Cover Sheet: Request 14351

Curriculum Revision Proposal for BSISE

Info

Process	Major Curriculum|Modify|Ugrad/Pro
Status	Pending at PV - University Curriculum Committee (UCC)
Submitter	Serdar Kirli kirli@ise.ufl.edu
Created	10/16/2019 11:34:00 PM
Updated	1/16/2021 10:52:06 PM
Description of request	The ISE Department proposes revisions to modernize and upgrade its undergraduate curriculum to better serve our stakeholders.

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	ENG - Industrial and Systems Engineering 19060000	David Kaber	ISE UG curriculum revision. Reviewed, edited and updated./DK	9/25/2020
Consult from Math for MAS3114.docx					9/22/2020
College	Approved	ENG - College of Engineering	Heidi Dublin	Approved by HWCOE Curriculum Committee and Faculty Council	10/9/2020
No document changes					
Associate Provost for Undergraduate Affairs	Approved	PV - APUG Review	Casey Griffith		10/27/2020
No document changes					
University Curriculum Committee	Commented	PV - University Curriculum Committee (UCC)	Lee Morrison	Added to the UCC November agenda. If approved, it will be effective Summer 2021.	11/13/2020
Model Semester Plan.docx Critical Tracking.docx					11/10/2020 11/10/2020
University Curriculum Committee	Tabled	PV - University Curriculum Committee (UCC)	Casey Griffith	Tabled for further discussion with submitter/department.	11/16/2020
Technical Electives.docx					11/13/2020
University Curriculum Committee	Commented	PV - University Curriculum Committee (UCC)	Lee Morrison	Added to the UCC January agenda. If approved, it will be effective Summer 2021.	1/15/2021
Notification for STA4321_STA4322.pdf Notification for PHY2048L_PHY2049L.pdf					12/9/2020 12/10/2020
University Curriculum Committee	Commented	PV - University Curriculum Committee (UCC)	Lee Morrison	Per request from Dr. Lindner's office, this was removed from the agenda for the January UCC.	1/15/2021
No document changes					
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			1/15/2021
No document changes					
Office of the Registrar					
No document changes					

Step	Status	Group	User	Comment	Updated
Student Academic Support System					
No document changes					
Catalog					
No document changes					
Academic Assessment Committee Notified					
No document changes					
College Notified					
No document changes					

Major|Modify_Curriculum for request 14351

Info

Request: Curriculum Revision Proposal for BSISE
Description of request: The ISE Department proposes revisions to modernize and upgrade its undergraduate curriculum to better serve our stakeholders.
Submitter: Serdar Kirli kirli@ise.ufl.edu
Created: 1/11/2021 1:47:39 PM
Form version: 26

Responses

Major Name
Enter the name of the major. Example: "Mathematical Modeling"

Response:
Industrial and Systems Engineering

Major Code
Enter the two-letter or three-letter major code.

Response:
ISE

Degree Program Name
Enter the name of the degree program in which the major is offered.

Response:
Bachelor of Science in Industrial and Systems Engineering

Undergraduate Innovation Academy Program
Is this an undergraduate program in the Innovation Academy?

Response:
No

Effective Term
Enter the term (semester and year) that the curriculum change would be effective.

Response:
Earliest Available

Effective Year

Response:
Earliest Available

Current Curriculum for Major

Response:
The BS in Industrial and Systems Engineering is currently a 125 credit hour program including general education courses (36 credits), additional courses in humanities, natural and social sciences and math (24 credits), engineering core courses (15 credits), required ISE courses (45 credits) and technical electives (5 credits).
There is very little flexibility in terms of course selection, particularly within the upper division required ISE courses. Regardless of his/her interest in a particular domain, every student must take the same engineering core courses as well as the same required ISE courses. The only choice the student has is in the selection of technical electives (5 credits). Related to this, internships are popular among our students and considered necessary for experience and resume building. Almost every ISE student uses 1-3 credits of internship to address the technical elective component of the curriculum. Consequently, their freedom-of-choice in coursework is essentially limited to one class outside the prescribed set of courses (without going above the degree requirement of 125 credits).

Proposed Curriculum Changes
Describe the proposed changes to the curriculum. If the change is to offer the program through UF Online, please explain and attach a letter of support from the Director of UF Online.

