

Status: PENDING

**PROGRAM REQUEST**  
Industrial and Systems Engineering

Last Updated: McCaul Jr, Edward Baldwin  
11/07/2011

<b>Fiscal Unit/Academic Org</b>	Integrated Systems Engineering - D1457
<b>Administering College/Academic Group</b>	Engineering
<b>Co-administering College/Academic Group</b>	
<b>Semester Conversion Designation</b>	Converted with minimal changes to program goals and/or curricular requirements (e.g., sub-plan/specialization name changes, changes in electives and/or prerequisites, minimal changes in overall structure of program, minimal or no changes in program goals or content)
<b>Current Program/Plan Name</b>	Industrial and Systems Engineering
<b>Proposed Program/Plan Name</b>	Industrial and Systems Engineering
<b>Program/Plan Code Abbreviation</b>	INDENG-MS
<b>Current Degree Title</b>	Master of Science

**Credit Hour Explanation**

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program		45	30.0	30	0.0
Required credit hours offered by the unit	Minimum	21	14.0	14	0.0
	Maximum				
Required credit hours offered outside of the unit	Minimum	0	0.0	0	0.0
	Maximum				
Required prerequisite credit hours not included above	Minimum	0	0.0	0	0.0
	Maximum				

**Program Learning Goals**

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

- Program Learning Goals**
- Students will be able to learn independently, apply what they have learned competently toward the solution of ISE problems, and with faculty guidance, define and conduct research.

**Assessment**

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

**Is this a degree program (undergraduate, graduate, or professional) or major proposal? Yes**

**Does the degree program or major have an assessment plan on file with the university Office of Academic Affairs? No**

**DIRECT MEASURES (means of assessment that measure performance directly, are authentic and minimize mitigating or intervening factors)**

**Standardized tests**

- Local comprehensive or proficiency examinations

**Classroom assignments**

- Other classroom assessment methods (e.g., writing assignments, oral presentations, oral exams)

**Evaluation of a body of work produced by the student**

- Capstone course reports, papers, or presentations

**Direct assessment methods specifically applicable to graduate programs**

- Candidacy exams
- Research proposals written and grants awarded
- Thesis/dissertation oral defense and/or other oral presentation
- Thesis/dissertation (written document)
- Publications

**INDIRECT MEASURES (means of assessment that are related to direct measures but are steps removed from those measures)**

**Surveys and Interviews**

- Student survey

**Additional types of indirect evidence**

- Student or alumni honors/recognition achieved
- External program review

**USE OF DATA (how the program uses or will use the evaluation data to make evidence-based improvements to the program periodically)**

- Analyze and discuss trends with the unit's faculty
- Make improvements in curricular requirements (e.g., add, subtract courses)
- Make improvements in course content
- Make improvements in course delivery and learning activities within courses

**Program Specializations/Sub-Plans**

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

**Pre-Major**

Does this Program have a Pre-Major? No

**Attachments**

- ISE Q2S MS Proposal Final.pdf: MS ISE Q2S

*(Program Proposal. Owner: Brevick, Jerald Ralph)*

**Comments**

- Please delete as per phone conversation.

*As pre our phone conversation (by McCaul Jr,Edward Baldwin on 11/07/2011 10:42 AM)*

Status: PENDING

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**Workflow Information**

Status	User(s)	Date/Time	Step
Submitted	Brevick,Jerald Ralph	11/01/2011 02:42 PM	Submitted for Approval
Revision Requested	McCaul Jr,Edward Baldwin	11/02/2011 12:49 PM	Unit Approval
Submitted	Brevick,Jerald Ralph	11/02/2011 01:43 PM	Submitted for Approval
Revision Requested	McCaul Jr,Edward Baldwin	11/07/2011 10:42 AM	Unit Approval
Submitted	Brevick,Jerald Ralph	11/07/2011 01:28 PM	Submitted for Approval
Approved	McCaul Jr,Edward Baldwin	11/07/2011 04:03 PM	Unit Approval
Approved	McCaul Jr,Edward Baldwin	11/07/2011 04:04 PM	College Approval
Pending Approval	Slotnick, Elliot E Myers,Dena Elizabeth	11/07/2011 04:04 PM	GradSchool Approval



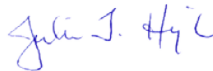
Department of Integrated Systems Engineering

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To: Office of Academic Affairs  
From: Julia L. Hagle, ISE Department Chair   
Date: October 31, 2011  
Re: Dept. of Integrated Systems Engineering Semester Transition Plan: MS in ISE.

