



College of Engineering

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Date: 7 February 2012

To: Randy Smith  
Vice Provost, Office of Academic Affairs

From: Ed McCaul   
Secretary, College of Engineering Committee on Academy Affairs (CCAA)

Subject: Semester Conversion Proposal for the BS degree in Industrial and Systems Engineering

Attached is a letter from Philip Smith, Department Chair of Integrated Systems Engineering, as well as a revised semester conversion proposal for their BS degree program in Industrial and Systems Engineering.

This proposal was reviewed by a subcommittee of CCAA. After reviewing the proposal and having some changes made to it, the subcommittee recommended to the full committee that it be approved. After a discussion, CCAA unanimously approved the proposal on the 3<sup>rd</sup> of February 2012 and requested that I forward the proposal to you for consideration by CAA. If you have any questions concerning the proposal please let me know.



Department of Integrated Systems Engineering

210 Baker Systems Building  
1971 Neil Avenue  
Columbus, OH 43210-1217

Phone (614) 292-6239

Fax (614) 292-7852

To: Office of Academic Affairs  
From: Philip Smith, ISE Department Interim Chair  
Date: 2 Feb. 2012  
Re: Dept. of Integrated Systems Engineering –Revised Undergraduate Semester Curriculum and Transition Plans.

A handwritten signature in blue ink, appearing to read "Philip Smith".

In the best interest of ISE students and faculty, the ISE faculty respectfully request that we be allowed to revise the undergraduate semester curriculum that was previously proposed. That proposal is infeasible to deliver and is not the best program for our students.

Changes we propose are based on the following:

1. a desire to bring our program into closer alignment with other programs within the College of Engineering
  - Physics 1251 E&M, Optics, Modern Physics (Physics II)- will be required as one of the Additional Science requirements
  - ENGR 2367 American Attitudes About Technology – will be required to fulfill the second writing requirement
2. a desire to provide a better balance of fundamental ISE courses across the three primary areas, while requiring depth in an area of particular interest to each student
  - Delete the following courses:
    - ISE 2000 Intro to ISE
    - ISE 2010 Systems Modeling
  - Merge the following courses:
    - ISE 3300 and 5100 are merged into ISE 5100 Stochastic Modeling and Simulation, 4 cr hr (ISE 5100 was previously named Discrete Event Simulation)
    - ISE 3800 and 3810 into ISE 3800 Project Management, 3 cr hr.
  - Increase the number of Technical Electives (TE) from 4 to 6, and provide structure and depth through implementation of TE packages, which consist of 3 courses, that will provide depth within an area of ISE . Students will choose from among several TE packages approved by the ISE Undergraduate Studies Committee. The remaining three TE will be chosen from a list of TE approved by the ISE Undergraduate Studies Committee. This handling of TE is only slightly modified from the original proposal (refer to pg A2 and Attachment #3).
    - TE package examples:
      - Manufacturing Design:
        - ISE 5560 Product Design Engineering
        - ISE 4500 Manufacturing Process Engineeringand choose 1 of the following:
        - ISE 5501 Fundamentals of Solid State Processing
        - ISE 5502 Fundamentals of Liquid Shaping Processes

- Operations Research Application:  
select 3 of the following courses:  
ISE 5430 Warehouse and Facility Design  
ISE 5410 Quant. Models in Production and Distribution Logistics  
ISE 5830 Decision Analysis  
ISE 5840 Market Engineering and Applications
- Human Factors: Risk Assessment and Safety  
select 3 of the following courses; only one selection in this package may be from PUBH-EHS:  
ISE 5620 Risk Assessment Tools for Occupational MSDs  
ISE 5640 Occ. Safety: Analysis & Design of Work Environments  
ISE 5710 Safety and Complex Systems  
PUBH-EHS 3320 Fundamentals of Environ. Health Risk Assessment  
PUBH-EHS 7365 Principles of Risk Assessment

The ISE Faculty who will be teaching in the semester system voted on the new curriculum, with the following outcomes:

13 faculty members voted in favor of all of the contents of the proposed semesters curriculum;

1 voted in favor of all of the contents of the proposed semesters curriculum, except for abstaining on the issue of whether to include a one 4 credit course including production planning and facilities design in the core along with offering a technical elective on advanced facilities design concepts instead of requiring two separate courses in the core (a 3 credit hour course on production planning and a 3 credit hour course on facilities design);

1 abstained in voting on the overall curriculum proposal but voted against:

- Limiting the choices for the additional science electives
- Moving the GE Ethics course to semester 3/1, and adding a note that the course must either be Philosophy 1332 (Intro to Engineering Ethics) or an alternative to be identified by the ISE undergraduate curriculum committee;

4 faculty did not vote, including those who will not be with the department when we move to semesters.

As requested, the following pages contain the original ISE Undergraduate semester proposal and the modifications that we are proposing. In the main document the modifications are highlighted in yellow on the pages of the original document. However, in the attachments, sometimes that was not possible to do, because it just made the particular document confusing to try to read. So, in many cases with the attachments, there is an original version followed by the modified version on another page. Header titles at the tops of these pages label them as original and modified.

We sincerely believe that it is in the best interest of ISE students and faculty to make the proposed modifications to the undergraduate semester curriculum, and we respectfully request that we be allowed to do so.

Please note that the ISE Graduate Program is not being modified and is not addressed in this revised plan.



Department of Integrated Systems Engineering

ORIGINAL COVER LETTER

210 Baker Systems Building  
1971 Neil Avenue  
Columbus, OH 43210-1217

To: Office of Academic Affairs  
From: Julia L. Higle, ISE Department Chair *Julia J. Higl*  
Date: June 8, 2010  
Re: Dept. of Integrated Systems Engineering Semester Transition Plans.

Phone (614) 292-6239  
Fax (614) 292-7852

The faculty of Integrated Systems Engineering has worked diligently, thoughtfully, and often times, tirelessly, for over a year to review and revise our curricula in preparation for OSU's transition to a semester-based academic calendar. Attached, you will find our proposal for the degree requirements for the degree programs in Industrial and Systems Engineering (i.e., BS, MS, and PhD) and our plan for transition to implementation. In agreement with the decision of the faculty, I heartily recommend its approval.

The ISE Department currently administers the following programs:

- PhD in Industrial and Systems Engineering. As indicated in the attached proposal, except for the translation of courses from quarters to semesters, the structure and requirements of this program are not undergoing revision driven by the transition to semesters.
- MS in Industrial and Systems Engineering. As indicated in the attached proposal, except for the translation of courses from quarters to semesters, the structure and requirements of this program are not undergoing revision driven by the transition to semesters.
- Advanced Professional Degree Program which leads to the post baccalaureate degree Industrial Engineer. We find neither a record nor a memory of students pursuing this program for an extended number of years. A recommendation to withdraw this program was approved by the faculty, without dissent. Consequently, we are withdrawing this Advanced Professional Degree Program, in accordance with the decision of the faculty.
- MBLE, the Master of Business Logistics Engineering. This program is offered in collaboration with the Fisher College of Business. Any revisions to the MBLE program will be undertaken in collaboration with our colleagues in the COB and will be submitted in accordance with the transition planning schedule determined by COB. Consequently, there are no revisions to this program included with this plan.
- Graduate Interdisciplinary Specialization in Manufacturing Science. Demand for this program has waned considerably over the past decade. On advice of the ISE Manufacturing Faculty, the ISMS is not being defined for the semester transition. In its place, we anticipate offering a minor in Manufacturing Processes. Once the requirements for undergraduate minors have been defined, we this program will be configured and submitted for approval.
- Graduate Interdisciplinary Specialization in Engineering Management. This program is offered in collaboration with the Fisher College of Business. Any revisions to the ISEM will be undertaken in collaboration with our colleagues in the COB and will be submitted in accordance with the transition planning schedule determined by COB. Consequently, there are no revisions to this program included with this plan.

- BS in Industrial and Systems Engineering. This program is undergoing a revision, per the attached proposal. The curriculum revision described within the proposal was approved by the faculty, without dissent.
- The department offers a BS/MS option, and will continue to do so. This program will adhere to the requirements as described in the College of Engineering document.

In arriving at the proposed curriculum, the faculty has been actively represented on the College of Engineering Quarter-to-Semester Task Force. We have similarly participated in the revision of the definition of the College of Engineering BS core requirements. Faculty members have been involved in all phases of the curriculum revision, through several iterations and in countless meetings. They have similarly been involved in the development and revision of our collection of course offerings that support our programs. We have solicited, and incorporated, input from current students through group meetings and in one-on-one advising sessions. We have solicited, and incorporated, input from our Alumni Advisory Board at both the start and the end of our deliberations. The response from our current students and our advisory board has been extremely positive.

This proposal has been submitted in its entirety to the faculty for review. The vote of the faculty is as follows:

- 15 approve
- 1 does not approve
- 3 defer to the judgement of their colleagues

We look forward to a favorable response from OAA, leading to implementation of our new curriculum and transition plan.

**Curriculum revision and transition proposal for:**

**A: BS, ISE**

**B: MS, ISE**

**C: PhD, ISE**

**Submitted by the Department of Integrated Systems Engineering**

J.L. Higle, Professor and Chair  
higle.1, 292-8100

**This document includes modifications proposed in January 2012 for the Undergraduate ISE program. Revisions to the Graduate ISE program are not being proposed.**

**A: Industrial and Systems Engineering (ISE) Program Proposal**

Primary Contact: - original proposal: BW Lilly (.2, 292-2297); revisions: CM Sommerich (.1; 292-9965)

**1. Name of Program**

Industrial and Systems Engineering

**2. Name of Degree:**

Bachelor of Science in Industrial and Systems Engineering (BSISE)

**3. Responsible Academic Unit:**

Department of Integrated Systems Engineering

**4. Type of program:**

Undergraduate bachelors degree program

**5. Semester Conversion Designation:**

a) Re-envisioned with significant changes to curricular requirements (core requirements, tracks/options/courses), but no changes to program goals.

**6. Program Learning Goals**

Because of a requirement to use the terminology of the ISE programs accrediting body (ABET, Inc), program goals are separated into “objectives” and “outcomes”. ABET terminology defines these terms as follows:

- Program Educational Objectives: broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve.
- Program Outcomes: narrower statements that describe what students are expected to know and be able to do by the time of graduation (related to skills, knowledge, and behaviors that students acquire in their matriculation through the program).

**PROGRAM EDUCATIONAL OBJECTIVES** (What our graduates will be doing two to three years after graduation)

1. Graduates are engaged in integrating systems of people, machines, materials, information, energy, and financial resources.
2. Graduates employ science and engineering based methods to solve real problems. Graduates continue to expand and enhance their professional skills.
3. ISE graduates effectively communicate opportunities and solutions to technical and non-technical communities.
4. Graduates work effectively and ethically as leaders and members of teams, and as individuals.

**PROGRAM OUTCOMES** (What we expect of our graduates at the time of graduation)

- (a) An ability to apply knowledge of mathematics, science, and engineering.
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data.
- (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- (d) An ability to function on multidisciplinary teams.
- (e) An ability to identify, formulate, and solve engineering problems.
- (f) An understanding of professional and ethical responsibility.
- (g) An ability to communicate effectively.
- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- (i) A recognition of the need for, and an ability to engage in life-long learning.

**A: Industrial and Systems Engineering (ISE) Program Proposal**

- (j) Knowledge of contemporary issues.
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**7. Proposed Program Requirements**

Throughout this document and its attachments, CH="credit hours", QCH = "credit hours taken on a quarter calendar" and SCH = "credit hours taken on a semester calendar".

See Attachment #1: BSISE Proposed Program Requirements, and Attachment #2: BSISE Proposed Program (Curriculum Map). The following notes apply:

- General Education requirements will be consistent with designations made by the College of Engineering once other departments' offerings and General Education approved courses are known. For the purposes of this proposal, our curriculum reflects these requirements generically. Our proposed program assumes that the current practice of permitting certain general education requirements such as mathematics, data analysis, and science to be "double counted" in the Engineering Core or the ISE Core will continue as we move to the semester calendar. **Modification: ENGR. 2367 American Attitudes About Technology – will be required to fulfill the second writing requirement; this brings our program into closer alignment with other programs within the College of Engineering (the Director of EEIC has indicated this can be accommodated; see Attachment 7 in this package)**
- Science elective courses may be any physical or biological science course chosen from a set to be designated by the ISE Undergraduate Studies Committee once science course offerings are known. **Modification: Physics 1251 E&M, Optics, Modern Physics (Physics II)- will be required as one of the Additional Science requirements; this brings our program into closer alignment with other programs within the College of Engineering. Chemistry 1250 (4) or Biology 2100 (3) remain the two alternatives for the other Additional Science course.**
- The Engineering Science elective course(s) may be chosen from a set to be designated by the ISE Undergraduate Studies Committee once engineering science course offerings are known. **Modification: The offerings are now known and the following have been designated: Choose one: MSE 2010 (3), ECE 2300 (3), CSE 2111 (3), CSE 2122 (3), ME 2030 (3), ME 2850 (3), ME 3500 (3).**
- Technical electives will be chosen in consultation with an academic advisor, and are subject to approval by the ISE Undergraduate Studies Committee. At least 6 of the 12 required technical elective credit hours must be ISE courses. Up to 6 of the 12 required technical elective credit hours may be double counted from one set of "related minors" to be designated by the ISE Undergraduate Studies Committee once other departments' minor offerings are known. See Attachment #3, for an illustration of potential elective sequences. Once other departments' course offerings are known, additional restrictions might become appropriate. In the absence of this information, ISE has decided by a unanimous vote of the faculty to defer to the decision of the ISE Undergraduate Studies Committee for the approval of technical elective courses. **Modification: a desire to provide a better balance of fundamental ISE courses across the three primary areas, while providing and requiring depth in an area of particular interest to each student resulted in removing two courses and combing some others, which yield an increase in the number of Technical Electives (TE) from 4 to 6. Technical elective "packages" will be implemented in order to provide additional structure, as well as depth in the curriculum. Each TE package consists of 3 courses that will provide depth within an area of ISE . Students will choose from among several TE packages approved by the ISE Undergraduate Studies Committee. The remaining three TE will be chosen from a list of TE approved by the ISE**



## A: Industrial and Systems Engineering (ISE) Program Proposal

Undergraduate Studies Committee. This handling of TE is only slightly modified from the original proposal.

### 8. Current and Proposed Advising Sheets

See Attachments #4 (current program requirement sheets and associated advising sheet) and Attachment #1 and #5 (proposed program requirements sheet and associated advising sheet, respectively).