Response:
The proposed changes can be organized in two categories:
(A) Structural improvements
1. Introduce restricted electives (initially in Data Analytics & Operations Research, Human Systems Engineering, Production & Logistics) to provide areas of focus and facilitate customization of curriculum.
Data Analytics & Operations Research: ESI4610 (introduction to Data Analytics), ESI4611 (Advanced Data Analytics), ESI4317 (Advanced Topics in Operations Research)
Human Systems Engineering: EIN4210 (Occupational Safety Engineering), EIN4XXX(Human Factors Applications), EIN4XXXC (Workplace Ergonomics and Biomechanics)
Production & Logistics: EIN4343 (Inventory and Supply Chain Systems), EIN4360C (Facility Layout and Work Design), ESI4221C (Industrial Quality Control)
2. Institute a depth requirement where each student selects a group of restricted electives and takes three courses from that set.
3. Institute a breadth requirement where each students takes at least one course in two of the other groups of restricted electives.
4. Define a required ISE core consisting of 11 courses that represent fundamental and essential skills for ISE: COP2271&L, ESI3327C, ESI3312, EIN3354, ESI4313, EIN4335, ESI4356, EIN4451, ESI4523, a new course on Human Factors and Ergonomics (EIN3241, 3 credits) and a new course on Data Analysis for Industrial Applications (ESI3215C, 4 credits).
5. Update the Engineering core by allowing students to select 2 out of EEL3003 (Circuits), EMA3010 (Materials) and EML3100 (Thermodynamics) rather than all three.
6. Increase free (unrestricted) elective credits from 5 to 9 (6 credits of technical electives and 3 credits of general electives).
(B) Course Additions, Removals and Credit Hour Changes
1. Replace PHY2048L and PHY2049L with EGN2020C (Engineering Design and Society).
2. Replace MAP2302 (Differential Equations) with MAS3114 (Computational Linear Algebra) in the critical tracking sequence.
3. Replace STA4321 (Introduction to Probability) and STA4322 (Introduction to Statistics Theory) with a new course: ESI3215C (Data Analysis for Industrial Applications).
4. Add a new course on Human Factors and Ergonomics (EIN3241).
5. Reduce the credit hours of ESI3327C (Matrix and Numerical Methods) from 4 to 3.
6. Reduce the credit hours of ESI3312 (Operations Research-1) from 4 to 3.
7. Reduce the credit hours of ESI4313 (Operations Research-2) from 4 to 3.

UF Online currciculum change
Will this curriculum change be applied to a UF online program as well?

Response:
No

Pedagogical Rationale/Justification
Describe the rationale for the proposed changes to the curriculum.

Response:
The proposed changes serve the following purposes:
(1) To modernize the curriculum to better serve the needs of the industry and provide our students competitive advantage in securing jobs and internships
Industry and alumni feedback indicated the need to focus on certain skills and topics that are not adequately covered in our current curriculum. The feedback also revealed topics that are no longer critical for industry work. Moreover, this feedback included suggestions on coverage and delivery of certain topics/courses and how to improve them.
(2) To diversify and increase our course offerings and allow customization of curriculum to fit individual student needs and interests
In the current curriculum, the flexibility in course selection is almost non-existent. Except for 9 credits of humanities/social sciences and 5 credits of technical electives, a student has no freedom of choice. Considering that a typical student completes 2-3 internships during their studies and uses internship credits to satisfy up to 3 credits of the technical elective requirement, they can select only one course outside of the pre-determined set of required courses within the degree requirement of 125 credits.
The proposed curriculum includes restricted electives to facilitate an in-depth study of several areas within the domain of industrial and systems engineering. Through the proposed restricted electives, we will introduce new courses that will modernize our curriculum and broaden the range of its coverage of ISE topics. These courses will elevate our program above the national standard while increasing the competitiveness of our students in the job market.
Introduction of restricted electives along with other adjustments to the program will enable our students to manage the use of up to 24 upper division credits (depth requirement: 9 credits, breadth requirement: 6 credits, electives: 9 credits) as opposed to only 5 credits (electives) currently. Consequently, our students will have an opportunity to customize their curriculum to fit their interests and career goals.
(3) To better prepare our students for graduate school
Introduction of focus areas (through restricted electives) allows students to explore different fields in ISE. Students will then be able to focus on a specific field where they take advanced courses. This will encourage and prepare them in their pursuit of advanced degrees.
(4) To make the major more attractive to students
Studies show that Gen-Z, which constitutes almost all of our undergraduate students, prefer an application-oriented education. Significant and unique experiences such as the stock market crash of 2008 have caused Gen-Z to be more focused on college degrees, which are directly applicable to specific jobs post-graduation.
Addition of an engineering design course (EGN2020C) at an early stage and introduction of courses with a high degree of focus on industrial applications will make our program attractive to students.
(5) To facilitate the pursuit of minors and certificates, to encourage undergraduate research and experiential learning, and to facilitate the acquisition of communication and professional skills
All the above are addressed with an increase of unrestricted elective credits from 5 to 9.
A considerable number of ISE students are interested in minors (15 credits) and certificates (9 credits). In addition, unrestricted electives will allow our students to pursue various curricular and co-curricular interests and opportunities within the degree program credits, such as internships (up to 3 credits), undergraduate research (up to 3 credits) and courses in leadership and innovation. While these are quite popular among our students, unfortunately, some of our students do not pursue these options with the possibility of exceeding the program limit of 125 credits. The excess credit surcharge applies after 13 credits above the program limit and

discourages students from pursuing minors.
(6) To increase retention and shorten the time to degree
Providing our students with the ability to focus in their areas of interest is expected to increase their motivation and performance and, consequently, increasing retention rate with reduced graduation timelines.

Impact on Enrollment, Retention, Graduation
Describe any potential impact of the curriculum changes on students who are currently in the major.