The faculty of Integrated Systems Engineering has worked diligently, thoughtfully, and often times, tirelessly, for over a year and a half 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 MS program in Industrial and Systems Engineering. This constitutes an elaboration on the proposal that was previously submitted. 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. This proposal is submitted under separate cover.
- 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. The withdrawal of this proposal has been approved.
- MBLE, the Master of Business Logistics Engineering. The transition of this program has been approved.
- BS in Industrial and Systems Engineering. The transition of this program has been approved.

In arriving at the proposed curriculum, the faculty has been actively represented on the College of Engineering Quarter-to-Semester Task Force. 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.

The vote of the faculty is as follows regarding the translation of our PhD program 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:**

**MS, ISE**

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

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

## Industrial and Systems Engineering (ISE) MS Program Proposal

Primary Contact: Jerald Brevick ([brevick.1@osu.edu](mailto:brevick.1@osu.edu); 292-0177)

### 1. Name of Program

Industrial and Systems Engineering

### 2. Name of Degree

Master of Science in Industrial and Systems Engineering (MS ISE)

### 3. Responsible Academic Unit

Department of Integrated Systems Engineering

### 4. Type of Program

Graduate degree program

### 5. Semester Conversion Designation

Converted with minimal changes to program goals and/or curricular requirements (e.g., name changes, changes in electives and/or prerequisites, minimal changes in overall structure of program, minimal or no changes in program goals or content)

### 6. Program Rationale Statement

ISE is an engineering discipline that applies the fundamentals of science (physics, chemistry, biology) and mathematics (deterministic math, probability, statistics) to a wide variety of societal problems that involve systems of people, materials, information, or machines. The ISE discipline consists of 3 sub-disciplines; Operations Research, Manufacturing, and Human Factors.

The current quarter-system MS ISE program core (both thesis and non-thesis options) consists of a “depth” requirement, a “breadth” requirement, and a Graduate Seminar requirement. ISE MS students identify a “depth” area of coursework in one of the ISE sub-disciplines in support of their primary intellectual interests or research area. The “depth” requirement consists of a minimum of 3 courses and 9 quarter hours in one ISE sub-discipline. The “breadth” requirement consists of a minimum of 3 courses and 9 quarter hours. One of the 3 courses is required to be in the category of “Research Methods”, which is typically a course in mathematical, statistical, or numerical methodologies. The other 2 “breadth” courses must be from at least two of the 3 ISE sub-disciplines; Operations Research, Manufacturing, or Human Factors.

In addition, all MS ISE students must enroll in a minimum of 3 quarter hours of Graduate Seminar. The ISE Graduate seminar consists of outside speakers (mostly ISE faculty from other academic institutions, or researchers from research labs) presenting their recent research. The objective of the seminar requirement is for graduate students to experience a wide variety of presentation methods, see the application of various research techniques, and to learn about the breadth of research problems addressed by the larger ISE community.

MS ISE students typically accumulate at least 21 quarter hours of graduate course credit in fulfilling the MS ISE program core requirements. Thesis option MS ISE students must

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complete a minimum of 33 quarter-hours of course work. Therefore, they must take at least another 12 credit hours ( $33-21=12$ ) of graduate level elective course work to complete the program coursework requirements. MS ISE thesis option students must also accumulate at least 6 hours of ISE 999 Research credits to fulfill program requirements. Thesis option MS ISE students must also write, and successfully defend, a research thesis.

Non-thesis option students must complete a minimum of 45 credit hours of graduate course work. Therefore, non-thesis option students must take at least another 24 credit hours ( $45-21=24$ ) of graduate level elective course work beyond the MS ISE core requirements to complete their coursework requirements. Non-thesis option MS ISE students must also pass an exit examination.