### 9. Curriculum Map

See Attachment #2: BSISE Proposed Program (Curriculum Map)

### 10. Rationale for Program Changes and Description of Changes

This curriculum was developed in stages, with substantial input from faculty, advising staff, alumni, and current students. The initial stage began in WI 09, when members of the ISE Undergraduate Studies Committee undertook a benchmark analysis of curricula offered by 17 universities. It was clear that our current program was heavier in “engineering core” than the benchmark group, and failed to include some content that all other programs included. Effort toward revising the curriculum began in earnest during SU09. A group of 8 faculty members met repeatedly throughout the summer in an effort to initialize a view of a semester curriculum. When the faculty returned to duty in AU09, this provided a preliminary basis for discussion. The ISE Alumni Advisory Committee met on 9/25/09 and 4/16/10, permitting Advisory Committee input before the faculty began to work in earnest on the curriculum, and comments on the penultimate draft. Throughout AU09 and WI10, the proposed curriculum was repeatedly revised and fine-tuned based on discussion among the faculty as a whole. Proposed courses were designed, discussed, revised, discussed, etc. Following this, the new curriculum was presented to current ISE students who responded to an open invitation for review and comment. The students offered several substantive suggestions, which have been incorporated in the attached document.

The primary curricular changes that resulted from this process are as follows:

- The Engineering Core is significantly streamlined in comparison to the quarter curriculum. This decision was made through several careful discussions involving all of the engineering majors. Among this group, a decision was made to favor depth in the major over breadth across Engineering. The net effect is that program quality improvements will result from better preparation in the major. As a result of this change, the ISE curriculum includes a larger number of SCH allocated to Technical Electives on semesters than on quarters.
- The ISE Core content in the proposed program bears a strong resemblance to the core content in the quarter curriculum, although there are notable changes. Students will have less flexibility in their choice of computer programming courses. This is primarily to ensure that our students develop familiarity with object-oriented programming. Students will be required to take a course in Probabilistic Models for Planning, which was previously absent in our curriculum but present in all of the curricula in our benchmark study. Students will be required to take a course in System Modeling in order to impart a stronger representation of “systems” concepts than was previously included in our curriculum. This course, in particular, will use systems concepts to draw connections to other engineering disciplines. Our quarter curriculum includes courses on “Statistical Process Control” and “Design of Engineering Experiments”. Our proposed curriculum includes a single course on “Quality Control and Improvement”, which will integrate these concepts into a single course.
- The Technical Elective portion of the proposed program is slightly larger than it is under quarters (12 SCH vs. 15 QCH). We will require that students take at least 6 SCH in ISE courses, and the combination of Technical Electives taken will be subject to the approval of the Undergraduate

**A: Industrial and Systems Engineering (ISE) Program Proposal**

Studies Committee (under the quarter curriculum, technical electives are restricted to a specific allocation among lists of courses). This change is primarily spurred by comments obtained from graduating seniors in exit interviews over several years. These students have regularly identified frustrations over insufficient choice in the selection of technical electives. The proposed program includes two initial “pre-approved” lists of Technical Electives. We envision that this list will expand and/or contract as we evolve through this new curriculum.

The student response to the proposed curriculum has been uniformly positive. All of the students who have expressed opinions, either in the group meetings that were held or in one-on-one meetings with the academic advisor prefer the proposed curriculum to the current curriculum. The Alumni Advisory Committee’s response to the proposed curriculum was extremely favorable.

**Modifications:** The proposed modifications to the semester curriculum retain many of the favorably viewed features of the original proposal, while bringing our program into closer alignment with other programs within the College of Engineering, providing a better balance of fundamental ISE courses across the three primary areas, and providing the opportunity for each student to obtain some depth in an area of particular interest to him or her in ISE.

**11. Credit Hour Changes**

	Number of QCH in current program	Calculated 2/3 of QCH in current program	Number of SCH required for proposed program	Modification: Number of SCH required for proposed program
Total CH required for completion of program	193	128.67	127	126-127
Required CH offered by the unit	64-71	42.67-47.33	51-57	49-55
Required CH offered outside of the unit	122-129	81.33-86	70-76	71-78
Free Elective CH	0	0	0	0

**12. Rationale for Significant Change in Credit Hours**

In comparison to the current curriculum the proposed semester curriculum includes a 9-10 CH deviation in credit hours required in and out of ISE. The proposed curriculum includes three new courses: ISE 2010 Systems Modeling (3 SCH), ISE 3300 Probabilistic Models for Planning (3 SCH), ISE 3810 Implementation Strategy and Change Management (1 SCH). These new courses account for an additional 7 SCH. The remaining 2-3 are accounted for in some of the shifting credit hour counts that arise as a result of transitioning existing courses from quarters to semesters. Given the absence of free electives, the increase in CH required within ISE is necessarily matched by a decrease in CH required outside of ISE. Currently, the engineering core requires 45 QCH (i.e., 30 SCH) all of which are outside ISE. In the revised curriculum, the engineering core is reduced to 20 SCH.

**Modifications:**

Changes are made that concern the proposed new courses. ISE 2010 Systems Modeling (3 SCH) will not be included in the core. ISE 3300 Probabilistic Models for Planning (3 SCH) will be combined with ISE 5100 to form ISE 5100 Stochastic Modeling & Simulation (4 SCH). ISE 3810 Implementation Strategy and

**A: Industrial and Systems Engineering (ISE) Program Proposal**

Change Management (1 SCH) will be combined with ISE 3800 to form ISE 3800 Project Management (3 SCH). Additionally, ISE 3400 Production Planning (3) and ISE 3410 Facilities Planning (3) will be combined into ISE 3400 Production and Facilities Planning (4).

**13. Transition Policy**

The transition plan is based on the premise that our semester curriculum will be approved and in effect no later than AU 11, one full year before the conversion to the semester calendar. Graduation requirements for all ISE Majors who initiate their studies during or after AU 11 will be those in effect for ISE Majors on the proposed curriculum. Graduation requirements for all ISE Majors who initiate their studies at OSU prior to AU 11 will be either those in effect for ISE Majors on the proposed curriculum, or those that are currently in effect, in accordance with individual student preferences. Our proposed curriculum eliminates some requirements in the current curriculum and includes additional requirements that are not currently present. Because of this, all current ISE majors, pre-majors, and prospective majors are already being advised in a manner that will facilitate planning for course schedules through the transition to a semester calendar. All ISE majors, pre-majors, and prospective majors are being educated about both the current and the proposed curriculum. Without exception, every student thus far has expressed a strong preference for the proposed curriculum. Consequently, we anticipate that it is highly likely that from AU12 onward, graduation requirements will be those associated with the semester curriculum. We are, however, also prepared to accommodate the preferences of those students who might elect the current curriculum. See Attachment #6, Transition Curricula, Advising Sheets, and Credit Hour Accounting) for a detailed representation of the transition plans that will be put in place for each student affected by the transition to the semester calendar. Attachment #6 includes four transition plans, one for each combination of student “cohort” (defined as the autumn quarter in which they were/are NFQF, and assuming that they follow the recommended curriculum) and student “preference” (for either the semester- or quarter-based curriculum). Students who are NFQF in WI, SP, or SU quarters and those who will have deviated from the recommended curriculum will follow the transition plan that most closely aligns with their set of course completions as they begin the major. If it is determined that “normal” conditions covered by these four generic transition plans would result in a particular student facing an unavoidable delay in graduation compared to quarters as a result of the change to semesters rather than a student’s failure to make satisfactory progress through the program, then a revision of specific requirements will be worked out for that student by the advising staff with approval by the ISE Undergraduate Studies Committee.

The transition plan adheres to the following principles:

- The switch to semesters will not increase the number of credit hours that a student must take in order to satisfy graduation requirements by more than one QCH.
- Graduation requirements may vary, depending on when the student first enrolled in OSU. For those who first enroll during or after AU 11, the requirements will follow the proposed curriculum. All others may choose either the current curriculum or the proposed curriculum.
- Semester program requirements may be met either by taking semester courses, or via a substantially similar learning experience obtained through quarter course(s).
- Deviations from credit-hour requirements, whether positive or negative deviations, will be accounted as described in Attachment #6.
- Bridge courses will be offered to ease the transition from quarter courses to semester courses, as identified in Attachment #6.
- All transition curriculum plans meet the requirements of our accreditation, as defined by ABET.

**A: Industrial and Systems Engineering (ISE) Program Proposal**

As indicated in Attachment #6, we anticipate a need for three bridge courses to ensure that NFQF '09 students who elect the semester curriculum will be able to meet graduation requirements. The content in these courses will be offered during AY 11-12 (on quarters) and during AY 12-13 (on semesters). Students who cannot or choose not to follow the standard schedule will be advised individually by the advising staff to minimize the effect of the transition to semesters. We will facilitate the transition by offering the courses required on the transition curricula that appear in Attachment #6. If at the end of AY 12-13 it appears that a significant number of students are still in transition, we will offer the necessary bridge courses again in AY 13-14. Syllabi for the bridge courses to be offered after the switch to semesters are included with the collection of new syllabi to be reviewed. Syllabi for the version of these bridge courses that will be offered prior to the switch to quarters will follow the normal course approval process.

Modification: We are currently in the process of advising all ISE students regarding transition to semesters. Group sessions are being held for each cohort (defined by when they entered or are expected to enter the major). Students with special circumstances are also participating in individualized advising sessions. We believe that all ISE students will be successfully transitioned into the semester curriculum beginning Summer 2012, and there will be no need for any ISE bridge courses taught in semesters.

**14. Assessment Practices**

We have developed assessment practices to systematically evaluate our program outcomes and objectives. Our assessment of program outcomes incorporates both direct and indirect assessment measures including evaluation of student work by outside professionals working in the field of Industrial Engineering, samples of student writing, evaluation of presentation quality scores, and an exit survey. Our assessment of program objectives is conducted via the College of Engineering Alumni Survey process which typically occurs every two years. All data are reviewed by the department's assessment committee, and where there are deficiencies, the undergraduate studies committee is consulted to determine the appropriate corrective actions.

**15. Assessment Plan on File with OAA**

ISE has a detailed assessment plan which is on file with our curricular Dean for final submission to OAA.

## Industrial and Systems Engineering (ISE) Program Proposal: Attachments

### List of Attachments:

- #1: Proposed Program Requirements
- #2: Proposed Curriculum Map, Course Comparison Table, and BSISE “Bingo” Sheet
- #3: Illustrative Elective Sequences
- #4: Current Requirements and Advising Sheet
- #5: Proposed Advising Sheet
- #6: Transition Curricula Plans, Advising Sheets, and Credit Hour Accounting
- #7: Letter from Bob Gustafson regarding EEIC’s ability to accommodate ISE students in ENGR 2367

**Attachment #1: Proposed Program Requirements**

**First page – original plan**

**Second page – revised plan**

<b>General Education</b>	<b>Course Number</b>	<b>CH</b>
Gen Ed		3
Gen Ed		3
Gen Ed		3
Gen Ed		3
Gen Ed		3
Gen Ed		3
Gen Ed		3
English 1100:	English 1100	3
<b>Total General Education Course Number</b>		<b>24</b>
<b>Engineering Core</b>	<b>Course Number</b>	<b>CH</b>
Eng Survey	ENG 1100	1
Intro Engineering I	ENG 1181	2
Intro Engineering II	ENG 1182	2
Engineering Calculus I	Math 1151	5
Engineering Math A	Math 1172	5
Physics I	Physics 1251	5
<b>Total Engineering Core CH</b>		<b>20</b>
<b>ISE Core</b>	<b>Course Number</b>	<b>CH</b>
Computer Programming	CSE 1222	3
Additional science*	Physics 1251 or Biology 2100 or Chem 1250	3
Additional science*	Physics 1251 or Biology 2100 or Chem 1250	4
Engineering science		3
Intro to ISE; 1/2 Sem.	ISE 2000	1.5
Systems Modeling	ISE 2010	3
Engineering Economics	ISE 2040	2
Design of Work; 1/2 Sem.	ISE 2400	1.5
Intro to Manufacturing Eng	ISE 2500	3
Opt. for Enterprise Systems	ISE 3200	3
Opt. for System Design	ISE 3210	3
Prob. Models for Planning	ISE 3300	3
Production Planning	ISE 3400	3
Facilities Planning	ISE 3410	3
Workplace Ergonomics	ISE 3600	3
Cog. Systems Engineering	ISE 3700	3
Project Management	ISE 3800	2
Implementation & Change Management	ISE 3810	1
Quality Control & Improvement	ISE 4120	3
Capstone Design	ISE 4900	4
Discrete Event Simulation	ISE 5310	3
Engineering Math B	Math 2173	3
Engineering Math C	Math 2174	3
Statics/Strength of Mat.	ME 2040	4
Probability and Statistics	Stat 3470	3
<b>Total ISE Core CH</b>		<b>71</b>
<b>Technical Elective</b>	<b>Course Number</b>	<b>CH</b>
Technical Elective		3
Technical Elective		3
Technical Elective		3
Technical Elective		3
<b>Total Technical Elective CH</b>		<b>12</b>

**Attachment #1 – with modifications highlighted in yellow**

<b>General Education</b>	<b>Course Number</b>	<b>CH</b>
Gen Ed		3
Gen Ed		3
Gen Ed		3
Gen Ed		3
Gen Ed		3
Gen Ed		3
Gen Ed - American Attitudes About Technology	ENGR 2367	3
Gen Ed – Writing I	English 1110.0x	3
<b>Total General Education Course Hours</b>		<b>24</b>
<b>Engineering Core</b>	<b>Course Number</b>	<b>CH</b>
Engineering Survey	ENGR 1100	1
Intro to Engineering I	ENGR 1181	2
Intro to Engineering II	ENGR 1182	2
Engineering Calculus I	Math 1151	5
Engineering Math A	Math 1172	5
Physics 1	Physics 1250	5
<b>Total Engineering Core Course Hours</b>		<b>20</b>
<b>ISE Core</b>		
Computer Programming	CSE 1222	3
Additional Science	Physics 1251	5
Additional Science	Biology 2100 or Chem 1250	3 or 4, respectively
Engineering Science	MSE 2010, ECE 2300, CSE 2111, CSE 2122, ME 2030, ME 2850, or ME 3500	3
Intro to ISE	DELETED	
Systems Modeling	DELETED	
Engineering Economics; ½ sem	ISE 2040	2
Design of Work; ½ sem	ISE 2400	2
Manufacturing Systems	ISE 2500	3
Linear & Integer Programming (name change)	ISE 3200	3
Non-linear Programming (name change)	ISE 3210	3
Prob. Models for Planning	MERGED WITH ISE 5100	
Production Planning & Facilities Design	ISE 3400	4
Facilities Planning	MERGED WITH 3400	
Workplace Ergonomics	ISE 3600	3
Cognitive Systems Engineering	ISE 3700	3
Project Management	ISE 3800	3
Implementation & Change Management	MERGED WITH ISE 3800	
Quality Control and Improvement	ISE 4120	3
Capstone Design	ISE 4900	4
Stochastic Modeling and Simulation (name change and merge)	ISE 5100 (incorrectly labeled as 5310 in the original proposal)	4
Engineering Math B	Math 2173	3
Engineering Math C	Math 2174	3
Statics & Strength of Materials	ME 2040	4
Probability & Statistics	Stats 3470	3
<b>Total ISE Core</b>		<b>64-65</b>
<b>Technical Elective</b>		
Technical Elective Package (set of 3 courses)		9
Technical Elective		3
Technical Elective		3
Technical Elective		3
<b>Total Technical Elective Hours</b>		<b>18</b>

Note about Technical Electives: As a result of deleting some courses and combining others, the revised curriculum includes a total of 6 TE. Structure will be provided through the implementation of TE packages, which consist of 3 courses, that will provide depth within an area of ISE. Students will choose from among several TE packages approved by the ISE Undergraduate Studies Committee. The remaining three TE will be chosen from a list of TE approved by the ISE Undergraduate Studies Committee. This handling of TE is only slightly modified from the original proposal (refer to pg A2 and Attachment #3).