Response:
We believe that the proposed curriculum will have a positive impact on enrollment, retention and 4-year graduation rate. Below we provide our rationale:

Enrollment:
ISE can be classified as a "found" major, meaning that most high-school seniors know less about ISE than more traditional engineering majors, such as mechanical, electrical or computer engineering. A considerable percentage of our incoming students do not declare ISE as heir major but rather change their major to ISE during their first or second years of study. Even though our department makes a concerted effort to raise awareness about ISE among engineering students, we believe that there is still a significant untapped pool of students for whom the ISE major would be a great fit. The proposed changes will significantly help our efforts to adequately explain and advertise the ISE major.
In the current curriculum, the ISE component consists of a set of fixed ISE courses required for every student, which severely limits the flexibility of course selection. The development of an ISE core for fundamentals and a pool of restricted electives for area-specific concentration expertise will make our curriculum more attractive and competitive. The benefits with respect to enrollment are two-fold:
(1) We will diversify the portfolio of courses offered by our department, particularly at the senior level. This effort will be structured around the new restricted electives. It is worth noting that the new courses will cover areas within our discipline that are currently not covered or addressed with little emphasis. These represent areas that are growing in popularity where jobs will be in high demand in the near future. The addition of courses in the proposed groups of restricted electives will elevate our program's standing among our peers while making our students more competitive in the job market.
(2) Introduction of restricted electives will make it easier to explain to students what our discipline is about. The discussion of "What is ISE?" can be framed around the focus areas represented by different groups of restricted electives within the program. These also provide a clear roadmap for students with respect to curriculum planning.
Another aspect of the proposed curriculum is the increased design content and heightened focus on applications. A trend we have been observing for many years is that the current generation of students are not content with just learning theory; they want learn about the applications for their knowledge. They prefer exercise-based, hands-on learning, and perform at a much higher level when they can see a direct correlation between coursework and its applications. The proposed curriculum addresses these interests in two ways:
(1) We will increase design content by adding a 2000-level course on engineering design (EGN2020C). This course was recently created by the Herbert Wertheim College of Engineering as part of an initiative to re-define the engineering curriculum for the 21st century. We believe that it will be very popular among engineering students due to its focus on applied design and a collaborative and multi-disciplinary nature. This course will also present an opportunity for our department to reach out to first-year students to educate them about ISE and raise their awareness on what the ISE major is about.
(2) Incorporation of focus areas enables a layered approach where a specific area within the discipline is explored by several courses in a progressive fashion. This allows for not only exploration of topics at a deeper level but also employment of application-focused teaching techniques.

Retention and 4-year Graduation Rate:
Retention issues arise when students lose focus and motivation. In our experience, this is often caused by a mismatch between student expectations and what the curriculum offers. This

mismatch may be real, meaning that the curriculum is not sufficiently diverse to include courses in student's area of interest, or it may simply be due to a lack of information. Early in their studies, many students have difficulty seeing how the fundamentals they learn are necessary for the profession they chose. The failure to make the connection between introductory courses and more advanced courses often result in students being discouraged and losing motivation.
The proposed curriculum takes the following steps to address issues outlined above:
(1) Improved coordination between core courses and advanced courses
(2) Exposing students to a multitude of sub-disciplines within ISE
(3) Higher flexibility in course selection including focus area and breadth
As part of the curriculum revision, we intend to create an ISE core that focuses on fundamentals and focus areas within restricted electives that allow for a concentrated study of several sub-disciplines within ISE. The ISE core includes several courses that cover the introductory topics for each focus area so that our students can make informed decisions when choosing their restricted electives. Students who find an area they want to specialize in, early in their studies, remain excited about their prospects and stay in the program.
In the proposed plan, EIN3241 (Intro to Human Factors & Ergonomics) serves as the entry level course for the Human Systems area, whereas EIN4451 (Lean Production Systems) introduces students to Production & Logistics. Similarly, ESI3312 (Deterministic Operations Research) prepares students for Data Analytics and Applied OR. Furthermore, other courses such as ESI3215C (Data Analysis) and ESI4313 (Operations Research-2) cover foundational concepts relevant to more than one specialization.
In addition, we seek to improve the coordination between foundational courses within the core. To this end, we plan to develop a new course in Data Analysis of Industrial Applications (ESI3215C) and revise several existing courses (ESI3327C, ESI3312 and ESI4313).
As covered in the previous section, the introduction of restricted electives, along with other adjustments to the degree program that free up credits, will provide our students with significant flexibility in curriculum planning. In specific, they will be able to manage up to 24 upper division credits (depth requirement: 9 credits, breadth requirement: 6 credits, unrestricted electives: 9 credits) as opposed to only 5 credits (electives), currently.
The feedback we have been receiving from our students regarding the proposed revisions has been positive. In fact, as we prepare to offer our new courses (as special topics), we have observed a large demand. In addition, we have received many inquiries from students regarding when the new curriculum, particularly the focus areas, will become effective.

Assessment Data Review
Describe the Student Learning Outcome and/or program goal data that was reviewed to support the proposed changes.

Response:
An assessment of the Student Learning Outcomes and our current curriculum was conducted via the following mechanisms:
(1) ABET Outcome Assessment
A recent assessment of ABET (accreditation) outcomes indicated the need to improve the coverage of SLO1 and SLO2. The proposed curriculum addresses this by introducing a sophomore level engineering design course into the engineering core, a data analysis course with a significant hands-on component into the ISE core, and focus areas that will allow for in-depth exposure into specific domains of ISE.
(2) Alumni Survey
An alumni survey was conducted consisting of 114 responses representing 11 graduating classes, where 75% of participants were from classes 2012-2016. As recent graduates, the respondents are not only familiar with the ISE curriculum but they are also in a position to evaluate and make suggestions regarding the technical skills necessary in industry. The survey focused on the following topics:
a. Workplace skill gaps
b. Focus Areas via restricted electives (93% favor)
c. Fundamental ISE courses (ISE Core)
d. Engineering core
A considerable number of observations and suggestions have been incorporated into the proposal.