The ISE faculty voted to convert the current quarter-system MS ISE program to semesters with as few changes as possible. However, simply converting existing graduate level 3 credit hour quarter-system courses (for example) to semesters would have resulted in a program consisting of mostly 2 credit hour semester-system courses. This would have violated the College of Engineering decision to have 3 credit hour courses the standard for the semester system. Furthermore, when converting the quarter-system graduate level courses to semesters, the faculty recognized that a direct conversion of existing ISE courses (10 weeks of content) to semester courses (14 weeks of content) would not often be pedagogically appropriate. To honor the College decision, the ISE faculty has invested a considerable amount of time and effort to logically re-package and preserve the overall content of existing ISE quarter-system course offerings into 3 credit hour semester-system courses. As a result, many ISE semester-system courses have new names which reflect the redesigned course system.

An ISE quarter to semester course comparison chart has been created to show which courses were offered in the quarter-system, and what courses have been proposed for the semester-system (see Attachment #1). The Comments column of the chart describes if the semester-system course is "Based on XXX", if a current quarter-system course was "Not offered since XXXX", if a current quarter-system course "Topics Distributed into XXXX", or if a semester-system course is a "New Course". The "Based on XXX", means that the new semester-system course is based on an existing quarter-system course number, and the content has been expanded by approximately 1/3. "Not offered since XXXX" means that the existing quarter-system course was no longer being offered due to lack of demand, or lack of instructional resources, and the faculty decided it was obsolete; thus the course was eliminated and not converted to a semester-system course. "Topics distributed into XXXX" means that the topical content of this course was broken-up and re-packaged into another course (or courses) for the semester-system. The "New Course", means that the new semester-system course consists of content taken from more than one existing quarter-based courses, and this content has been re-packaged into a new course.

In summary, the overall construct, and content, of the current quarter-system MS ISE program and course offerings has been preserved. The course content has been re-

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packaged by the ISE faculty to create a program that conforms to the College of Engineering standard 3 credit hour semester-system course offerings. As a result of the re-packaging, and elimination of some obsolete courses and content, the total number of ISE graduate level courses proposed for the semester-system is (logically) slightly less than 2/3 (58 versus 95) of the total number ISE courses that currently exist in the quarter-system.

The ISE comparison table (Attachment #1) has been included as an aid in explaining the rationale for re-packaging the ISE graduate course content from quarters to semesters. Attachment #2 is a listing of all proposed ISE graduate level semester courses to-date, in numerically increasing order. Table 1 (below) explains the mapping of the ISE course numbering system to subject areas and sub-disciplines within ISE for both the current quarter system courses, and the proposed semester-system courses.

**Table 1. Definition Key for the ISE Course Numbering System for Both the Quarter-System and Proposed Semester-System**

Digit in the “tens” column (XXX) for Quarter-System courses; or in the “hundreds” column (XXX) for Semester-System courses	Specific Subject Area Category of the ISE Course	ISE Sub-Discipline
0	Systems Modeling and Analysis	Operations Research
1	Engineering Statistical Methods	
2	Optimization	
3	Stochastic Processes	
4	Production / Manufacturing / Distribution Systems	Manufacturing
5	Production / Manufacturing Processes	
6	Physical Ergonomics	Human Factors
7	Cognitive Ergonomics	
8 or 9	Integrative Methodologies/Capstone/Research	All ISE

For example, in Attachment #1, the first quarter-system course listed is ISE 720 Linear Programming. The “tens” digit is 2, meaning the course falls under the Optimization subject area of the program, which is in the Operations Research sub-discipline of ISE; correspondingly, it is listed in Attachment #1 under the Operations Research Course heading. Similarly, the first semester-system course listed in Attachment #1 is ISE 5200 Linear Optimization. The “hundreds” digit is 2, meaning the course falls under the



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Optimization subject area of the program, in the Operations Research sub-discipline of ISE. Thus, it is listed in Attachment #1 under the Operations Research Course heading.