**BSISE Program Requirements (S)**



**Attachment #2: Proposed Curriculum Map, Course Comparison Table, and BSISE “Bingo” Sheet**

**For each of these documents, the original is presented first, followed by the revised version**

Curriculum Map for the BS degree in Industrial and Systems Engineering - **original proposal**

Program Outcomes Key: \*\*\* significant contribution; \*\* substantial contribution; \* some contribution

	a	b	c	d	e	f	g	h	i	j	k
<b>Required ISE Courses</b>											
ISE 2000	*				*	**	**	***	***	***	
ISE 2010	***		***		***			*		*	***
ISE 2040	**		*		***			**			***
ISE 2400	**		***	*	***	**	**	*		*	**
ISE 2500	***	**	**		**		**	*	*	**	***
ISE 3200	***	*	***		***		**	***	*	**	***
ISE 3210	***	*	***		***		*	***	*	**	***
ISE 3300	**		**		***				*		**
ISE 3400	***	*	***		***		*	***	*	**	***
ISE 3410	**	*	***		**	*	***	**	*	***	***
ISE 3600	**	**	*	**	***	*	**			*	***
ISE 3700	***	*	***	**	***	*	**	*	**	*	***
ISE 3800			***	*	**	*	*				***
ISE 3810			**								
ISE 4120	***	***	**		**		*	*		*	**
ISE 4900	**	**	**	***	**	**	**	*	**	*	**
ISE 5310	**	**	*		**				*		**
Technical electives											***
<b>Other Required Courses</b>											
Engineering 1100											
Engineering 1181	***		**	**	*	**	**				**
Engineering 1182	***		***	**							**
CSE 1222	**				***						***
Mathematics 1151, 1172	***				***						***
Mathematics 2173, 2174	***				***						***
Physics 1250	***	***									***
Physics or Chemistry or Biology	***	***									***
Mechanical Engineering 2040	***				***						
Statistics 3470	***										
General Education Courses					***	***	**	***	*	***	

## Key to Program Outcomes for Industrial & Systems Engineering

### Outcome

- a An ability to apply knowledge of mathematics, science and engineering
- b An ability to design and conduct experiments, as well as to analyze and interpret data
- c An ability to design a system, component, or process to meet desired needs
- d An ability to function on multi-disciplinary teams
- e An ability to identify, formulate, and solve engineering problems
- f An understanding of professional and ethical responsibility
- g An ability to communicate effectively
- h The broad education necessary to understand the impact of engineering solutions in a global and societal context
- i A recognition of the need for, and an ability to engage in, life-long learning
- j A knowledge of contemporary issues
- k An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Curriculum Map for the BS degree in Industrial and Systems Engineering -REVISED**

Program Outcomes Key: \*\*\* significant contribution; \*\* substantial contribution; \* some contribution

	a	b	c	d	e	f	g	h	i	j	k
<b>Required ISE Courses</b> ++											
ISE 2040	**		*		***			**			***
ISE 2400	**		***	*	***	**	**	*		*	***
ISE 2500	***	**	**		**		**	*	*	**	***
ISE 3200	***	*	***		***		**	***	*	**	***
ISE 3210	***	*	***		***		*	***	*	**	***
ISE 3400	***	*	***		***	*	***	***	*	***	***
ISE 3600	**	**	*	**	***	*	**	**	*	**	***
ISE 3700	***	*	***	**	***	*	**	*	**	*	***
ISE 3800			***	*	**	*	*	*			***
ISE 4120	***	***	**		**		*	*		*	**
ISE 4900	**	**	**	***	**	**	**	*	**	*	***
ISE 5100	***	**	**		***				**		***
Technical electives											***
<b>Other Required Courses</b>											
Engineering 1100											
Engineering 1181	***		**	**	*	**	**				**
Engineering 1182	***		***	**							**
CSE 1222	**				***						***
Mathematics 1151, 1172	***				***						***
Mathematics 2173, 2174	***				***						***
Physics 1250	***	***									***
Physics 1251	***	***									***
Chemistry 1250 or Biology 2100	***	**									***
Mechanical Engineering 2040	***				***						***
Statistics 3470	***										***
Engineering Science - Choices listed below	***				***						***
Engineering 2367 (Gen Ed., Writing II)						**	***	**	*	**	**
General Education Courses (remainder)						***	**	***	*	***	

Engineering Science choices:  
MSE 2010 (3), ECE 2300 (3), CSE 2111 (3), CSE 2122 (3), ME 2030 (3), ME 2850 (3), ME 3500 (3)

++ Removed from original proposed ISE list:  
ISE 2000 (withdrawn), 2010 (removed from core), 3300 (merged with 5100), 3410 (merged with 3400), 3810 (merged with 3800)

**Key to program outcomes for Industrial and Systems Engineering**

- a** An ability to apply knowledge of mathematics, science, and engineering
- b** An ability to design and conduct experiments, as well as to analyze and interpret data
- c** An ability to design a system, component, or process to meet desired needs
- d** **An ability to function on multi-disciplinary teams**
- e** An ability to identify, formulate, and solve engineering problems
- f** An understanding of professional and ethical responsibility
- g** An ability to communicate effectively
- h** The broad education necessary to understand the impact of engineering solutions in a global and societal context
- i** **A recognition of the need for, and an ability to engage in life-long learning**
- j** A knowledge of contemporary issues
- k** An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

ORIGINAL

**Comparison of Quarter and Semester Industrial and Systems Engineering Core Curricula**

Quarter Course Number, (Hours)	Course Title	Semester Course Number, (Hours)	Course Title	Comments
350 (3)	Manufacturing Engineering	2500 (3)	Intro to Manufacturing Eng.	Conversion of 350
500 (3)	Intro to Industrial and Systems Engineering	2000 (1.5)	Introduction to ISE	Conversion of 500 (a)
		2010 (3)	Systems Modeling	New course; (b)
501 (5)	Simulation	5310 (3)	Discrete Event Simulation	Conversion of 501
504 (3)	Engineering Economics	2040 (2)	Engineering Economics	Conversion of 504
		2050 (1.5)	Design of Work	New course (c)
510 (3)	Statistical Process Control	4120 (3)	Quality Control & Improvement	New course (d)
520 (3)	Linear Optimization	3200 (3)	Opt. for Enterprise Systems	Conversion of 520
521 (3)	Non-linear Optimization	3210 (3)	Opt. for System Design	Conversion of 521
540 (4)	Production Systems Design	3400 (3)	Production Planning	Conversion of 540
541 (4)	Facilities Design	3410 (3)	Facilities Design	Conversion of 541
542 (4)	Production Control	3300 (3)	Probabilistic Models for Planning	Conversion of 542
550 (3)	Principles of Manufacturing Processes			Course discontinued
560 (3)	Work Physiology and Biomechanics in Work Design	3600 (3)	Workplace Ergonomics	Conversion of 560
610 (3)	Planning Engineering Experiments	4120 (3)	Quality Control & Improvement	New course (d)
670 (3)	Cognitive Engineering	3700 (3)	Cognitive Systems Engineering	Conversion of 670
680 (8)	Capstone Design	4900 (4)	Capstone design	Conversion of 680
681	Project Management	3800 (3)	Project management	Conversion of 681
		3810 (1)	Change management	New course (e)

Notes:

- a) ISE 2000 contains a subset of the topics covered in ISE 500; some of this material is transferred to new ISE 2050.
- b) ISE 2010 is a new course in systems modeling, that resulted from benchmarking comparable programs as well as alumni surveys.
- c) ISE 2050 will contain material previously covered in ISE 500 and ISE 560.
- d) ISE 4120 combines topics previously covered in ISE 509 and ISE 610. Course material from 509 and 610 not covered in 4120 will be covered in technical electives.
- e) ISE 3810 is a new course in change management, resulting from input from our Industrial Advisory Board, alumni, and other engineering departments.

**Comparison of Quarter and Semester Industrial and Systems Engineering Core Curricula - modified**

Quarter Course Number, (Hours)	Course Title	Semester Course Number, (Hours)	Course Title	name changed ++	Comments	affected by changes to semester curriculum ++
350 (3)	Manufacturing Eng.	2500 (3)	Intro. To Manufacturing Eng.		Conversion of 350	
500 (3)	Introl to Industrial & Systems. Eng.	2000 (1.5)	Introduction to ISE		removed	X
		2010 (3)	Systems Modeling		removed	X
501(5)	Simulation	5100 (4)	Stochastic Modeling & Simulation	x	Conversion of 501: (b)	X
504 (3)	Eng. Economics	2040 (2)	Engineering Economics		Conversion of 504	
540 (4)	Production Systems Design	2400 (2)	Design of Work		New course: (c)	X
510 (3)	Statistical Process Control	4120 (3)	Quality Control & Improvement		New course: (d)	
520 (3)	Linear Optimization	3200 (3)	Linear & Integer Programming	x	Conversion of 520	X
521 (3)	Non-linear Optimization	3210 (3)	<b>Non-linear Programming</b>	x	Conversion of 521	X
541 (4) 542 (4)	Facilities Design Production Control	3400 (4)	Production Planning & Facilities Design	+	Conversion and merging of 541 and 542	X
550 (3)	Principles of Manufacturing Processes				Course discontinued	
560 (3)	Work Physiology and Biomechanics in Work Design	3600 (3)	Workplace Ergonomics		Conversion of 560	
610 (3)	Planning Engineering Experiments	4120 (3)	Quality Control & Improvement		New course: (d)	
670 (3)	Cognitive Engineering	3700 (3)	Cognitive Systems Engineering		Conversion of 670	
680.01 (4) 680.02 (4)	Capstone Design	4900 (4)	Capstone design		Conversion of 680.01 & 680.02	
681 (3)	Project Management	3800 (3)	Project management	+	Conversion of 681: (f)	X

Notes:

- a) Some content will be included in 2400: much will come from ENGR 2367, which is required as the second writing course in the revised ISE semester curriculum.
- b) course number 5310 was incorrect - the correct number is 5100: 3300 is merged with 5100 in revised ISE semester curriculum and hours increased to 4 (continued) 3300 was a new course; content designed based on perceived need from benchmarking competitive schools
- c) course number 2050 was incorrect - correct number for Design of Work is 2400: topics from 500 and 540 and not from 560: hrs increased to 2
- d) ISE 4120 combines topics previously covered in ISE 510 and 610. Course material from 510 and 610 not covered in 4120 will be covered in tech. electives.
- e) ISE 3800 now includes content from 3810 Change Management, resulting from input from our Industrial Advisory Board, alumni, and other engineering departments.

++: name changed to readily inform about course content (x): name change reflects course merger (+)

<b>Semester: 1/1</b>		<b>Semester: 1/2</b>	
Physics 1251: Physics I	5	Math 1172: Engineering Math A	5
Math 1151: Engineering Calculus I	5	ENG 1182: Intro Engineering II	2
ENG 1181: Intro Engineering I	2	CSE 1222: Computer Programming	3
ENG 1100: Eng Survey	1	English 1100:	3
Gen Ed	3	Additional science*	4
<b>Total:</b>	<b>16</b>	<b>Total:</b>	<b>17</b>
<b>Semester: 2/1</b>		<b>Semester: 2/2</b>	
Math 2173: Engineering Math B	3	Math 2174: Engineering Math C	3
Stat 3470: Probability and Statistics	3	ISE 2000: Intro to ISE; 1/2 Sem.	1.5
ME 2040: Statics/Strength of Mat.	4	ISE 2010: Systems Modeling	3
ISE 2040: Engineering Economics	2	ISE 2400: Design of Work; 1/2 Sem.	1.5
Additional science*	3	ISE 2500: Intro to Manufacturing Eng	3
Gen Ed	3	Engineering science	3
		Gen Ed	3
<b>Total:</b>	<b>18</b>	<b>Total:</b>	<b>18</b>
<b>Semester: 3/1</b>		<b>Semester: 3/2</b>	
ISE 3200: Opt. for Enterprise Systems	3	ISE 3210: Opt. for System Design	3
ISE 3300: Prob. Models for Planning	3	ISE 3410: Facilities Planning	3
ISE 3400: Production Planning	3	ISE 3700: Cog. Systems Engineering	3
ISE 3600: Workplace Ergonomics	3	ISE 4120: Quality Control & Improvement	3
Gen Ed	3	Gen Ed	3
<b>Total:</b>	<b>15</b>	<b>Total:</b>	<b>15</b>
<b>Semester: 4/1</b>		<b>Semester: 4/2</b>	
ISE 3800: Project Management	2	ISE 4900: Capstone Design	4
ISE 3810: Implementation & Change Managem	1	Technical Elective	3
ISE 5310: Discrete Event Simulation	3	Technical Elective	3
Technical Elective	3	Gen Ed	3
Technical Elective	3		
Gen Ed	3		
<b>Total:</b>	<b>15</b>	<b>Total:</b>	<b>13</b>