(3) Advisory Board Feedback
The Advisory Board consists of graduates of our department who occupied or currently occupy upper-management positions in corporations representing a variety of industries. The Advisory Board meets in Gainesville at least once a year to provide feedback on departmental initiatives. A major topic of discussion in the last few meetings was the re-structuring of the curriculum. We received useful feedback regarding the technical and professional skills necessary to succeed in the industry. The board was supportive of the finalized plan with respect to all major areas, particularly the introduction of focus areas, the make-up of the ISE core and the proposed revisions to the engineering core and electives.
(4) Study of Peer Institutions
A study of the curricula of the top-15 ISE departments in the US was completed with a focus on focus areas and ISE core courses.
Eight ISE departments have been identified as having focus areas. Among the departments studied, the number of core courses range from 7 to 15 with an average of 10.4. A detailed analysis was conducted to identify ISE courses that appear in core curricula with the highest frequency. For comparison, the plan we propose includes 11 core courses.

Academic Learning Compact and Academic Assessment Plan
Describe the modifications to the Academic Learning Compact (for undergraduate programs) and Academic Assessment Plan that result from the proposed change.

Response:
Please see the Academic Learning Compact and Academic Assessment Plan submitted separately through the approval process.

Catalog Copy
Submitter agrees to prepare and upload document showing the catalog copy with the current and proposed curricula edited using the "track changes" feature in Word.

Response:
Yes

Industrial and systems engineering prepares students for industrial practice in process design, efficiency planning with technical operation research component, data analytics for Industry 4.0, human and systems analysis, production and quality control and economic analysis of operational systems.

Students are prepared to use engineering principles to solve problems that require a quantitative basis for decision making and the application of operations research, statistics, economics, mathematics and engineering analysis, with dependence on the computer. The curriculum also provides the preparation necessary for graduate study.

ADMISSION REQUIREMENTS

The minimum requirements for admission to the undergraduate program are an overall 2.5 grade point average and a 2.5 grade point average in the designated pre-engineering technical courses. Students who have not met these requirements at 60 credits may be admitted on probation with successful petition.

DEPARTMENT REQUIREMENTS

Students must complete each required course with a minimum grade of C in at most three attempts. Grades of H, I, N, U, and W are considered attempts. Registration cancelled for non-payment is also considered an attempt.

The discipline-specific courses offered by the Industrial and Systems Engineering Department fall into two distinct categories:

(1) ISE Core
(2) Restricted Electives

The courses in the *ISE Core* cover the fundamentals of Industrial and Systems Engineering and introduce students to different sub-disciplines within the profession. These courses provide the essential knowledge necessary for every graduating engineer in ISE and therefore are required for all students.

In addition, the ISE core lays the foundation for different focus areas within the field represented by restricted electives. These courses prepare students to make an informed decision when selecting a specific ISE area (within the restricted electives) that they would like to focus on.

RESTRICTED ELECTIVES

In order to facilitate an in-depth study of specific areas within the ISE discipline, the department of Industrial and Systems Engineering offers restricted electives in:

(1) Operations Research and Data Analytics
(2) Human Systems Engineering
(3) Production and Logistics

Grouping of courses into these areas (sets of restricted electives) enable a layered approach, where a specific area is explored by several courses in a thorough and progressive fashion. This allows for not only exploration of topics at a deeper level but also employment of application-focused teaching techniques.

Students must select one of the restricted elective areas listed above. The deadline to make the selection is one week before the start of advance registration preceding the student's final semester. Students are always encouraged to discuss their decisions with their advisors.

There are two graduation requirements associated with respect to restricted electives:

Depth Requirement: Students must take at least three (3) courses in their selected area. Since some of the courses may have pre-requisites from the same area, course planning must be done carefully to ensure timely graduation.

Breadth Requirement: Students must take at least one (1) course from each of the other two areas. Since most restricted elective courses are offered once a year, course planning must be done carefully to optimize scheduling.

A list of restricted electives is available here.

EDUCATIONAL OBJECTIVES

The objective of the industrial and systems engineering program is to produce graduates who:

- will be successful professionals in industrial and systems engineering or other disciplines
- can acquire advanced knowledge through continuing education or advanced degree programs
- can become active leaders in their profession and/or community

MISSION

The mission of the undergraduate program is to provide a top quality, state-of-the-art education and student research training in industrial and systems engineering and to foster leading-edge instruction and cutting edge research. The program seeks national recognition by peer institutions and key employers of industrial and systems engineering graduates.

Hi Serdar.

We don't have any real objection, but this will require us to find another TA to help with the grading. We often find ourselves short of such students and it is unclear that CLAS will be able to boost our TA numbers anytime soon. I'm sure you can't commit anything, but it might be helpful if ISE (or HWCOE more broadly) could offer some assistance in that regard. Not a deal breaker, but we do seem to find ourselves asked more and more to provide service courses for other colleges while no increase in resources comes our way.