### 7. Proposed Program Requirements

Although there are no fundamental structural changes being proposed for the MS ISE program, the nomenclature is being altered. Specifically, the quarter-system core requirement terms “depth” and “breadth” have been eliminated.

Proposed semester-system MS ISE graduate degree core program minimum requirements include:

- 30 total graduate-level credit hours, of which at least 80% must be taken at OSU (24 hours)
- 6 semester credit hours of ISE graduate level courses in one selected sub-discipline within ISE; Operations Research, Manufacturing, or Human Factors.
- 3 semester credit hours of graduate level course work from a second sub-discipline within ISE.
- 3 semester credit hours of graduate level course work focused on mathematical, statistical, or numerical methodologies.
- 2 semester credit hours of ISE Graduate Research Seminar.

Thesis option program requirements:

- Minimum of 22 semester hours of graduate level course work, which must include MS ISE core requirements, plus graduate level elective courses.
- Minimum of 4 semester hours of thesis research.
- The total of course hours, plus research hours, must sum to be a minimum of 30 semester hours.
- Fulfillment of the Graduate School thesis examination and thesis document approval requirements.

Non-Thesis option program requirements:

1. 30 semester hours of graduate level course work, which must include the MS ISE core requirements, plus graduate level elective courses.
2. Fulfillment of the Graduate School exit examination requirement.

### 8. Current and Proposed Advising Sheets

Attachment #3 consists of Current Quarter-System MS ISE Advising Sheets; including a blank quarter-system Plan of Study form, and 3 example quarter-system Plan of Study forms for MS ISE students in the Operations Research, Manufacturing, and Human Factors sub-disciplines. Attachment #4 consists of Proposed Semester-System MS ISE Advising Sheets; including a blank semester-system Plan of Study form, and 3 example

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semester-system Plan of Study forms for MS ISE students in the Operations Research, Manufacturing, and Human Factors sub-disciplines. The courses listed in the Selected Sub-discipline Requirement heading are those highly recommended by the ISE faculty for each sub-discipline in the semester-system. However, recognizing that some MS ISE students come from other disciplines (not ISE) in Engineering, Math, or the Physical Sciences, while others do have an ISE academic background, each Plan of Study is customized to some degree based on the previous formal educational background of the student, and their intended area of research or intellectual interest. All MS ISE programs of study are subject to oversight and approval by the ISE Graduate Studies Committee.

**9. Credit Hour Changes**

	Number of QCH in current program	Calculated 2/3 of QCH in current program	Number of SCH required for proposed program
Total CH required for completion of program	45	30	30
Prerequisite credit hours required for admission to program which are not counted toward total hours	N/A	N/A	N/A
Required CH offered by the unit	21	14	14
Required CH offered outside of the unit	0	0	0
Free Elective CH	24	16	16

**10. Transition Policy**

No ISE graduate student who begins their degree program under quarters will have progress toward graduation impeded by the transition to semesters. Graduation requirements beginning Summer 2012 will be those in place for ISE graduate students under semesters. Every quarter-credit-hour that would have counted toward an ISE graduate degree under the quarter-based program will count (as 2/3 of a semester credit hour) toward the requirements for graduation under the corresponding semester-based program. Additional advising support will be provided for ISE graduate students to assist in planning course scheduled for the last year of quarters (2011-2012), and for the first year of semesters (2012-2013). If it is determined that the “normal” conditions covered by the ISE transition policy would result in a particular student facing an unavoidable delay in graduation compared to quarters due to the change to semesters, then a revision of specific requirements will be determined for that student by their faculty advisor. Any revision would be subject to approval by the ISE Graduate Studies Committee.