Total Credit Hours 127

\*Additional Science

Physics 1251 (5) Physics II

Chemistry 1250 (4) Chemistry for Engineers

Biology 2100 (3) Biological Analysis



**Attachment #2 – revised**

<b>Semester 1/1</b>		<b>Semester 1/2</b>	
Physics 1250 – Mechanics, Thermal Physics, Waves (Physics I)	5	Physics 1251 – E&M, Optics, Modern Physics (Physics II)	5
Math 1151 – Engineering Calculus I	5	Math 1172 - Engineering Math A	5
ENGR 1181 – Intro to Engineering I	2	ENGR 1182 – Intro to Engineering II	2
ENGR 1100 – Engineering Survey	1	CSE 1222 Programming in C++	3
Gen Ed: Literature	3	Gen Ed: Writing I (English 1110.0x)	3
<b>Total</b>	<b>16</b>	<b>Total</b>	<b>18</b>
<b>Semester 2/1</b>		<b>Semester 2/2</b>	
Math 2173 Engineering Math B	3	Math 2174 Linear Algebra & Diff. Eqns.	3
Stats 3470 Probability & Statistics	3	ISE 2400 Design of Work	2
ME 2040 Statics & Strength of Materials	4	Engineering Science <sup>2</sup>	3
Additional Science <sup>1</sup>	3–4	ISE 2040 Engineering Economics	2
Gen Ed: Arts	3	Gen Ed: Writing II, (ENGR 2367 American Attitudes About Technology)	3
<b>Total</b>	<b>16–17</b>	<b>Total</b>	<b>13</b>
<b>Semester 3/1</b>		<b>Semester 3/2</b>	
ISE 3200 Linear & Integer Programming	3	ISE 3210 Non-linear Programming	3
ISE 3400 Prod Plan & Fac Design	4	ISE 3800 Project Management	3
ISE 2500 Intro to Manufacturing eng.	3	ISE 4120 Quality Control & DOE	3
ISE 3700 Cognitive Systems Eng.	3	ISE 3600 Workplace Ergonomics	3
Gen Ed: Culture and Ideas (Ethics) <sup>3</sup>	3	Gen Ed: Historical Study	3
<b>Total</b>	<b>16</b>	<b>Total</b>	<b>15</b>
<b>Semester 4/1</b>		<b>Semester 4/2</b>	
ISE 5100 Stoch. Modeling & Simulation	4	ISE 4900 Capstone Design	4
Technical Elective <sup>4</sup>	3	Technical Elective	3
Technical Elective	3	Technical Elective	3
Technical Elective	3	Technical Elective	3
Gen Ed: Social Science I	3	Gen Ed: Social Science II	3
<b>Total</b>	<b>16</b>	<b>Total</b>	<b>16</b>
<b>Total Credit Hours</b>		<b>126–127</b>	

**Notes**

<sup>1</sup> Choose either Chemistry 1250 (4) or Biology 2100 (3)

<sup>2</sup> Choose one: MSE 2010 (3), ECE 2300 (3), CSE 2111 (3), CSE 2122 (3), ME 2030 (3), ME 2850 (3), ME 3500 (3)  
(Note that ME 3500 and MSE 2010 require Chemistry 1250 as prerequisite; ME 2850 requires permission of instructor)

<sup>3</sup> Philosophy 1332, or approved alternative

<sup>4</sup> At least three technical electives must be taken as a set, from a list of approved packages; a maximum of two technical electives may come from programs other than Industrial & Systems Engineering.

**Attachment #3: Illustrative Elective Sequences**

**Original document is followed by Revised**

**Attachment #3: Illustrative Elective Sequences - original**

**Manufacturing:**

ISE 4500 (Manufacturing Process Engineering)

ISE 5110 (Design of Engineering Experiments)

One of:

ISE 5510 (Fundamentals of Solid State Processing)

ISE 5520 (Fundamentals of Liquid Shaping Processes)

One of:

ISE 5530 (Fundamentals of Tool Engineering)

ISE 5540 (Polymer Processing Fundamentals)

ISE 5550 (Principals of Precision Engineering)

**Management Systems**

ISE 5110 Design of Experiments

ISE 5410 Quantitative Models in Production and Distribution Logistics

Business Elective

One of:

ISE 5810 Lean Sigma Foundations

ISE 5830 Decision Analysis

**Attachment #3: Illustrative Examples of Technical Elective Packages – revised**

**Manufacturing Design:**

- ISE 5560 Product Design Engineering
  - ISE 4500 Manufacturing Process Engineering
- and choose 1 of the following:
- ISE 5501 Fundamentals of Solid State Processing
  - ISE 5502 Fundamentals of Liquid Shaping Processes

**Manufacturing Solid Shaping:**

- ISE 5501 Fundamentals of Solid State Processing
  - ISE 4500 Manufacturing Process Engineering
- and choose 1 of the following:
- ISE 5550 Principles of Precision Engineering
  - ISE 5555 Manufacturing processes and machine tools

**Operations Research – Applications:**

- select 3 of the following courses:
- ISE 5430 Warehouse and Facility Design
  - ISE 5410 Quantitative Models in Production and Distribution Logistics
  - ISE 5830 Decision Analysis
  - ISE 5840 Market Engineering and Applications

**Operations Research - Optimization:**

- ISE 5200 Linear Optimization
  - ISE 5210 Operations Research Models and Methods
- and one of
- ISE 5830 Decision Analysis
  - ISE 5840 Market Engineering and Applications

**Human Factors – Product Design**

- select 3 of the following courses:
- ISE 5560 Product Design Engineering
  - ISE 5610 Ergonomics in the Product Design Process
  - ISE 5770 Cognitive Systems Engineering: Design & Evaluation
  - DESIGN 3105 Design Concepts for Non-Majors

**Cognitive Systems Engineering**

- select 3 of the following courses:
- ISE 5705 Distributed and Cooperative Work
  - ISE 5710 Safety and Complex Systems
  - ISE 5720 Human Systems Integration
  - ISE 5730 Information Analysis and Synthesis
  - ISE 5740 Human-Centered Automation
  - ISE 5760 Visualization and HCI
  - ISE 5770 Cognitive Systems Engineering: Design & Evaluation

**Attachment #4: Current Requirements and Advising Sheet (quarters curriculum)**

<b>General Education</b>	<b>Course Number</b>	<b>QCH</b>
GEC	English 110	5
GEC	Psych 100	5
GEC	Econ 200	5
GEC	2nd Writing GEC	5
GEC	GEC	5
GEC	GEC	5
GEC	GEC	5
<b>Total General Education Course Number</b>		<b>35</b>
<b>Engineering Core</b>	<b>Course Number</b>	<b>QCH</b>
Math	Math 151	5
	Math 152	5
	Math 153	5
Science	Chem 121	5
	Physics 131	5
	Physics 132	5
	Additional Sci	4
Computing	CSE 294/202; EG 167	4
Engineering Core	Eng 100	1
	Eng 181	3
	Eng 183	3
<b>Total Engineering Core CH</b>		<b>45</b>
<b>ISE Core</b>	<b>Course Number</b>	<b>QCH</b>
Calc & Analytic Geometry	Math 254	5
Differential Equations	Math 255 or 415	5
Linear Algebra	Math 568 or 571	3
Prob & Stat I	Stat 427	3
Prob & Stat II	Stat 428	3
Statics	ME 410	4
Strength of Materials	ME 420	4
Dynamics	ME 430	4
Intro to MSE	MSE 205	3
Electrical Circuits	ECE 300 & 309	4
Accounting	Acct 501	3
Manufacturing Engineering	ISE 350	3
Introduction to ISE	ISE 500	3
Simulation	ISE 501	5
Engineering Economics	ISE 504	3
Statistical Process Control	ISE 510	3
Linear Optimization	ISE 520	3
Nonlinear Optimization	ISE 521	3
Production Systems Design	ISE 540	4
Facilities Design	ISE 541	4
Production Control	ISE 542	4
Princ Mfg Processes	ISE 550	3
Phys Biomech Work Des	ISE 560	3
Planning Engineering Experiments	ISE 610	3
Cognitive Engineering	ISE 670	3
Capstone Design I & II	ISE 680.01 & 680.02	8
Project Management	ISE 681	3
<b>Total ISE Core CH</b>		<b>68</b>
<b>Technical Elective</b>	<b>Course Number</b>	<b>QCH</b>
Technical Elective		3
Technical Elective		3
Technical Elective		3
Technical Elective		3
Technical Elective		3
<b>Total Technical Elective CH</b>		<b>15</b>

Undergraduate Program in Industrial and Systems Engineering  
The Ohio State University  
Effective Spring 2005 (new #s WI'09)

**COURSES WHICH MUST BE COMPLETED BEFORE APPLYING TO ISE MAJOR:**

Student must have at least a 2.0 Cum GPA and at least a 2.0 cumulative in these courses (OR in their equivalent courses):

ENG 181 (3) (or ENG H191) \_\_\_\_\_  
ENG 183 (3) (or ENG H193) \_\_\_\_\_

CSE 202 (4) \_\_\_\_\_  
(or: ENG H192, CSE294P, or EngGraph 157)

ENGLISH 110.XX (5) \_\_\_\_\_

MATH 151.XX (5) \_\_\_\_\_  
152.XX (5) \_\_\_\_\_  
153.XX (5) \_\_\_\_\_

PHYSICS 131 (5) \_\_\_\_\_  
132 (5) \_\_\_\_\_

**OTHER COURSES TO BE TAKEN BEFORE BEGINNING ISE MAJOR CORE COURSES:**

CHEM 121 (5) \_\_\_\_\_

ADDITIONAL SCIENCE (choose one:  
Chem 122, Chem 125 or Physics 133 \_\_\_\_\_

ME 410 (4) \_\_\_\_\_

ME 420 (4) \_\_\_\_\_

ME 430 (4) \_\_\_\_\_

MATH 254.XX (5) \_\_\_\_\_

MATH 255.XX (5) or 415.XX (4) \_\_\_\_\_

MATH 571 or 568 (3) \_\_\_\_\_

STATISTICS 427 (3) \_\_\_\_\_

STATISTICS 428 (3) \_\_\_\_\_

ECON 200 (5) \_\_\_\_\_

PSYCH 100 (5) \_\_\_\_\_

2<sup>nd</sup> WRITING GEC (5) \_\_\_\_\_

ACCTG 501 (3) \_\_\_\_\_

ISE 350 (3) \_\_\_\_\_

ISE 504 or H504 (3) \_\_\_\_\_

ISE 500 (3) \_\_\_\_\_

**SEQUENCE OF COURSES FOR STUDENTS WHO BEGIN ISE CORE IN AUTUMN**  
Apply to major by preceding January 10

AUTUMN	WINTER	SPRING	AUTUMN	WINTER
ISE 501 (5)	ISE 521 (3)	ISE 541 (4)	ISE 680.01 (4)	ISE 680.02 (4)
ISE 520 (3)	ISE 540 (4)	ISE 542 (4)	ISE 610 (3)	MSE 205 (3)
ISE 560 (3)	ISE 670 (3)	ISE 681 (3)	TECH ELEC	TECH ELEC
ECE 300 (3)	ISE 550/H550 (3)	ISE 510 (3)	TECH ELEC	TECH ELEC
ECE 309 (1)				

**SEQUENCE OF COURSES FOR STUDENTS WHO BEGIN ISE CORE IN WINTER**  
Apply to major by preceding April 10

WINTER	SPRING	AUTUMN	WINTER	SPRING
ISE 501 (5)	ISE 521 (3)	ISE 541 (4)	ISE 680.01 (4)	ISE 680.02 (4)
ISE 520 (3)	ISE 540 (4)	ISE 542 (4)	ISE 610 (3)	MSE 205 (3)
ISE 560 (3)	ISE 670 (3)	ISE 681 (3)	TECH ELEC	TECH ELEC
ECE 300 (3)	ISE 550/H550 (3)	ISE 510 (3)	TECH ELEC	TECH ELEC
ECE 309 (1)				

**Attachment #5: Proposed Advising Sheet (for Semester curriculum)**

Original proposal is followed by revised



ORIGINAL

Undergraduate Program in Industrial and Systems Engineering  
The Ohio State University  
NFQF Autumn 2012

**COURSES WHICH MUST BE COMPLETED BEFORE APPLYING TO THE MAJOR:**

Student must have at least a cumulative 2.0 GPA and at least a 2.0 cumulative in these courses or their equivalents:

- Engineering 1181 (2)
- Engineering 1182 (2)
- CSE 1222 (3)
- MATH 1151 (5)
- MATH 1172 (5)
- PHYSICS 1250 (5)

**ADDITIONAL PREREQUISITES WHICH MUST BE COMPLETED BEFORE BEGINNING ISE MAJOR CORE COURSES:**

- ENG 1100 (1)
- ENGLISH 1100 (3)
- MATH 2173 (3)
- MATH 2174 (3)
- STAT 3470 (3)
- Additional Science: Choose 7 CH from:
  - PHYSICS 1251 (5)
  - CHEMISTRY 1250 (4)
  - BIOLOGY 2100 (3)

- ENG Science (3)
- ME 2040 (4)
- ISE 2000 (1.5)
- ISE 2010 (3)
- ISE 2040 (2)
- ISE 2400 (1.5)
- ISE 2500 (3)

**Sequence of courses for students who begin ISE core in Autumn Semester**

AU	SP	AU	SP
ISE 3200 (3)	ISE 3210 (3)	ISE 3800, 3810 (2, 1)	ISE 4900 (4)
ISE 3300 (3)	ISE 3410 (3)	ISE 5310 (3)	Tech Elec (3)
ISE 3400 (3)	ISE 3700 (3)	Tech Elec (3)	Tech Elec (3)
ISE 3600 (3)	ISE 4120 (3)	Tech Elec (3)	Gen Ed (3)

**Sequence of courses for students who begin ISE core in Spring Semester**

SP	AU	SP	AU
ISE 3200 (3)	ISE 3210 (3)	ISE 3800, 3810 (2, 1)	ISE 4900 (4)
ISE 3300 (3)	ISE 3410 (3)	ISE 5310 (3)	Tech Elec (3)
ISE 3400 (3)	ISE 3700 (3)	Tech Elec (3)	Tech Elec (3)
ISE 3600 (3)	ISE 4120 (3)	Tech Elec (3)	Gen Ed (3)

An additional 21 credit hours of general education courses are required for graduation.