Best,
Kevin

Professor and Chair
UF Distinguished Teaching Scholar
Department of Mathematics
University of Florida
PO Box 118105
Gainesville, FL 32611
e: kknudson@ufl.edu
w: http://people.clas.ufl.edu/kknudson

On Sep 22, 2020, at 11:06 AM, Kirli,Serdar <kirli@ise.ufl.edu> wrote:

Dear Kevin,

I was wondering if you have had a chance to get input from Konstantina and Larissa regarding MAS3114. I would hate to rush you but we would like to put this item on the agenda for the next college curriculum meeting and the deadline for that is this Friday (9/25).
I would appreciate any input you can provide. Thank you.

Serdar

From: Kirli,Serdar <kirli@ise.ufl.edu>
Sent: Monday, September 14, 2020 1:29 PM
To: . CLAS-Mathematics Department Chair <departmentchair@math.ufl.edu>; Christodoulopoulou,Konstantina <kchristod@ufl.edu>; Williamson,Larissa G <lwill@ufl.edu>
Cc: Knudson,Kevin P <kknudson@ufl.edu>
Subject: Re: Adding MAS3114 to the ISE curriculum

Dear Kevin,

As you pointed out linear algebra is a foundational topic for us. We offer ESI3327C (Matrix and Numerical Methods, 4 credits), a required course that includes a review of Linear Algebra. However, for a long time students and instructors have been complaining that time allocated to linear algebra in that course is not sufficient. We are now in the middle of a major curriculum revision effort, which presents an opportunity to do something about it. It would be a great service to our students if we could include MAS3114 in our curriculum as a pre-requisite to ESI3327C.

Serdar

From: . CLAS-Mathematics Department Chair <departmentchair@math.ufl.edu>
Sent: Monday, September 14, 2020 10:59 AM
To: Kirli,Serdar <kirli@ise.ufl.edu>; Christodoulopoulou,Konstantina <kchristod@ufl.edu>; Williamson,Larissa G <lwill@ufl.edu>
Cc: Knudson,Kevin P <kknudson@ufl.edu>
Subject: Re: Adding MAS3114 to the ISE curriculum

Dear Serdar,

I'm copying our undergraduate coordinator, Konstantina Christodoulopoulou, and the instructor of MAS 3114, Larissa Williamson. Currently, MAS 3114 enrolls approximately 350 students per semester, many (most?) of whom are engineering majors. Before we say yes, I want to get some input from my colleagues.

Just out of curiosity, how are your students learning the requisite linear algebra now? It's surely important in ISE (operations research, supply chain management, etc.) so they must have been getting it somewhere.

Best,
Kevin

From: Kirli,Serdar
Sent: Saturday, September 12, 2020 1:40 PM
To: . CLAS-Mathematics Department Chair
Subject: Adding MAS3114 to the ISE curriculum

Kevin,

I hope that all is well with you, and you and your family are in good health and spirits.

I am the Associate Chair for Undergraduate Studies in Industrial and Systems Engineering at UF. Our department is working on a major curriculum revision effort, and as a part of this revision, our faculty would like to add MAS3114 (Computational Linear Algebra) as a required course. We intend this to be effective Fall 2021 and we project that this move will result in an additional yearly enrollment of 100-120 in MAS3114. I am e-mailing you to ask if that there is enough capacity to accommodate our students and to ensure that you have time to plan and prepare for it.
Please let me know if you have any questions or reservations about this at your earliest convenience.

Serdar

Critical Tracking records each student's progress in courses that are required for progress toward each major. Please note the critical-tracking requirements below on a per-semester basis.

Equivalent critical-tracking courses as determined by the State of Florida Common Course Prerequisites may be used for transfer students.

SEMESTER 1

- Complete 1 of 8 critical-tracking courses with a minimum grade of C within two attempts: COP 2271 (VB .NET), ESI 3327C, MAC 2311, MAC 2312, MAC 2313, MAS 3114 ~~MAP 2302~~, PHY 2048, PHY 2049
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

SEMESTER 2

- Complete 2 additional critical-tracking course with ~~a~~ minimum grades of C within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

SEMESTER 3

- Complete 2 additional critical-tracking courses with minimum grades of C within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

SEMESTER 4

- Complete 2 additional critical-tracking courses with minimum grades of C within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

SEMESTER 5

- Complete 1 additional critical-tracking course with a minimum grade of C within two attempts

- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

SEMESTER 6

- Complete ESI 4356 and ESI 4523~~STA 4322~~
- Complete 2 additional required courses
- 2.0 UF GPA required

SEMESTER 7

- ~~Complete ESI 4523~~
- Complete 2 restricted ISE electives
- Complete 2 additional required courses
- 2.0 UF GPA required

SEMESTER 8

- Complete all remaining required ISE courses
- 2.0 UF GPA required

To remain on track, students must complete the appropriate critical-tracking courses, which appear in bold. These courses must be completed by the terms as listed above in the Critical Tracking criteria.

This semester plan represents an example progression through the major. Actual courses and course order may be different depending on the student's academic record and scheduling availability of courses. Prerequisites still apply.

