade of C.				
ELEN 5336 - Instrumentation Systems & Automation Study of electronic instrumentation systems for performing engineering measurements on electrical, mechanical, and fluid systems; and design of modern computerized industrial control and automation systems. The topics covered include: architectures of instrumentation and industrial control and automation systems IAS; signal conditioning circuits; recording systems; measurement systems for: strain, force, displacement velocity, acceleration, temperature, fluid mass/velocity, and vibration; digital-interface; IAS design using: IEC61131-3 control programming languages, RDB, and HMI; PID-controls; open system buses; and an introduction to advanced topics in ISA.	**ELEN 5336 - Advanced Instrumentation and Automation Systems** The course starts with an overview of electronic instrumentation systems for performing engineering measurements on electrical, mechanical, and fluid systems and then progresses to more advanced topics and design of modern computerized industrial control and automation systems. The topics covered include: detailed discussion of physical principles of sensors' operation; architectures of IAS; principals of signal conditioning, recording and measurement systems for: strain, force, displacement, velocity, acceleration, temperature, fluid mass/velocity, and vibration; digital-interface; PID controls; open system buses; and other advanced topics in ISA. Prerequisite: Prerequisite: ELEN 4351 or equivalent with a minimum grade of C.	X	X	X	
ELEN 5346 - Digital Signal Processing Sampling/reconstruction, quantization, discrete-time systems, digital filtering, Z-transforms, transfer functions, digital filter realizations, discrete Fourier transform (DFT) and fast Fourier transform (FFT), finite impulse response (FIR) and infinite impulse response (IIR) filter design, and digital signal processing (DSP)applications. Offered: Other	**ELEN 5346 - Statistical DSP** This course discusses the topics of Statistical DSP. These topics include an overview of Discrete Random Processes, Wiener and Adaptive filtering, Non-parametric and Parametric spectral estimation, and Frequency estimation; and other advanced topics. Prerequisite: ELEN	X	X	X	

Current From University Catalog	Suggested Modification	Modifications			
		Title	Description	Pre-Req	New
	4314 or equivalent with a minimum grade of C.				
ELEN 5350 - Python Programming This course covers the fundamentals of computer programming using Python as a programming language. Important elements of Python programming and its unique features will be covered. Its applications to solve some engineering problems will be presented. Pre-request ELEN 1301 or equivalent with a minimum grade of C.					X
ELEN 5366 - Image Processing This course introduces the principals of Image Processing. Topics include discussions of basics of digital imaging, an overview of human visual system, intensity transformations and spatial filtering, filtering in frequency domain, image restoration and reconstruction (including the optimum approach), discussion of color modes, color image processing, wavelets and multiresolution image processing, image compression, and introduction to morphological image processing. Prerequisite: ELEN 4314 or equivalent with a minimum grade of C.					X
ELEN 5371 - Computational Electromagnetics This course covers concepts regarding electromagnetics, antennas, RF and microwaves, computational electromagnetics as well as design and simulation of various types of antennas and radar cross section using electromagnetic simulation software. In addition, some specific types of antennas such as broadband and frequency-independent antennas will be covered. Pre-request ELEN 3371 or equivalent with a minimum grade of C.					X
ELEN 5372 - Printed Antennas & RF Circuits This course introduces the printed antennas and microstrip circuits such as patch antennas, inverted L/F antennas, monopole and dipole antennas, transmission lines, feeding networks, filters, and directional couplers, for wideband, ultrawideband, and multiband applications. Prerequisite: “Antenna Theory” or equivalent with a minimum grade of C.					X

Appendix 3: Example of Continuous Improvement on Graduate Courses

INEN 5320 Statistical Decision Making (summer 23)

Identification: INEN 5320 Statistical Decision Making is usually offered during long semester, but it had to be offered during the summer to meet the needs of some of our graduate students. In order to adapt the course to an accelerated half-summer term the content had to be reduced.

Improvement: The instructor reviewed the content that he had previously taught during the long semester in a similar graduate statistics course and identified the most important topics to cover. Priority was given to core concepts with the assumption that graduate students could expand their knowledge independently later on. For example, the core ideas associated with hypothesis testing were covered and a few example tests were given, but the full list of tests covered in the textbook were left out.

Result: Students need time outside of class to work problems in order to master the material taught in this statistics course. The reduced load appears to have synced well with the time they had (usually 1 evening) between lessons to learn the materials. Students generally provided positive feedback and indicated that they spend a lot of time outside of class. Some students felt very challenged and in the course evaluation comments asked that that more material be removed, but at the same time, they did indicate a positive experience and the grades for the course suggest that they learned the material.

ELEN-5314 - Intro to Robotics (Spring 22)

Identification: Main Students' Comments - Introducing labs on some sort, and/or implementing MATLAB to both practice using MATLAB and to help students better practice what they learn

Improvement Plan: Add MATLAB/Simulink to the course material.

ELEN-5301 Num. Methods in Electromagnetics (Fall 22)

Identification: Main Students' Comments

- No FEKO Software License for Mac PC user, student version software doesn't convenient for some of the project. Need FEKO official license for all students.
- Need to FEKO full version license software, in student version some parameter not work properly.

Improvement Plan:

- Check if we can solve FEKO issues.

ELEN 5301-Python Programming I (Spring 22)

Identification: Main Students' Comments

- The grading system used to grade the assignments is almost for professionals. Not even professionals have to worry about this type of grading, because they are judged on whether the code works or not. My second assignment for example, I have worked the entire week to make sure my

code is functioning and it does not look like anything on the internet. However, I still lost over 28 points on minor details that is not even mentioned in the assignment. even though the codes accomplish the main objective of the assignment.

Improvement Plan:

- Check the grading system.

ELEN 5314- PLC Prog (Summer 2022)

Identification: Main Students' Comments

- As I have 3+ years field work experience as a control system engineer, therefore I will suggest that this course can be improved, by providing the industrial software and hardware like Rs Logix 5000 and the course content should be industry/field oriented. This PLC is installed in every second industry, so it would be good for student to work on its software and test his/her logic in lab with hardware. so in this way he/she can get best job and make a career by utilizing only this single course. if university need my help regarding the course content focused on industry (i.e. process industry), software and hardware that would be honor for me

Improvement Plan:

- Work with the college to get licensing for up-to-date software.