## Undergraduate Program in Industrial and Systems Engineering

The Ohio State University

NFQF AU 12

**COURSES WHICH MUST BE COMPLETED BEFORE APPLYING TO ISE MAJOR:**

Student must have at least a 2.0 Cum GPA and at least a 2.0 cumulative in these courses (**OR in their equivalent courses**):

ENGR 1181 \_\_\_\_\_  
ENGR 1182 \_\_\_\_\_  
ENGR 1100 \_\_\_\_\_

CSE 1222 \_\_\_\_\_

ENGLISH 1110.0X (Gen Ed) \_\_\_\_\_

MATH 1151 (5) \_\_\_\_\_  
1172 (5) \_\_\_\_\_  
2173 (3) \_\_\_\_\_

PHYSICS 1250 (5) \_\_\_\_\_

**OTHER COURSES TO BE TAKEN BEFORE BEGINNING ISE MAJOR CORE COURSES:**

PHYSICS 1251 (5) \_\_\_\_\_

Additional Science (4) \_\_\_\_\_ Choose one: Chemistry 1250, Biology 2100)

ME 2040 (4) \_\_\_\_\_

ENG. SCIENCE (3) \_\_\_\_\_ (choose from: ME 2030, ME 3500, MSE 2010, ECE 2300, CSE 2111, CSE 2122, ME 2850)

MATH 2174 (3) \_\_\_\_\_

STATISTICS 3470 (3) \_\_\_\_\_

LITERATURE (Gen Ed) \_\_\_\_\_

ARTS (Gen Ed) \_\_\_\_\_

**Sequence of ISE courses:**

<b>Begin ISE core in Spring 14</b>		<b>Begin ISE core in Autumn 14</b>	
<b><u>Autumn 13 - Semester</u></b>	<b><u>Spring 14 - Semester</u></b>	<b><u>Spring 14 - Semester</u></b>	<b><u>Autumn 14 - Semester</u></b>
ENGINEER 2367	ISE 3200	ENGINEER 2367	ISE 3200
ISE 2400 (2)	ISE 3400	ISE 2400 (2)	ISE 3400
ISE 2040 (2)	ISE 3700	ISE 2040 (2)	ISE 3700
	ISE 2500		ISE 2500
	Gen Ed: Ethics		Gen Ed: Ethics
<b><u>Autumn 14 - Semester</u></b>	<b><u>Spring 15 - Semester</u></b>	<b><u>Spring 15 - Semester</u></b>	<b><u>Autumn 15 - Semester</u></b>
ISE 3210	ISE 5100 (4)	ISE 3210	ISE 5100 (4)
ISE 3800	Technical Elective	ISE 3800	Technical Elective
ISE 3600	Technical Elective	ISE 3600	Technical Elective
ISE 4120	Technical Elective	ISE 4120	Technical Elective
Gen Ed: Historical Study	Gen Ed: Social Science I	Gen Ed: Historical Study	Gen Ed: Social Science I
<b><u>Autumn 15 - Semester</u></b>		<b><u>Spring 16 - Semester</u></b>	
ISE 4900 (4)		ISE 4900 (4)	
Technical Elective		Technical Elective	
Technical Elective		Technical Elective	
Technical Elective		Technical Elective	
Gen Ed: Social Science I		Gen Ed: Social Science I	

At least three technical electives must be taken as a set, from a list of approved packages; a maximum of two technical electives may come from programs other than Industrial & Systems Engineering.

**Attachment #6: Transition Curricula Plans, Advising Sheets, and Credit Hour Accounting**

The following pages include the primary transition plans for ISE majors. They are presented based on the quarter in which the student initiates studies at OSU (NFQF09, NFQF10, and NFQF11) and the curriculum that the student wishes to follow (Semester or Quarter) for NFQF09 and NFQF10 students. All NFQF11 students will follow the Semester Plan after their first year. Consequently, there are five distinct transition plans.

Each plan identifies the program requirements and the manner in which they will be fulfilled. For courses to be taken after the calendar transition, we have identified the semester in which the course is scheduled to be taken. Credit hour accounting is based on 1 SCH = 1.5 QCH. Credit hour differentials are accounted for to the fullest extent possible. Where we have determined that surpluses/shortages are unavoidable, these have been accumulated and allocated against technical electives. In doing this, none of the four plans shows a total credit hour difference of more than 1QCH.

In reviewing the transition curricula, please note that the credit hour accounting is based on the curriculum plan being presented. Thus, for students following the semester curriculum the accounting is in SCH, while for students following the quarter curriculum the accounting is in QCH.

The original proposal included the following transition plans (advising sheets and credit hr accounting):

1. NFQF AU09 (Begin ISE Major in AU11; Graduate in SP13), SEMESTER OPTION
2. NFQF AU10 (Begin ISE Major in AU12; Graduate in SP14), SEMESTER OPTION
3. NFQF AU09 (Begin ISE Major in AU11; Graduate in SP13), Quarter OPTION
4. NFQF AU10 (Begin ISE Major in AU12; Graduate in SP14), Quarter OPTION
5. NFQF AU11 (Begin ISE Major in AU13; Graduate in SP15), SEMESTER OPTION

We have prepared and included modified versions for 1, 2, and 5; they are placed after the original versions. There are no changes to #3 and no one is electing to follow #4, so there are no modified versions of these.

I. NFQF AU09 (Begin ISE Major in AU11; Graduate in SP13), SEMESTER OPTION

Courses Completed Prior to AU11 (on Quarters)		
Math 151: (5) Math 152: (5) Math 153: (5) Math 254: (5) Math 255 or 415: (5) Math 568 or 571: (3) Stats 427: (3) Stats 428: (3) Engr 100: (1) Engr 181: (3) Engr 183: (3)	Physics 131: (5) Physics 132: (5) Additional Science (4) English 110: (5) Psych 100: (5) Econ 200: (5) 2 <sup>nd</sup> Writing GEC (5) GEC1 (5)	CSE 202/205 or EG 167: (4) ME 410: Statics (4) ME 420: Strength of Materials (4) ISE 350: (3) ISE 500: Intro to ISE (3) ISE 504: Engineering Economics (3) <b>ISE 599.1L: Systems Modeling (5)</b>
<b>AU 11 (First Qtr as ISE Major)</b>	WI 12	SP 12
ISE 501: Simulation (5) ISE 520: Linear Optimization (3) ISE 560: Phys Biomech Work Des (3) <b>ISE 599.2G: Mfg Bridge Course (4)</b>	ISE 521: Nonlinear Optimization (3) ISE 540: Prod Systems Design (4) ISE 670: Cognitive Engineering (3) HF Elective (3)	ISE 510: Stat Process Control (3) ISE 541: Facilities Design (4) ISE 542: Production Control (4) <b>ISE 599.3G: Opt. Bridge Course (3)</b> GEC2 (3)
AU12	SP 13	
ISE 3300: Prob. Models for Planning (3) ISE 3800: Project Mangement (2) ISE 3810: Implementation & Change Mgmt (1) Technical Elective (3) Gen Ed (3)	ISE 4900: Capstone Design (4) Technical Elective (3) Technical Elective (3)	

General Education	Course Number	SCH	Class Taken	QCH	Sem Taken	SCH	SCH Differential (Taken - Required)	Reallocated SCH	Net Change in SCH	Notes / Resolution
Gen Ed 1		3	Psych 100	5						
Gen Ed 2		3	Econ 200	5						
Gen Ed 3		3	2nd Writ. GEC	5						
Gen Ed 4		3	GEC1	5						
Gen Ed 5		3	GEC2	5						
Gen Ed 6		3	Gen Ed (Sem.)		AU12	3				
Gen Ed 7		3								
English 1100:	English 1100	3	English 110	5						
<b>Total General Education Course Number</b>		<b>24</b>		<b>30</b>		<b>3</b>	<b>-1.00</b>		<b>-1.00</b>	<b>T1: Tech Elective</b>
<b>Engineering Core</b>	<b>Course Number</b>	<b>SCH</b>								
Eng Survey	ENG 1100	1	ENG 100	1			-0.33		-0.33	
Intro Engineering I	ENG 1181	2	ENG 181	3						
Intro Engineering II	ENG 1182	2	ENG 183	3						
Engineering Calculus I	Math 1151	5								
Engineering Calculus II	Math 1152	5	Math 151, 152, 153	15						
Physics I	Physics 1151	5	Phys 131,132	10			1.67	-1.00	0.67	A: Add'l Science
<b>Total Engineering Core CH</b>		<b>20</b>		<b>32</b>					<b>0.33</b>	<b>T2: Tech Elective</b>
<b>ISE Core</b>	<b>Course Number</b>	<b>SCH</b>								
Additional science		4	Chem 121	5			-0.67	0.67		A1: from A
Additional Science		3	Additional Sci	4			-0.33	0.33		A2: from A
Engineering science		3					-3.00	3.00		B: B1, B2, B3
Computer Programming	CSE 1222	3	CSE / EG	4			-0.33		-0.33	
*** Prereq for Math 255 and 415	n/a		*** Math 254	5			3.33		3.33	
Differential Equations	Math 2xxx	3	Math 255 or 415	5			0.33		0.33	
Linear Algebra	Math 2xxx	3	Math 568 or 571	3			-1.00		-1.00	
Statics/Strength of Mat.	ME 2040	4	ME 410, 420	8			1.33	-1.33		B1: Eng Science
Probability and Statistic	Stat 4278	3	Stat 427,428	6			1.00		1.00	
Intro to ISE; 1/2 Sem.	ISE 2000	1.5	ISE 500	3			0.50	-0.50		B2: Eng Science
Systems Modeling	ISE 2010	3	ISE 599.1L	5			0.33		0.33	
Engineering Economics	ISE 2040	2	ISE 504	3						
Design of Work; 1/2 Sem.	ISE 2400	1.5	ISE 540	4			1.17	-1.17		B3: Eng Science
Intro to Manufacturing Eng	ISE 2500	3	ISE 350	3			-1.00	1.00		D: Mfg Bridge
Opt. for Enterprise Systems	ISE 3200	3	ISE 520	3			-1.00	1.00		C: Opt Bridge
Opt. for System Design	ISE 3210	3	ISE 521	3			-1.00	1.00		C: Opt Bridge
Prob. Models for Planning	ISE 3300	3			AU12	3				
Production Planning	ISE 3400	3	ISE 542	4			-0.33	0.33		D: Mfg Bridge
Facilities Planning	ISE 3410	3	ISE 541	4			-0.33	0.33		D: Mfg Bridge
Workplace Ergonomics	ISE 3600	3	ISE 560	3			-1.00	1.00		E: HF Elective
Cog. Systems Engineering	ISE 3700	3	ISE 670	3			-1.00	1.00		E: HF Elective
Eng. Project Management	ISE 3800	2			AU12	2				
Implementation & Change Mgmt	ISE 3810	1			AU12	1				
Quality Control & Improvement	ISE 4120	3	ISE 510	3			-1.00	1.00		D: Mfg Bridge
Capstone Design	ISE 4900	4			SP13	4				
Discrete Event Simulation	ISE 5310	3	ISE 501	5			0.33		0.33	
<b>Total ISE Core CH</b>		<b>71</b>		<b>86</b>		<b>10</b>			<b>4.00</b>	<b>T3: Tech Elective</b>
<b>Technical Elective</b>	<b>Course Number</b>	<b>SCH</b>								
Technical Elective		3			AU12	3				
Technical Elective		3			SP13	3				
Technical Elective		3			SP13	3				
Technical Elective		3								T1+T2+T3
<b>Total Technical Elective CH</b>		<b>12</b>				<b>9</b>	<b>-3.00</b>	<b>3.33</b>	<b>0.33</b>	<b>Final Differential</b>

Additional Transition Courses		SCH	Target of SCH allocations
C: Optimization "Transition"	ISE 599.3G (3QCH)	2	ISE 3200, 3210
D: Manufacturing "Transition"	ISE 599.2G (4QCH)	2.67	ISE 2500, 3400, 3410,4120
E: HF Elective	Elective (3QCH)	2	ISE 3600, 3700

REVISED

## Undergraduate Program in Industrial and Systems Engineering

The Ohio State University

NFQF WI 10, SP 10 & SU 10 (Taking ISE 500 in SP 11) (Semester Option)

### COURSES WHICH MUST BE COMPLETED BEFORE APPLYING TO ISE MAJOR:

Student must have at least a 2.0 Cum GPA and at least a 2.0 cumulative in these courses (OR in their equivalent courses):

ENG 181.xx (3) (or ENG H191) \_\_\_\_\_

ENG 183.xx (3) (or ENG H193) \_\_\_\_\_

CSE 205 (4) \_\_\_\_\_

(or: CSE 202 or ENG H192 or EngGraph 167.01)

ENGLISH 110.xx (5) \_\_\_\_\_

MATH 151.xx (5) \_\_\_\_\_

152.xx (5) \_\_\_\_\_

(or 161 for both 151 & 152) (5) \_\_\_\_\_

153.xx (or 162) (5) \_\_\_\_\_

PHYSICS 131 (5) \_\_\_\_\_

132 (5) \_\_\_\_\_

### OTHER COURSES TO BE TAKEN BEFORE BEGINNING ISE MAJOR CORE COURSES:

(Choose **two**: Chem 121, Chem 122, Chem 125, Bio 113, Bio 114 or Physics 133)

Additional Science (4) \_\_\_\_\_

Additional Science (3-4) \_\_\_\_\_

ME 410 (4) \_\_\_\_\_

ME 420 (4) \_\_\_\_\_

ENG. SCIENCE (3) \_\_\_\_\_ (choose from: ME 430, ME 500, MSE 205, ECE 300, Other Upper Level ENG. Course)

MATH 254.xx (5) \_\_\_\_\_

MATH 255.xx (5) (or 415.xx) \_\_\_\_\_

MATH 568 (3) \_\_\_\_\_

STATISTICS 427 (3) \_\_\_\_\_

STATISTICS 428 (3) \_\_\_\_\_

ECON 200 (5) \_\_\_\_\_

PSYCH 100 (5) \_\_\_\_\_

2<sup>nd</sup> WRITING GEC (5) \_\_\_\_\_

HISTORY GEC (5) \_\_\_\_\_

ETHICS GEC (5) \_\_\_\_\_

### Sequence of ISE core courses:

(Apply to Major by January 10, 2011)