Semester One		Credits
Select one:		3
CHM 2045	General Chemistry 1 (Gen Ed Physical Sciences) [1]	
CHM 2095	Chemistry for Engineers 1 [1]	
CHM 2045L	General Chemistry 1 Laboratory (Gen Ed Physical Sciences) [1]	1
ENC 1101	Expository and Argumentative Writing (~~State Core~~ Gen Ed Composition; Writing Requirement: 6,000 words) [1]	3
MAC 2311	Analytic Geometry and Calculus 1 (**Critical Tracking**; ~~State Core~~ Gen Ed Mathematics) [1,3]	4
Quest 1 (Gen Ed Humanities) [1,2]		3
~~State Core~~ Gen Ed Humanities with Diversity or International, Writing Requirement: 6,000 words [1,2]		3
	Credits	**17**
Semester Two		
ECO 2013	Principles of Macroeconomics (~~State Core~~ Gen Ed Social and Behavioral Sciences) [1,2]	4
EGN 2020C	Engineering Design and Society (Gen Ed Physical Sciences) [1]	2
~~EGS 4034~~	~~Engineering Ethics and Professionalism~~ [1]	~~1~~
Quest 2 (Gen Ed Biological and Physical or Social and Behavioral Sciences) [1,2]		3
~~Select one:~~		~~3~~

Commented [MEL1]: Moved to Semester 5

~~Gen Ed Humanities with Diversity or International, Writing Requirement: 6,000 words~~ [1]		~~-~~
~~Gen Ed Social and Behavioral Sciences with Diversity or International; Writing Requirement: 6,000 words~~ [1,2]		~~-~~
PHY 2048	Physics with Calculus 1 (**Critical Tracking**; Gen Ed Physical Sciences) [1,3,4]	3
~~PHY 2048L~~	~~Laboratory for Physics with Calculus 1 (Gen Ed Physical Sciences)~~ [1,3]	~~1~~
MAC 2312	Analytic Geometry and Calculus 2 (**Critical Tracking**; Gen Ed Mathematics) [1,3]	4
	Credits	**16**
Semester Three		
~~ECO 2023~~	~~Principles of Microeconomics (Gen Ed Social and Behavioral Sciences)~~ [1,2]	~~4~~
MAC 2313	Analytic Geometry and Calculus 3 (**Critical Tracking**; Gen Ed Mathematics) [1,3]	4
~~MAP 2302~~	~~Elementary Differential Equations (**Critical Tracking**)~~	~~3~~
PHY 2049	Physics with Calculus 2 (**Critical Tracking**) [1,3,4]	3
~~PHY 2049L~~	~~Laboratory for Physics with Calculus 2~~ [1]	~~1~~
COP 2271	Computer Programming for Engineers (**Critical Tracking**; VB .NET) [1,3]	2
COP 2271L	Computer Programming for Engineers Laboratory (VB .NET) [1,3]	1
ENC 3246	Professional Communication for Engineers (Gen Ed Composition; Writing Requirement: 6,000 words) [1]	3
MAS 3114	Computational Linear Algebra [1,3]	3
	Credits	**16~~5~~**
Semester Four		

Commented [MEL2]: Moved to Semester 4

ECO 2023	Principles of Microeconomics (Gen Ed Social and Behavioral Sciences) [1]	4
~~COP 2271~~	~~Computer Programming for Engineers (Critical Tracking; VB.NET)~~	~~2~~
~~COP 2271L~~	~~Computer Programming for Engineers Laboratory (VB.NET) [1]~~	~~1~~
EGM 2511	Engineering Mechanics: Statics [1]	3
EIN 3354	Engineering Economy [1]	3
~~EMA 3010~~	~~Materials [1]~~	~~3~~
~~ENC 3246~~	~~Professional Communication for Engineers (Gen Ed Composition; Writing Requirement: 6,000 words) [1]~~	~~3~~
ESI 3327C	Matrix and Numerical Methods in Systems Engineering [1,3]	43
Select one:		3
EML 2023	Computer Aided Graphics and Design [1]	-
CGN 2328	Technical Drawing and Visualization [1]	-
	Credits	**16**
Semester Five		
~~Select one:~~		~~3~~
~~EML 2023~~	~~Computer Aided Graphics and Design [1]~~	~~-~~
~~CGN 2328~~	~~Technical Drawing and Visualization [1]~~	~~-~~
~~EIN 3354~~	~~Engineering Economy [1]~~	~~3~~
ESI 3312	Operations Research 1 [1]	34
EGS 4034	Engineering Ethics and Professionalism [1]	1
EIN 3241	Human Factors and Ergonomics [1]	3
ESI 3215C	Data Analysis for Industrial Applications [1]	4
Engineering Elective [6]		3

Commented [MEL3]: Moved to Semester 3

Commented [MEL4]: Moved to Semester 3

Commented [MEL5]: Moved to Engineering Elective group (Semesters 5 and 6). Identified by superscript 6.

Commented [MEL6]: Moved to Semester 3

Commented [MEL7]: Moved to Semester 4

Commented [MEL8]: Moved to Semester 4

~~STA 4321~~	~~Introduction to Probability~~ [1]	~~3~~
~~Technical elective~~ [4]		~~3~~
	Credits	**1~~4~~6**
Semester Six		
~~EIN 4360C~~	~~Facility Planning and Work Design~~ [1]	~~4~~
ESI 4313	Operations Research 2 [1]	~~4~~3
ESI 4356	Decision Support Systems for Industrial and Systems Engineers (**Critical Tracking**) [1]	4
~~STA 4322~~	~~Introduction to Statistics Theory (**Critical Tracking**)~~ [1]	~~3~~
ESI 4523	Industrial Systems Simulation (**Critical Tracking**) [1]	3
EIN 4451	Lean Production Systems [1]	3
Engineering Elective [6]		3
	Credits	**16~~5~~**
Semester Seven		
~~EIN 4343~~	~~Inventory and Supply Chain Systems~~ [1]	~~3~~
~~EML 3100~~	~~Thermodynamics~~ [1]	~~3~~
~~ESI 4221C~~	~~Industrial Quality Control~~ [1]	~~3~~
~~ESI 4523~~	~~Industrial Systems Simulation (**Critical Tracking**)~~ [1]	~~3~~
Financial accounting course [1]		3
Technical Elective [5]		3
Restricted Elective (Breadth) [7]		3
Restricted Elective (Depth) (**Critical Tracking**) [7]		3
Restricted Elective (Depth/Breadth) (**Critical Tracking**) [7]		3
	Credits	**15**