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Attachment #1:

ISE Graduate Courses Quarters to Semesters Comparison Chart Organized by Sub-Discipline

Quarter Course Number (hours)	Course Title	Semester Course Number (hours)	Course Title	Comments
<b>Operations Research Courses</b>				
720 (3)	Linear Programming	5200 (3)	Linear Optimization	Based on 720
730 (3)	Stochastic Processes Used in Systems Engineering I	5300 (3)	Probabilistic Models for Planning Under Uncertainty	Based on 730
820 (3)	Nonlinear Programming	6200 (3)	Fundamentals of Optimization	Based on 820
821 (3)	Advanced Nonlinear Programming	7200 (3)	Algorithms for Nonlinear Optimization	Based on 821
822 (3)	Integer Optimization Methods	6210 (3)	Integer Optimization	Based on 822
823 (3)	Optimization Methods for Large Systems	7210 (3)	Large Scale Optimization	Based on 823
830 (3)	Stochastic Processes Used in Systems Engineering II	7300 (3)	Stochastic Processes	Based on 830
831 (3)	Advanced Queuing Theory			Will offer as special topics
832 (3)	Dynamic Programming			Not offered since 2000
835 (3 – 12)	Programming and Control Research			Offered 1 time since 2000, no demand
894 (1 – 6)	Group Studies	7220	Network Optimization	Based on 894
<b>Manufacturing Courses</b>				
784 (3)	Industrial Ecology: Production Systems Perspectives	5450 (3)	Industrial Ecology	Based on 784
640 (3)	Introduction to Integrated Production Control Systems			Not offered since 2000
650.01 (3)	Introduction to Manufacturing Processes	5510 (3)	Fundamentals of Solid State Processing	Based on 650.01
650.02 (4)	Tool Engineering	5530 (3)	Fundamentals of Tool Engineering	Based on 650.02
650.03 (4)	Manufacturing Processes and Simulation			Topics distributed into 5510 and 5520
651.01 (4)	Machining Processes and Machine Tools			Topics distributed into 5510 and 5530
651.02 (3)	Analysis of Die Casting Processes	5520 (3)	Fundamentals of Liquid Shaping Processes	Based on 651.02
651.03 (4)	Net Shape Forming of Automotive Parts			Topics distributed into 5510, 5520, 5530, and 5560
651.04 (4)	Machine Tool Control and Programming			Topics distributed into 5530 and 5560
652.01 (3)	CAD/CAM Laboratory for Rapid Design Prototyping			Course was previously cross-listed with ME; then adopted solely by ME in 2009.

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652.02 (3)	Introduction to Nanofabrication and Nanomanufacturing			Topics distributed into 5550
682 (4)	Product Design Fundamentals	5560 (3)	Product Design Engineering	Based on 682
742 (3)	Warehouse and Facility Design	5410 (3)	Quantitative Models in Production and Distribution Logistics	Based on 742
748 (3)	Design, Analysis, and Control of Integrated Manufacturing Systems	5420 (3)	Design and Analysis of Lean and Flexible Manufacturing Systems	Based on 748
750.01 (3)	Introduction to Modeling of Materials Processing			Topics distributed into 5530 and 5560
750.02 (3)	Introduction to Metal Forming			Topics distributed into 5510
750.03 (3)	Robotic Applications in Manufacturing			Not offered since 2000
751.01 (3)	Advanced Metal Forming			Not offered since 2000
751.02 (3)	Polymer Processing Fundamentals	5540 (3)	Polymer Processing Fundamentals	Based on 751.02
752.01 (4)	Introduction to Precision Engineering	5550 (3)	Principles of Precision Engineering	Based on 752.01
H752.01 (4)	Introduction to Precision Engineering			Offered 1 time since 2000, no demand
841 (3)	Sequencing and Scheduling	6420 (3)	Sequencing and Scheduling	Based on 841
842 (3)	Advanced Studies in Plant Design and Materials Handling			Will offer as special topics
843 (3)	Advanced Models in Production Planning			Not offered since 2000
850 (3 – 12)	Problems in Production Engineering			Will offer as special topics
851 (3)	Seminar in Advanced Topics in Engineering			Offered 1 time since 2000, no demand
<b>Human Factors Courses</b>				
		5620 (3)	Risk Assessment Musculoskeletal Disorders	New Course
		5630 (3)	Human Factors for Engineering	New Course
		5710 (3)	Safety and Complex Systems	New Course
		5720 (3)	Human Systems Integration	New Course
		5730 (2)	Information Analysis and Synthesis	New Course
		5740 (2)	Human-Centered Automation	New Course
		5760 (3)	Visualization and HCI	New Course
		5770 (3)	Cognitive Systems Engineering: Design & Evaluation	New Course
660 (3)	Principles of Occupational Biomechanics and Industrial Ergonomics	6660 (3)	Principles of Occupational Biomechanics and Ergonomics	Based on 660
664 (3)	Industrial Accident Prevention and Control			
665 (4)	Analysis and Design of Workplace Environments			
670 (3)	Cognitive Engineering	6700 (3)	Introduction to Cognitive Systems Engineering	Based on 670
761.01 (3)	Practice Oriented Ergonomics			Not offered since 2000