#### Spring 11 - Quarter

ISE 500

ISE 504

ISE 350

ISE 599.01

#### Autumn 11 - Quarter

ISE 501

ISE 520

ISE 560

Remaining GEC

#### Winter 12 - Quarter

ISE 521

ISE 540

ISE 670

ISE 599.03

#### Spring 12 - Quarter

ISE 541

ISE 542

ISE 510

599.02

#### Autumn 12- Semester

ISE 3800

Technical Elective

Technical Elective

Technical Elective - HF

#### Spring 13- Semester

ISE 4900

Technical Elective

Technical Elective

General Education	Course Number	SCH	Class Taken	QCH	Sem Taken	SCH	SCH Differential (Taken - Required)	Reallocated SCH	Net Change in SCH	Notes / Resolution
Gen Ed 1		3	Psych 100	5						
Gen Ed 2		3	Econ 200	5						
Gen Ed 3	ENGR 2367	3	2nd Writ. GEC	5						
Gen Ed 4		3	GEC1	5						
Gen Ed 5		3	GEC2	5						
Gen Ed 6		3	Gen Ed (au11.)	3						
Gen Ed 7		3								
English 1100:	English 1100	3	English 110	5						
<b>Total General Education Course Number</b>		<b>24</b>		<b>33</b>			<b>-2.00</b>		<b>-2.00</b>	<b>T1: Tech Elective</b>
Engineering Core	Course Number	SCH								
Eng Survey	ENGR 1100	1	ENGR 100	1			-0.33		-0.33	
Intro Engineering I	ENGR 1181	2	ENGR 181	3						
Intro Engineering II	ENGR 1182	2	ENGR 183	3						
Engineering Calculus I	Math 1151	5								
Engineering Math A	Math 1172	5	Math 151, 152, 153	15						
Physics I	Physics 1250	5	Phys 131,132	10			1.67	-2.00	-0.33	A: Add'l Science
<b>Total Engineering Core CH</b>		<b>20</b>		<b>32</b>			<b>1.33</b>		<b>-0.67</b>	<b>T2: Tech Elective</b>
ISE Core	Course Number	SCH								
Additional science	Chm1250 or Bio2100	3	Chem 121	5			0.33	-0.33	0	A1: add to A
Additional Science	Physics 1251	5	Additional Sci	4			-2.33	2.33	0	A2: from A
Engineering science		3					-3.00	4.00	1.00	B: B1, B2, B3
Computer Programming	CSE 1222	3	CSE / EG	4			-0.33		-0.33	
*** Prereq for Math 255 and 415	n/a		*** Math 254	5			3.33		3.33	
Eng. Math B	Math 2173	3	Math 255 or 415	5			0.33		0.33	
Linear Algebra & Diff Eq.	Math 2174	3	Math 568 or 571	3			-1.00		-1.00	
Statics/Strength of Mat.	ME 2040	4	ME 410, 420	8			1.33	-1.33		B1: Eng Science
Probability and Statistic	Stat 3470	3	Stat 427,428	6			1.00		1.00	
			ISE 500	3			2.00	-2.00		B2: Eng Science
Engineering Economics	ISE 2040	2	ISE 504	3						
Design of Work; 1/2 Sem.	ISE 2400	2	ISE 540	4			0.67	-0.67	0	B3: Eng Science
Intro to Manufacturing Eng	ISE 2500	3	ISE 350	3			-1.00	1.33	0.33	D: Mfg Bridge
Linear & Integer Programming	ISE 3200	3	ISE 520	3			-1.00		-1	C: OR Bridge
Non-linear Programming	ISE 3210	3	ISE 521	3			-1.00		-1	C: OR Bridge
Production & Facilities Planning	ISE 3400	4	ISE 541 & 542	8			1.33		1.33	
Workplace Ergonomics	ISE 3600	3	ISE 560	3			-1.00		-1	E: HF Elective
Cog. Systems Engineering	ISE 3700	3	ISE 670	3			-1.00		-1	E: HF Elective
Eng. Project Management (inclcd Chnge Mng)	ISE 3800	3			AU12	3				
Quality Control & Improvement	ISE 4120	3	ISE 599.02 OR Bridge sp1	2			1		1	C: OR Bridge
Capstone Design	ISE 4900	4	ISE 510	3			-1.00	1.33	0.33	D: Mfg Bridge
Stoch. Modeling & Simulation	ISE 5100	4	ISE 501	5			-0.67		-0.67	C: OR Bridge
<b>Total ISE Core CH</b>		<b>64</b>		<b>83</b>		<b>7</b>	<b>-1.67</b>		<b>3.00</b>	<b>T3: Tech Elective</b>
Technical Elective	Course Number	SCH								
Technical Elective		3	te1		AU12	3				
Technical Elective		3	te2		SP13	3				
Technical Elective		3	te3		AU12	3				
Technical Elective		3	te4		SP13	3				
Technical Elective		3	te5		HF tech elec	3				
Technical Elective		3	ISE 599.01L	5			0.33		0.33	
<b>Total Technical Elective CH</b>		<b>18</b>		<b>5</b>		<b>15</b>	<b>0.33</b>		<b>0.33</b>	<b>T4: Tech Elective</b>
		126							<b>0.67</b>	<b>Final Differential</b>

Additional Bridge Courses		SCH	Target of SCH allocations
C: OR Bridge (2)	ISE 599.02G (2QCH)	1.3333	ISE 3200, 3210, 501 1.67
D: Manufacturing "Bridge"	ISE 599.03G (4QCH)	2.67	ISE 2500, 3400,4120 -0.67
E: HF Elective	Elective (3QCH)	3	ISE 3600, 3700 2

B: 3 courses make up for deficit from Eng. Sci and end up 1 SCH ahead  
 A: physics and additional sci offset, but leave a -0.67 balance  
 C, cont: due to merger of 3300 and 5100, balance with 3200/3210 deficit is offset and completely balances with taking of OR Elective in SEM

Note that depending on when students choose to tak TEs (quarters v. semesters) the final differential will vary from this calculated value

2. NFQF AU10 (Begin ISE Major in AU12; Graduate in SP14), SEMESTER OPTION

Courses Completed Prior to AU12 (on Quarters)		
Math 151: (5) Math 152: (5) Math 153: (5) Math 254: (5) Math 255 or 415: (5) Math 568 or 571: (3) Stats 427: (3) Stats 428: (3) Engr 100: (1) Engr 181: (3) Engr 183: (3)	Physics 131: (5) Physics 132: (5) Chem 121 (4) Additional Science (4) English 110: (5) Psych 100: (5) Econ 200: (5) GEC 1 (5)	CSE 202/205 or EG 167: (4) ME 410: Statics (4) ME 420: Strength of Materials (4) ISE 350: (3) ISE 500: Intro to ISE (3) ISE 504: Engineering Economics (3) ISE 599.1L: Sys Modeling (5) ISE 599.2L: Design of Work (2)
<b>AU12 (First Semester as ISE Major)</b>	SP 13	
ISE 3200: Opt. for Enterprise Systems (3) ISE 3300: Prob. Models for Planning (3) ISE 3400: Production Planning (3) ISE 3600: Workplace Ergonomics (3) Gen Ed (3)	ISE 3210: Opt. for System Design (3) ISE 3410: Facilities Planning (3) ISE 3700: Cog. Systems Engineering (3) ISE 4120: Quality Control and Imp. (3) Gen Ed (3)	
AU13	SP14	
ISE 3800: Project Mangement (2) ISE 3810: Implementation & Change Mgmt (1) ISE 5310: Discrete Event Simulation (3) Technical Elective (3) Technical Elective (3) Gen Ed (3)	ISE 4900: Capstone Design (4) Technical Elective (3) Technical Elective (3) Gen Ed (3)	



General Education	Course Number	SCH	Class Taken	QCH	Sem Taken	SCH	SCH Differential (Taken - Required)	Reallocated SCH	Net Change in SCH	Notes / Resolution
Gen Ed 1		3	Psych 100	5						
Gen Ed 2		3	Econ 200	5						
Gen Ed 3		3	GEC1	5						
Gen Ed 4		3	Gen Ed (Sem.)		AU12	3				
Gen Ed 5		3	Gen Ed (Sem.)		SP13	3				
Gen Ed 6		3	Gen Ed (Sem.)		AU13	3				
Gen Ed 7		3	Gen Ed (Sem.)		SP14	3				
English 1100:	English 1100	3	English 110	5						
<b>Total General Education Course Number</b>		<b>24</b>		<b>20</b>		<b>12</b>	<b>1.33</b>		<b>1.33</b>	<b>T1: Tech Elective</b>
<b>Engineering Core</b>	<b>Course Number</b>	<b>SCH</b>								
Eng Survey	ENG 1100	1	ENG 100	1			-0.33		-0.33	
Intro Engineering I	ENG 1181	2	ENG 181	3						
Intro Engineering II	ENG 1182	2	ENG 183	3						
Engineering Calculus I	Math 1151	5								
Engineering Calculus II	Math 1152	5	Math 151, 152, 153	15						
Physics I	Physics 1151	5	Phys 131,132	10			1.67	-1.00	0.67	A: Add'l Science
<b>Total Engineering Core CH</b>		<b>20</b>		<b>32</b>					<b>0.33</b>	<b>T2: Tech Elective</b>
<b>ISE Core</b>	<b>Course Number</b>	<b>SCH</b>								
Additional science		4	Chem 121	5			-0.67	0.67		A1: from A
Additional Science		3	Additional Sci	4			-0.33	0.33		A2: from A
Engineering science		3					-3.00	3.00		B1, B2, B3
Computer Programming	CSE 1222	3	CSE / EG	4			-0.33		-0.33	
*** Prereq for Math 255 and 415	n/a		*** Math 254	5			3.33		3.33	
Differential Equations	Math 2xxx	3	Math 255 or 415	5			0.33		0.33	
Linear Algebra	Math 2xxx	3	Math 568 or 571	3			-1.00		-1.00	
Statics/Strength of Mat.	ME 2040	4	ME 410, 420	8			1.33	-1.33		B1: Eng Science
Probability and Statistic	Stat 4278	3	Stat 427,428	6			1.00		1.00	
Intro to ISE; 1/2 Sem.	ISE 2000	1.5	ISE 500	3			0.50	-0.50		B2: Eng Science
Systems Modeling	ISE 2010	3	ISE 590.1L	5			0.33		0.33	
Engineering Economics	ISE 2040	2	ISE 504	3						
Design of Work; 1/2 Sem.	ISE 2400	1.5	ISE 590.2L	2			-0.17	-1.17	-1.33	B3: Eng Science
Intro to Manufacturing Eng	ISE 2500	3	ISE 350	3			-1.00		-1.00	
Opt. for Enterprise Systems	ISE 3200	3			AU12	3				
Opt. for System Design	ISE 3210	3			SP13	3				
Prob. Models for Planning	ISE 3300	3			AU12	3				
Production Planning	ISE 3400	3			AU12	3				
Facilities Planning	ISE 3410	3			SP13	3				
Workplace Ergonomics	ISE 3600	3			AU12	3				
Cog. Systems Engineering	ISE 3700	3			SP13	3				
Eng. Project Management	ISE 3800	2			AU13	2				
Implementation & Change Mgmt	ISE 3810	1			AU13	1				
Quality Control & Improvement	ISE 4120	3			SP13	3				
Capstone Design	ISE 4900	4			SP14	4				
Discrete Event Simulation	ISE 5310	3			AU13	3				
<b>Total ISE Core CH</b>		<b>71</b>		<b>56</b>		<b>34</b>			<b>1.33</b>	<b>T3: Tech Elective</b>
<b>Technical Elective</b>	<b>Course Number</b>	<b>SCH</b>								
Technical Elective		3			AU12	3				
Technical Elective		3			SP13	3				
Technical Elective		3			SP13	3				
Technical Elective		3						3.00		T1+T2+T3
<b>Total Technical Elective CH</b>		<b>12</b>				<b>9</b>	<b>-3.00</b>	<b>3.00</b>		<b>Final Differential</b>

**Undergraduate Program in Industrial and Systems Engineering**

The Ohio State University  
NFQF AU 10 (Starting Major in SP 12)

**COURSES WHICH MUST BE COMPLETED  
BEFORE APPLYING TO ISE MAJOR:**

Student must have at least a 2.0 Cum GPA  
and at least a 2.0 cumulative in these courses  
**(OR in their equivalent courses):**

ENG 181.xx (3) (or ENG H191) \_\_\_\_\_  
ENG 183.xx (3) (or ENG H193) \_\_\_\_\_

CSE 205 (4) \_\_\_\_\_  
(or: CSE 202 or ENG H192 or EngGraph 167.01)

ENGLISH 110.xx (5) \_\_\_\_\_

MATH 151.xx (5) \_\_\_\_\_  
152.xx (5) \_\_\_\_\_  
(or 161 for both 151 & 152) (5) \_\_\_\_\_  
153.xx (or 162) (5) \_\_\_\_\_

PHYSICS 131 (5) \_\_\_\_\_  
132 (5) \_\_\_\_\_

**Sequence of ISE core courses:  
(Apply to Major by January 10, 2012)****Spring 12 - Quarter**

Finish Up Requirements  
Gen Ed  
Technical Elective  
Technical Elective

**Autumn 12 - Semester**

ISE 3200  
ISE 3400  
ISE 3700  
ISE 2400 (2)  
ISE 2040 (2)  
ISE 2500

**Autumn 13 - Semester**

ISE 5100 (4)  
Technical Elective  
Technical Elective  
Technical Elective

**OTHER COURSES TO BE TAKEN BEFORE  
BEGINNING ISE MAJOR CORE COURSES:**

(Choose **two**: Chem 121, Chem 122, Chem 125, Bio 113,  
Bio 114 or Physics 133)

Additional Science (4) \_\_\_\_\_  
Additional Science (3-4) \_\_\_\_\_

ME 410 (4) \_\_\_\_\_

ME 420 (4) \_\_\_\_\_

ENG. SCIENCE (3) \_\_\_\_\_ (choose from: ME 430, ME 500,  
MSE 205, ECE 300, Other Upper Level ENG. Course)