Commented [MEL9]: Moved to Semester 6

Semester Eight		
~~EEL 3003~~	~~Elements of Electrical Engineering~~ [1]	~~3~~
EIN 4335	Senior Design Project [1,2,5]	3
~~EIN 4451~~	~~Lean Production Systems~~ [1]	~~3~~
~~ESI 4357~~	~~Web-Based Decision Support Systems for Industrial and Systems Engineers~~ [1]	~~4~~
Technical Elective [4,5]		3~~2~~
General Elective [5]		3
Restricted Elective (Breadth/Depth) [7]		3
Restricted Elective (Depth) [7]		3
	Credits	**15**
	Total Credits	**125**

[1] Minimum grade of C required. A C- will not satisfy this requirement.

[2] The curriculum requires the completion of both the Diversity (D) component and the International (N) component. The curriculum also requires the Writing Requirement of 24,000 words to be met.

[3] Critical Tracking Courses. These courses must be completed within the first five semesters. {COP 2271, ESI 3327C, MAC 2311, MAC 2312, MAC 2313, MAS 3114, PHY 2048, PHY 2049} See Critical Tracking Tab for more information.

[4~~3~~] Students with deficient backgrounds in physics should first take a lower-level course such as PHY 2020. After successful remediation, they can begin the physics sequence: PHY 2048~~/PHY 2048L~~ and PHY 2049/~~PHY 2049L~~.

[5~~4~~] The curriculum requires ~~five~~ six technical elective credits and three general elective credits. Technical Electives are 3000-level or above courses with significant scientific and/or technical content. Information on Pre-Approved Technical and General Electives can be found here. Students can also elect to take additional courses within the Industrial and Systems Engineering Restricted Electives as their Technical Electives. ~~Students should choose technical electives that are related to one another and provide expertise in an ISE concentration area. Several minors provide such concentrations; information is available in 368 Weil.~~

Commented [MEL10]: Moved to Semester 6

[6] The curriculum requires students to take six credits of engineering electives. Students need to pass two of the following courses with a minimum grade of C: EEL 3003 (Elements of Electrical Engineering), EML 3100 (Thermodynamics), and EMA 3010 (Materials).

[7] The Department of Industrial and Systems Engineering has three different focus areas. Information on focus area requirements and a list of all restricted elective courses is available here.

[8] As an alternative, students can participate in the Integrated Product and Process Design (IPPD) program. Multidisciplinary teams of engineering students in this program work closely with a liaison engineer to design a new product or process for an industry sponsor. The program requires students to take, typically in their senior year, a sequence of two 3-credit courses, ~~EIN 4912~~EGN 4951 in fall and ~~EIN 4913~~EGN 4952 in spring. The former is a course approved for a technical elective and the latter can replace EIN 4335.

FUNDAMENTALS OF ENGINEERING EXAM PREPARATION

Approximately 10 percent of the members of the Institute of Industrial Engineers pursue a professional engineer (PE) license. A PE license is especially desirable for engineers who want to start their own businesses. The industrial and systems engineering curriculum does not require certain courses that are necessary for the Fundamentals of Engineering (FE) exam (also known as the Engineer Intern exam). The latter is also a prerequisite for pursuing a professional engineer license.

Students preparing for the FE exam should choose a set of technical electives that properly prepare them for this exam, such as EGM 3520 and EGM 3400 / EGM 3401.

Re: PHY2048L and PHY2049L

Hershfield,Selman Philip <selman@phys.ufl.edu>

Thu 12/10/2020 5:55 AM

To: Kirli,Serdar <kirli@ise.ufl.edu>

Dear Serdar,

Thank you for notifying us of this change. It will help with our planning going forward.

Regards, Selman

Prof. Selman Hershfield
Department of Physics
P.O. Box 118440
Gainesville, FL 32611-8440
Tel: (352)-392-9387
Fax: (352)-392-0524
selman@ufl.edu
http://www.phys.ufl.edu/~selman/

From: Kirli,Serdar <kirli@ise.ufl.edu>
Sent: Wednesday, December 9, 2020 1:48 PM
To: Ingersent,Kevin
Cc: Hershfield,Selman Philip
Subject: PHY2048L and PHY2049L

Dear Drs. Ingersent and Hershfield,

I am the Associate Chair for Undergraduate Studies in Industrial and Systems Engineering. I would like to inform you that effective Fall 2021 our curriculum will not include PHY2048L and PHY2049L as required courses. Since the current students subject to the 2020 catalog still have the option to take PHY2048L and PHY2049L, the impact on enrollment may take a year, but we expect the transition to be complete by the 2022-2023 academic year.
On behalf of my department and our current and past students, I would like to thank you for the valuable hands-on experience you have provided to our students over many decades.
Please do not hesitate to reach out to me if you have any questions.
Happy holidays!