MATH 254.xx (5) \_\_\_\_\_

MATH 255.xx (5) (or 415.xx) \_\_\_\_\_

MATH 568 (3) \_\_\_\_\_

STATISTICS 427 (3) \_\_\_\_\_

STATISTICS 428 (3) \_\_\_\_\_

SOCIAL SCIENCE GEC(5) \_\_\_\_\_

HISTORY GEC(5) \_\_\_\_\_

2<sup>nd</sup> WRITING GEC (5) \_\_\_\_\_

ARTS & HUM GEC (5) \_\_\_\_\_

**Spring 13 - Semester**

ISE 3210  
ISE 3600  
ISE 3800  
ISE 4120

**Spring 14 - Semester**

ISE 4900  
Technical Elective  
Technical Elective  
Gen Ed - Ethics

General Education	Course Number	SCH	Class Taken	QCH	Sem Taken	SCH	SCH Differential (Taken - Required)	Reallocated SCH	Net Change in SCH	Notes / Resolution
Gen Ed 1		3	Psych 100	5						
Gen Ed 2		3	Econ 200	5						
Gen Ed 3		3	GEC1	5						
Gen Ed 4		3	Gen Ed	3						
Gen Ed 5	ENGR 2367	3	Gen Ed	3						
Gen Ed 6		3	Gen Ed	3						
Gen Ed 7		3	Gen Ed (Sem.)		SP14	3				
English 1100:	English 1100	3	English 110	5						
<b>Total General Education Course Number</b>		<b>24</b>		<b>29</b>		<b>3</b>	<b>-1.67</b>		<b>-1.67</b>	<b>T1: Tech Elective</b>
<b>Engineering Core</b>	<b>Course Number</b>	<b>SCH</b>								
Eng Survey	ENGR 1100	1	ENGR 100	1			-0.33		-0.33	
Intro Engineering I	ENGR 1181	2	ENGR 181	3						
Intro Engineering II	ENGR 1182	2	ENGR 183	3						
Engineering Calculus I	Math 1151	5								
Engineering Math A	Math 1172	5	Math 151, 152, 153	15						
Physics I	Physics 1250	5	Phys 131,132	10			1.67	-2.00	-0.33	A: Add'l Science
<b>Total Engineering Core CH</b>		<b>20</b>		<b>32</b>					<b>-0.67</b>	<b>T2: Tech Elective</b>
<b>ISE Core</b>	<b>Course Number</b>	<b>SCH</b>								
Additional science	Chm1250 or Bio2100	3	Chem 121	5			0.33	-0.33		A1: from A
Additional Science	Physics 1251	5	Additional Sci	4			-2.33	2.33		A2: from A
Engineering science		3					-3.00	1.33	-1.67	B1
Computer Programming	CSE 1222	3	CSE / EG	4			-0.33		-0.33	
*** Prereq for Math 255 and 415	n/a		*** Math 254	5			3.33		3.33	
Eng. Math B	Math 2173	3	Math 255 or 415	5			0.33		0.33	
Linear Algebra & Diff Eq.	Math 2174	3	Math 568 or 571	3			-1.00		-1.00	
Statics/Strength of Mat.	ME 2040	4	ME 410, 420	8			1.33	-1.33		B1: Eng Science
Probability and Statistic	Stat 3470	3	Stat 427,428	6			1.00		1.00	
Engineering Economics	ISE 2040	2			AU12	2				
Design of Work; 1/2 Sem.	ISE 2400	2			AU12	2				
Intro to Manufacturing Eng	ISE 2500	3			AU12	3				
Linear & Integer Programming	ISE 3200	3			AU12	3				
Non-linear Programming	ISE 3210	3			SP13	3				
Production & Facilities Planning	ISE 3400	4	tech elec	3			2.00		2.00	
Workplace Ergonomics	ISE 3600	3			SP13	3				
Cog. Systems Engineering	ISE 3700	3			AU12	3				
Eng. Project Management (incl Chng Mng)	ISE 3800	3			SP13	3				
Quality Control & Improvement	ISE 4120	3			SP13	3				
Capstone Design	ISE 4900	4			SP14	4				
Stoch. Modeling & Simulation	ISE 5100	4			AU13	4				
<b>Total ISE Core CH</b>		<b>64</b>		<b>46</b>		<b>37</b>			<b>5.67</b>	<b>T3: Tech Elective</b>
<b>Technical Elective</b>	<b>Course Number</b>	<b>SCH</b>								
Technical Elective		3			AU13	3				
Technical Elective		3			AU13	3				
Technical Elective		3			AU13	3				
Technical Elective		3			SP14	3				
Technical Elective		3			SP14	3				
Technical Elective		3					-3		-3.00	
<b>Total Technical Elective CH</b>		<b>18</b>				<b>15</b>	<b>-3.00</b>	<b>-3.00</b>	<b>-3.00</b>	<b>T4: Tech Elective</b>
		126							<b>0.33</b>	<b>Final Differential</b>

3. NFQF AU09 (Begin ISE Major in AU11; Graduate in SP13) QUARTER OPTION

Courses Completed Prior to AU 11 (on Quarters)		
Math 151: (5) Math 152: (5) Math 153: (5) Math 254: (5) Math 255 or 415: (5) Math 568 or 571: (3) Stats 427: (3) Stats 428: (3) Engr 100: (1) Engr 181: (3) Engr 183: (3)	Physics 131: (5) Physics 132: (5) Chem 121: (5) Additional Science (4) English 110: (5) Psych 100: (5) Econ 200: (5) 2 <sup>nd</sup> Writing GEC (5) GEC1 (5) GEC2 (5) GEC3 (5) Acctg 501: (3)	CSE 202/205 or EG 167: (4) ME 410: Statics (4) ME 420: Strength of Materials (4) ME 430: Dynamics (4) ISE 350: (3) ISE 500: Intro to ISE (3) ISE 504: Engineering Economics (3)
<b>AU 11 (First Qtr as ISE Major)</b>	WI 12	SP 12
ISE 501: Simulation (5) ISE 520: Linear Optimization (3) ISE 560: Phys Biomech Work Des (3) ECE 300 & 309: (4)	ISE 521: Nonlinear Optimization (3) ISE 540: Prod Systems Design (4) ISE 550: Princ Mfg Processes (3) ISE 670: Cognitive Engineering (3) MSE 205: Intro to MSE (3)	ISE 510: Stat Process Control (3) ISE 541: Facilities Design (4) ISE 542: Production Control (4) ISE 610: Plng for Eng Exp (3) ISE 681: Project Management (3)
AU12	SP 13	
Technical Elective (3) Technical Elective (3) Technical Elective (3)	ISE 4900: Capstone Design (4) Technical Elective (3) Technical Elective (3)	

NO MODIFICATIONS TO THIS ONE

General Education	Course Number	QCH	Class Taken	QCH	Sem Taken	SCH	QCH Differential (Taken - Required)	Reallocated QCH	Net Change in QCH	Notes / Resolution
GEC	English 110	5	English 110	5						
GEC	Psych 100	5	Psych 100	5						
GEC	Econ 200	5	Econ 200	5						
GEC	2nd Writing GEC	5	2nd Writing GEC	5						
GEC	GEC	5	GEC1	5						
GEC	GEC	5	GEC2	5						
GEC	GEC	5	GEC3	5						
<b>Total General Education Course Number</b>		<b>35</b>		<b>35</b>						
<b>Engineering Core</b>	<b>Course Number</b>	<b>QCH</b>								
Math	Math 151	5	Math 151	5						
	Math 152	5	Math 152	5						
	Math 153	5	Math 153	5						
Science	Chem 121	5	Chem 121	5						
	Physics 131	5	Physics 131	5						
	Physics 132	5	Physics 132	5						
	Additional Sci	4	Additional Sci	4						
Computing	CSE 202/205; EG 167	4	CSE 202/205 or EG 167	4						
Engineering Core	Eng 100	1	Eng 100	1						
	Eng 181	3	Eng 181	3						
	Eng 183	3	Eng 181	3						
<b>Total Engineering Core CH</b>		<b>45</b>		<b>45</b>						
<b>ISE Core</b>	<b>Course Number</b>	<b>QCH</b>								
Calc & Analytic Geometry	Math 254	5	Math 254	5						
Differential Equations	Math 255 or 415	5	Math 255 or 415	5						
Linear Algebra	Math 568 or 571	3	Math 568 or 571	3						
Prob & Stat I	Stat 427	3	Stat 427	3						
Prob & Stat II	Stat 428	3	Stat 428	3						
Statics	ME 410	4	ME 410	4						
Strength of Materials	ME 420	4	ME 420	4						
Dynamics	ME 430	4	ME 430	4						
Intro to MSE	MSE 205	3	MSE 205	3						
Electrical Circuits	ECE 300 & 309	4	ECE 300 & 309	4						
Accounting	Acctg 501	3	Acctg 501	3						
Manufacturing Engineering	ISE 350	3	ISE 350	3						
Introduction to ISE	ISE 500	3	ISE 500	3						
Simulation	ISE 501	5	ISE 501	5						
Engineering Economics	ISE 504	3	ISE 504	3						
Statistical Process Control	ISE 510	3	ISE 510	3						
Linear Optimization	ISE 520	3	ISE 520	3						
Nonlinear Optimization	ISE 521	3	ISE 521	3						
Production Systems Design	ISE 540	4	ISE 540	4						
Facilities Design	ISE 541	4	ISE 541	4						
Production Control	ISE 542	4	ISE 542	4						
Princ Mfg Processes	ISE 550	3	ISE 550	3						
Phys Biomech Work Des	ISE 560	3	ISE 560	3						
Planning Eng Experiments	ISE 610	3	ISE 610	3						
Cognitive Engineering	ISE 670	3	ISE 670	3						
Capstone Design I & II	ISE 680.01 & 680.02	8	ISE 4900	3	SP 13	4	-2.00		-2.00	
Project Management	ISE 681	3	ISE 681	3						
<b>Total ISE Core CH</b>		<b>99</b>		<b>91</b>		<b>4</b>			<b>-2.00</b>	<b>T1: Tech Elective</b>
<b>Technical Elective</b>	<b>Course Number</b>	<b>QCH</b>								
Technical Elective		3			AU 12	3		-2.00		T1
Technical Elective		3			AU 12	3				
Technical Elective		3			SP 13	3				
Technical Elective		3			SP 13	3				
Technical Elective		3								
<b>Total Technical Elective CH</b>		<b>15</b>				<b>12</b>	<b>3.00</b>	<b>-2.00</b>	<b>1.00</b>	<b>Final Differential</b>

4. NFQF AU10(Begin ISE Major in AU12; Graduate in SP14) QUARTER OPTION

Courses Completed Prior to AU12 (on Quarters)		
Math 151: (5) Math 152: (5) Math 153: (5) Math 254: (5) Math 255 or 415: (5) Math 568 or 571: (3) Stats 427: (3) Stats 428: (3) Engr 100: (1) Engr 181: (3) Engr 183: (3)	Physics 131: (5) Physics 132: (5) Chem 121 (5) Additional Science (4) English 110: (5) 2 <sup>nd</sup> Writing GEC (5) Psych 100: (5) Econ 200: (5) GEC 1(5) GEC2 (5) Acctg 501: (3)	CSE 202/205 or EG 167: (4) ME 410: Statics (4) ME 420: Strength of Materials (4) ME 430: Dynamics (4) ISE 350: (3) ISE 500: Intro to ISE (3) ISE 504: Engineering Economics (3)
<b>AU12 (First Semester as ISE Major)</b>	SP 13	
ISE 2400: Design of Work (1.5) ISE 3200: Opt. for Enterprise Systems (3) ISE 3400: Production Planning (3) ISE 3600: Workplace Ergonomics (3) ECE 2300: Electrical Circuits & Electronic Devices (3)	ISE 3210: Opt. for System Design (3) ISE 3410: Facilities Planning (3) ISE 3700: Cog. Systems Engineering (3) ISE 4120: Quality Control and Imp. (3)	
<b>AU13</b>	SP14	
MSE 2010: Intro to Eng. Materials (3) ISE 3800: Engineering Project Management (2) ISE 5310: Discrete Event Simulation (3) Technical Elective (1) Gen Ed (3)	ISE 4900: Capstone Design (4) ISE 4500: Manufacturing Process Eng (3) Technical Elective (3) ISE 5110: Des. Eng. Experiments (3)	

NO CHANGES; NO ONE IS OPTING FOR THIS PLAN

General Education	Course Number	QCH	Class Taken	QCH	Sem Taken	SCH	QCH Differential (Taken - Required)	Reallocated QCH	Net Change in QCH	Notes / Resolution
GEC	English 110	5	English 110	5						
GEC	Psych 100	5	Psych 100	5						
GEC	Econ 200	5	Econ 200	5						
GEC	2nd Writing GEC	5	2nd Writing GEC	5						
GEC	GEC	5	GEC1	5						
GEC	GEC	5	GEC2	5						
GEC	GEC	5	Gen Ed		AU13	3				
<b>Total General Education Course Number</b>		<b>35</b>		<b>30</b>		<b>3</b>	<b>-0.50</b>		<b>-0.50</b>	<b>T1: Tech Elective</b>
<b>Engineering Core</b>	<b>Course Number</b>	<b>QCH</b>								
Math	Math 151	5	Math 151	5						
	Math 152	5	Math 152	5						
	Math 153	5	Math 153	5						
Science	Chem 121	5	Chem 121	5						
	Physics 131	5	Physics 131	5						
	Physics 132	5	Physics 132	5						
	Additional Sci	4	Additional Sci	4						
Computing	CSE 202/205; EG 167	4	CSE 202/205 or EG 167	4						
Engineering Core	Eng 100	1	Eng 100	1						
	Eng 181	3	Eng 181	3						
	Eng 183	3	Eng 181	3						
<b>Total Engineering Core CH</b>		<b>45</b>		<b>45</b>						
<b>ISE Core</b>	<b>Course Number</b>	<b>QCH</b>								
Calc & Analytic Geometry	Math 254	5	Math 254	5						
Differential Equations	Math 255 or 415	5	Math 255 or 415	5						
Linear Algebra	Math 568 or 571	3	Mth 568 or 571	3						
Prob & Stat I	Stat 427	3	Stat 427	3						
Prob & Stat II	Stat 428	3	Stat 428	3						
Statics	ME 410	4	ME 410	4						
Strength of Materials	ME 420	4	ME 420	4						
Dynamics	ME 430	4	ME 430	4						
Intro to MSE	MSE 205	3	MSE 2010		AU13	3	1.50		1.50	
Electrical Circuits	ECE 300 & 309	4	ECE 2300		SP13	3	0.50		0.50	
Accounting	Acct 501	3	Acctg 501							
Manufacturing Engineering	ISE 350	3	ISE 350							
Introduction to ISE	ISE 500	3	ISE 500							
Simulation	ISE 501	5	ISE 5310		AU 13	3	-0.50		-0.50	
Engineering Economics	ISE 504	3	ISE 504							
Statistical Process Control	ISE 510	3	ISE 4120		SP 13	3	1.50		1.50	
Linear Optimization	ISE 520	3	ISE 3200		AU 12	3	1.50		1.50	
Nonlinear Optimization	ISE 521	3	ISE 3210		SP 13	3	1.50		1.50	
Production Systems Design	ISE 540	4	ISE 2400		AU 12	1.5	-1.75	1.00	-0.75	W1, W2
Facilities Design	ISE 541	4	ISE 3410		SP 13	3	0.50	-0.50		W1: Prod Sys
Production Control	ISE 542	4	ISE 3400		AU 12	3	0.50	-0.50		W2: Prod Sys
Princ Mfg Processes	ISE 550	3	ISE 4500		SP 13	3	1.50		1.50	
Phys Biomech Work Des	ISE 560	3	ISE 3600		AU 12	3	1.50		1.50	
Planning Eng Experiments	ISE 610	3	ISE 5110		SP13	3	1.50		1.50	
Cognitive Engineering	ISE 670	3	ISE 3700		SP 13	3	1.50		1.50	
Capstone Design I & II	ISE 680.01 & 680.02	8	ISE 4900		SP 14	4	-2.00		-2.00	
Project Management	ISE 681	3	ISE 3800		AU 13	2				
<b>Total ISE Core CH</b>		<b>68</b>		<b>43</b>		<b>43.5</b>	<b>40.25</b>		<b>9.25</b>	<b>T2: Tech Elective</b>
<b>Technical Elective</b>	<b>Course Number</b>	<b>QCH</b>								
Technical Elective		3						8.75		T1,T2
Technical Elective		3			AU 13	1				
Technical Elective		3			SP 14	3				
Technical Elective		3								
Technical Elective		3								
<b>Total Technical Elective CH</b>		<b>15</b>				<b>4</b>	<b>-9.00</b>	<b>8.75</b>	<b>-0.25</b>	<b>Final Differential</b>