Serdar Kirli

Re: STA4321 and STA4322

Daniels,Michael Joseph <daniels@ufl.edu>

Wed 12/9/2020 2:49 PM

To: Kirli,Serdar <kirli@ise.ufl.edu>
Cc: Athienitis,Demetris <athienit@ufl.edu>

Thanks for the update. Have a nice holiday as well.

_____

Mike Daniels
Professor and Chair
Andrew Banks Family Endowed Chair
Department of Statistics
University of Florida
Gainesville, FL 32611

> On Dec 9, 2020, at 1:33 PM, Kirli,Serdar <kirli@ise.ufl.edu> wrote:
>
> Dear Drs. Daniels and Athienitis,
>
> I am the Associate Chair for Undergraduate Studies in Industrial and Systems Engineering. I would like to inform you about a particular change to our curriculum which will have an impact on the enrollment of STA4321 and STA4322. As of Fall 2021, our curriculum will not include STA4321 and STA4322 as required courses. Instead, our students will take ESI3215C (Data Analysis for Industrial Applications). Since the current students subject to the previous catalogs still have the option to take the STA4321-STA4322 sequence, the impact on enrollment may be gradual, but we expect the transition to be mostly complete by the 2022-2023 academic year.
> On behalf of my department and our current and past students, I would like to thank you for the valuable service you have provided over many decades. We are grateful to you for helping our students receive a solid foundation in probability and statistics and help them become better engineers.
> Please do not hesitate to reach out to me if you have any questions.
> I wish you happy holidays!
>
> Serdar Kirli

PRE-APPROVED TECHNICAL ELECTIVES

ISE Courses

EIN4905 Design of Experiments	3
EIN4905 Honors Intro to Financial Engineering	3
EIN4905 Data Mining	3
EIN4905 Models and Methods for Health Systems Engineering	3
EIN4905 Occupational Safety	3
EIN4912 Integrated Product & Process Design 1	3
EIN4944 Internship or Co-op in ISE	3
EGN4641 Engineering Entrepreneurship	3
EGN4643 Engineering Innovation	3
EGS4038 Engineering Leadership	3
EGS4625 Fundamentals of Engineering Project Management	3
EGN4912 Engineering Undergraduate Research	1-3
ISE Restricted Elective	3

Other Courses

CAP4621 Artificial Intelligence and Heuristics	3
CDA3101 Introduction to Computer Organization	3
CEN3031 Introduction to Software Engineering	3
CEN4072 Software Testing and Verification	3

CIS4301 Information System Design and Development	3
COP3530 Data Structures and Algorithms	4
COP4600 Operating Systems	3
COT3100 Applications of Discrete Structures	3
ECO3101 Intermediate Microeconomics (only counts as 1 credit of tech)	3
ECO3203 Intermediate Macroeconomics (only counts as 1 credit of tech)	3
ECO4400 Game Theory and Applications	4
EEE3308C Electronic Circuits I	4
EEL3701C Digital Logic and Computer Systems	4
EEL3135 Introduction to Signals and Systems	4
EES3008 Energy & Environment	3
EGM 3520 Mechanics of Materials	3
EGM3400 Elements of Dynamics (will not count if receiving tech credit for EGM3401)	2
EGM 3401 Dynamics (will not count if receiving tech credit for EGM3400)	3
EGM4590 Biodynamics	3
EGM4592 Bio-Solid Mechanics	3
EML4321 Manufacturing Engineering	3
FIN3403 Business Finance	4
FIN4243 Debt and Money Markets	4
FIN4504 Equity and Capital Markets	4

FIN4414 Financial Management	4
GIS3072C Geographic Information Systems	3
ISM3004 Computing in the Business Environment	4
ISM4113 Business Systems Design and Applications	2
ISM4210 Database Management	2
ISM 4220 Business Data Communications 1	2
ISM 4221 Business Data Communications 2	2
MAA4211 Advanced Calculus 1	3
MAA4212 Advanced Calculus 2	3
MAA4226 Introduction to Modern Analysis 1	3
MAA4227 Introduction to Modern Analysis 2	3
MAA4402 Functions of a Complex Variable	3
MAD4203 Introduction to Combinatorics 1	3
MAD4204 Introduction to Combinatorics 2	3
MAR3023 Principles of Marketing	4
MAS4301 Abstract Algebra 1	3
MAS4302 Abstract Algebra 2	3
MHF3202 Sets and Logic	3
PKG3103 Food Packaging	3
PKG4101C Computer Tools for Packaging	3
STA4183 Theory of Interest	3
STA4210 Regression Analysis	3

STA4211 Design of Experiments	3
STA4222 Sample Survey Design	3
STA4502 Nonparametric Statistical Methods	3
STA4504 Categorical Data Analysis	3
STA4702 Multivariate Statistical Methods	3
STA4712 Introduction to Survival Analysis	3
STA4853 Introduction to Time Series and Forecasting	3
SUR3103C Geomatics	3
TTE4004C Transportation Engineering	4
TTE4106 Urban Transportation Planning	3
TTE4201 Traffic Engineering	3
TTE 4300 Transportation Systems Analysis	3