5. NFQF AU11(Begin ISE Major in AU13; Graduate in SP15) SEMESTER OPTION

AU 11	WI 12	SP 12
Math 151: (5) Physics 131: (5) Engr 100: (1) Engr 181: (3) GEC (5)	Physics 132: (5) Math 152: (5) Engr 183: (3) GEC (5)	Math 153: (5) CHEM 121 (5) CSE 202/205 or ENG 167: (4) English 110: (5)
AU12		SP 13
ISE 2040: Engineering Economics (2) MATH 2173: Engineering Mathematics (3) STAT 3470: Probability and Statistics (3) ME 2040: Statics and Strength of Materials (4) 2 <sup>nd</sup> Writing GEC (3) Gen Ed (3)		ISE 2000: Intro to ISE (1.5) ISE 2010: Systems Modeling (3) ISE 2400: Design of Work (1.5) ISE 2500: Manufacturing Eng (3) Math 2174: Linear Algebra & Differential Equations (3) Engineering Science (3)
<b>AU13 (First Semester as ISE Major)</b>		SP 14
ISE 3200: Opt. for Enterprise Systems (3) ISE 3300: Prob. Models for Planning (3) ISE 3400: Production Planning (3) ISE 3600: Workplace Ergonomics (3) Gen Ed (3)		ISE 3210: Opt. for System Design (3) ISE 3410: Facilities Planning (3) ISE 3700: Cog. Systems Engineering (3) ISE 4120: Quality Control and Imp. (3) Gen Ed (3)
AU14		SP 15
ISE 3800: Project Management (2) ISE 3810: Implementation & Change Mgmt (1) ISE 5310: Discrete Event Simulation (3) Technical Elective (3) Technical Elective (3) Gen Ed (3)		ISE 4900: Capstone Design (4) Technical Elective (3) Technical Elective (3) Gen Ed (3)



General Education	Course Number	SCH	Class Taken	QCH	Sem Taken	SCH	SCH Differential	Reallocated SCH	Net Change in SCH	Notes / Resolution
Gen Ed 1	GEC1	3		5					0.00	
Gen Ed 2	GEC2	3		5					0.00	
Gen Ed 3	Gen Ed (Sem.)	3			AU12	3			0.00	
Gen Ed 4	Gen Ed (Sem.)	3			AU13	3			0.00	
Gen Ed 5	Gen Ed (Sem.)	3			SP14	3			0.00	
Gen Ed 6	Gen Ed (Sem.)	3			AU14	3			0.00	
Gen Ed 7	Gen Ed (Sem.)	3			SP15	3			0.00	
English 1100	English 110	3		5					0.00	
<b>Total General Education Course Number</b>		<b>24</b>		<b>15</b>		<b>15</b>	<b>1.00</b>		<b>1.00</b>	<b>T1: Tech Elective</b>
<b>Engineering Core</b>		<b>SCH</b>								
Eng Survey	ENG 100	1		1					0.00	
Intro Engineering I	ENG 181	2		3					-0.33	
Intro Engineering II	ENG 182	2		3					0.00	
Engineering Calculus I	Math 1151	5							0.00	
Engineering Calculus II	Math 1172	5	Math 151, 152, 153	15					0.00	
Physics I	Physics 1151	5	Phys 131,132	10					0.00	
<b>Total Engineering Core CH</b>		<b>20</b>		<b>32</b>		<b>0</b>			<b>0.67</b>	<b>A: Add'l Science</b>
<b>ISE Core</b>		<b>SCH</b>								<b>T2: Tech Elective</b>
Additional science	Chem 121	4		5					0.00	
Additional Science	Additional Sci	3		4					-0.67	A1: from A
Engineering science	CSE 205 / ENG 167	3			SP13	3			0.00	A2: from A
Computer Programming	Math 2173	3		4					0.00	B1, B2, B3
Differential Equations	Math 2174	3		5					-0.33	
Linear Algebra	ME 2040	4		8					0.33	
Statics/Strength of Mat.	Stat 3470	3		6					-1.00	
Probability and Statistic	ISE 2000	1.5		3					0.00	B1: Eng Science
Intro to ISE: 1/2 Sem.	ISE 2010	3		5					1.00	
Systems Modeling	ISE 2040	2		3					0.50	B2: Eng Science
Engineering Economics	ISE 2400	1.5		2					0.33	
Design of Work: 1/2 Sem.	ISE 2500	3		3					0.00	
Intro to Manufacturing Eng	ISE 3200	3		3					-0.17	B3: Eng Science
Opt. for Enterprise Systems	ISE 3210	3		3					-1.00	
Opt. for System Design	ISE 3300	3		3					0.00	
Prob. Models for Planning	ISE 3400	3		3					0.00	
Production Planning	ISE 3410	3		3					0.00	
Facilities Planning	ISE 3600	3		3					0.00	
Workplace Ergonomics	ISE 3700	3		3					0.00	
Cog. Systems Engineering	ISE 3800	2		2					0.00	
Eng. Project Management	ISE 3810	1		1					0.00	
Implementation & Change Mgmt	ISE 4120	3		3					0.00	
Quality Control & Improvement	ISE 4900	4		4					0.00	
Capstone Design	ISE 5310	3		3					0.00	
Discrete Event Simulation									0.00	
<b>Total ISE Core CH</b>		<b>71</b>		<b>51</b>		<b>0</b>			<b>-2.00</b>	<b>T3: Tech Elective</b>
<b>Technical Elective</b>		<b>SCH</b>								
Technical Elective		3			AU14	3			0.00	
Technical Elective		3			AU14	3			0.00	
Technical Elective		3			SP15	3			0.00	
Technical Elective		3			SP15	3			0.00	
<b>Total Technical Elective CH</b>		<b>12</b>		<b>0</b>		<b>0</b>			<b>-0.67</b>	<b>T1+T2+T3</b>
									<b>-0.67</b>	<b>Final Differential</b>

REVISED

**Undergraduate Program in Industrial and Systems Engineering**

The Ohio State University  
NFQF AU 11 (Starting Major in SP 13)

**COURSES WHICH MUST BE COMPLETED BEFORE APPLYING TO ISE MAJOR:**

Student must have at least a 2.0 Cum GPA and at least a 2.0 cumulative in these courses **(OR in their equivalent courses)**:

ENG 181.xx (3) (or ENG H191) \_\_\_\_\_  
ENG 183.xx (3) (or ENG H193) \_\_\_\_\_

CSE 205 (4) \_\_\_\_\_ (or: CSE 202 or ENG H192 or EngGraph 167.01)

ENGLISH 110.xx (5) \_\_\_\_\_

MATH 151.xx (5) \_\_\_\_\_  
152.xx (5) \_\_\_\_\_  
(or 161 for both 151 & 152) (5) \_\_\_\_\_  
153.xx (or 162) (5) \_\_\_\_\_

PHYSICS 131 (5) \_\_\_\_\_  
132 (5) \_\_\_\_\_

**OTHER COURSES TO BE TAKEN BEFORE BEGINNING ISE MAJOR CORE COURSES:**

**QUARTER:**

(Choose **two**: Chem 121, Chem 122, Chem 125, Bio 113, Bio 114 or Physics 133)

Additional Science (4) \_\_\_\_\_  
Additional Science (3-4) \_\_\_\_\_

ME 410 (4) \_\_\_\_\_  
ME 420 (4) \_\_\_\_\_

ENG. SCIENCE (3) \_\_\_\_\_ (choose from: ME 430, ME 500, MSE 205, ECE 300, Other Upper Level ENG. Course)

MATH 254.xx (or 263.xx) (5) \_\_\_\_\_  
MATH 255.xx (5) (or 415.xx) \_\_\_\_\_  
MATH 568 (3) \_\_\_\_\_

STATISTICS 427 (3) \_\_\_\_\_  
STATISTICS 428 (3) \_\_\_\_\_

SOCIAL SCIENCE GEC \_\_\_\_\_  
HISTORY GEC \_\_\_\_\_  
ARTS & HUM GEC \_\_\_\_\_

**SEMESTER:**

(Choose **two**: Physics \*, Chemistry 1250, Biology 2100)

Additional Science (4) \_\_\_\_\_  
Additional Science (4) \_\_\_\_\_

ME 2040 (4) \_\_\_\_\_

ENG. SCIENCE (3) \_\_\_\_\_ (choose from: ME 2030, ME 3500, MSE 2010, ECE 2300, CSE 2111, CSE 2122, ME 2850)

MATH 2173 (3) \_\_\_\_\_  
MATH 2174 (3) \_\_\_\_\_

STATISTICS 3470 (3) \_\_\_\_\_

SOCIAL SCIENCE GEC \_\_\_\_\_  
HISTORY GEC \_\_\_\_\_  
ARTS & HUM GEC \_\_\_\_\_

**Sequence of ISE core courses:  
(Apply to Major by September 3, 2012)**

**Spring 13 - Semester**

ENGINEER 2367  
ISE 2400 (2)  
ISE 2500  
ISE 2040 (2)  
Technical Elective

**Autumn 13 - Semester**

ISE 3200  
ISE 3400  
ISE 3700  
Technical Elective

**Autumn 14 - Semester**

ISE 5100 (4)  
Technical Elective  
Technical Elective  
Gen Ed

**Spring 14 - Semester**

ISE 3210  
ISE 3800  
ISE 3600  
ISE 4120

**Spring 15 - Semester**

ISE 4900 (4)  
Technical Elective  
Gen Ed - Ethics

**\*Physics Note:**

Physics 1250= Physics 131+  
Half of 133  
Physics 1251= Physics 132+  
Other half of 133

Physics 1240= 1<sup>st</sup> half of 133  
(2 credit hours)  
Physics 1241= 2<sup>nd</sup> half of 133  
(2 credit hours)

General Education	Course Number	SCH	Class Taken	QCH	Sem Taken	SCH	SCH Differential (Taken - Required)	Reallocated SCH	Net Change in SCH	Notes / Resolution
Gen Ed 1		3	Psych 100	5						
Gen Ed 2		3	Econ 200	5						
Gen Ed 3		3	GEC1	5						
Gen Ed 4		3	Gen Ed (Sem.)		AU12	3				
Gen Ed 5	ENGR 2367	3	ENGR 2367		SP13	3				
Gen Ed 6		3	Gen Ed (Sem.)		AU14	3				
Gen Ed 7		3	Gen Ed (Sem.)		SP15	3				
English 1100:	English 1100	3	English 110	5						
<b>Total General Education Course Number</b>		<b>24</b>		<b>20</b>		<b>12</b>	<b>1.33</b>		<b>1.33</b>	<b>T1: Tech Elective</b>
<b>Engineering Core</b>	<b>Course Number</b>	<b>SCH</b>								
Eng Survey	ENGR 1100	1	ENGR 100	1			-0.33		-0.33	
Intro Engineering I	ENGR 1181	2	ENGR 181	3						
Intro Engineering II	ENGR 1182	2	ENGR 183	3						
Engineering Calculus I	Math 1151	5	Math 151, 152,							
Engineering Math A	Math 1152	5	153	15						
Physics I	Physics 1151	5	Phys 131,132	10			1.67	-2.00	-0.33	A: Add'l Science
<b>Total Engineering Core CH</b>		<b>20</b>		<b>32</b>					<b>-0.67</b>	<b>T2: Tech Elective</b>
<b>ISE Core</b>	<b>Course Number</b>	<b>SCH</b>								
Additional science	Chm1250 or Bio21	3	Chem 121	5			0.33	-0.33		A1: from A
Additional Science	Physics 1251	5	Additional Sci	4			-2.33	2.33		A2: from A
Engineering science		3	Eng. Sci	3			-1.00	1.33	0.33	B: B1
Computer Programming	CSE 1222	3	CSE / EG	4			-0.33		-0.33	
*** Prereq for Math 255 and 415	n/a		*** Math 254	5			3.33		3.33	
Eng. Math B	Math 2173	3	Math 255 or 415	5			0.33		0.33	
Linear Algebra & Diff Eq.	Math 2174	3	Math 568 or 571	3			-1.00		-1.00	
Statics/Strength of Mat.	ME 2040	4	ME 410, 420	8			1.33	-1.33		B1: Eng Science
Probability and Statistic	Stat 3470	3	Stat 427,428	6			1.00		1.00	
Engineering Economics	ISE 2040	2			SP13	2				
Design of Work; 1/2 Sem.	ISE 2400	2			SP13	2				
Intro to Manufacturing Eng	ISE 2500	3			SP13	3				
Linear & Integer Programming	ISE 3200	3			AU12	3				
Non-linear Programming	ISE 3210	3			SP13	3				
Production & Facilities Planning	ISE 3400	4			AU12	4				
Workplace Ergonomics	ISE 3600	3			AU12	3				
Cog. Systems Engineering	ISE 3700	3			SP13	3				
Eng. Project Management (incld Chnge	ISE 3800	3			AU13	3				
Quality Control & Improvement	ISE 4120	3			SP13	3				
Capstone Design	ISE 4900	4			SP14	4				
Stoch. Modeling & Simulation	ISE 5100	4			AU13	4				
<b>Total ISE Core CH</b>		<b>64</b>		<b>43</b>		<b>37</b>			<b>3.67</b>	<b>T3: Tech Elective</b>
<b>Technical Elective</b>	<b>Course Number</b>	<b>SCH</b>								
Technical Elective		3			SP13	3				
Technical Elective		3			AU13	3				
Technical Elective		3			AU14	3				
Technical Elective		3			AU14	3				
Technical Elective		3			SP15	3				
Technical Elective		3					-3.00		-3.00	-3.00
<b>Total Technical Elective CH</b>		<b>18</b>				<b>15</b>	<b>-3.00</b>		<b>-3.00</b>	<b>T4: Tech Elective</b>
								<b>1.33</b>	<b>Final Differential</b>	

**Attachment #7: Letter from Bob Gustafson regarding EEIC's ability to accommodate ISE students in ENGR 2367**



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18 January 2012

TO: Carolyn Sommerich, Integrated Systems Engineering Department

FR: Bob Gustafson, Director EEIC

RE: ENGR 2367 Class for ISE Students

The EEIC is aware that the Industrial and System Engineering BS students will be required to take the ENGR 2367 second writing course. The EEIC expects to be able to meet any increased demand this may place on the course.