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761.02 (3)	Intermediate Occupational Biomechanics			Offered once since 2000
763 (3)	Clinical Ergonomics			Not offered since 2000
769 (3)	Ergonomics in the Product Design Process	5610 (3)	Ergonomics in the Product Design Process	Based on 769
770 (3)	Cognitive Engineering	6770 (3)	Introduction to Cognitive Systems Engineering	Based on 770
771.01 (3)	Human-Computer Interaction in Complex Systems	5700 (2)	Cognitive Engineering Systems: Distributed and Cooperative Work	Based on 771.01
772 (3)	Cognitive Engineering Methods: Protocol Analysis and Knowledge Acquisition			
773.01 (3)	Human Interaction with Intelligent Systems			
775 (2)	Proseminar in Cognitive Science			Not offered since 2000
868.01 (4)	Biodynamic Measurement Tools Used in Research	7610 (3)	Advanced Topics in Biomechanics and Musculoskeletal Disorders: Spine Biomechanics	Based on 868.01
868.02 (4)	Modeling Upper Extremity Cumulative Trauma Disorder	7620 (3)	Advanced Topics in Biomechanics and Musculoskeletal Disorders: Upper Extremity Biomechanics	Based on 868.02
868.03 (3)	Advanced Topics in Biomedical Ergonomics	7630 (3)	Advanced Topics in Biomechanics and Musculoskeletal Disorders	Based on 868.03
869.01 (4)	Dynamic Biomechanical Lab Analysis for Occupational Low Back Disorder	7615 (3)	Biomechanics Research Practicum: Experience in Spine Biomechanics	Based on 869.01
869.02 (4)	Risk Assessment for Musculoskeletal Disorders	7625 (3)	Biomechanics Research Practicum: Experience in Spine Biomechanics	Based on 869.02
870 (3)	Advanced Seminar Cognitive Engineering	7700 (3)	Cognitive Engineering Systems: Advanced Topics	Based on 870
871 (1)	Man-Machine Systems Research			
873 (3)	Advanced Models in Human Factors Engineering			
875.01 (3)	Human Error and the Human Contribution to System Failures			

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**Attachment #2: Proposed Semester-System ISE Graduate Courses  
Listed by Numerically Increasing Course Number**

<b>Sub-discipline</b>	<b>Course Number</b>	<b>Course Title</b>	<b>Credit Hours</b>
Subject Area			
<b>5XXX Operations Research</b>			
Engineering Statistical Methods	ISE 5100	Discrete event simulation	3
	ISE 5110	Design of Engineering Experiments	3
	ISE 5193	Individual Studies in Integrated Systems Engineering	1 – 4
	ISE 5194	Group Studies in Integrated Systems Engineering	1 – 4
Optimization	ISE 5200	Linear Optimization	3
Stochastic Processes	ISE 5300	Probabilistic Models for Planning Under Uncertainty	3
<b>5XXX Manufacturing</b>			
Production / Manufacturing / Distribution Systems	ISE 5410	Quantitative Models in Production and Distribution Logistics	3
	ISE 5420	Design of Lean Manufacturing Systems	3
	ISE 5450	Industrial Ecology	3
Production / Manufacturing Processes	ISE 5510	Fundamentals of Solid State Processing	3
	ISE 5520	Fundamentals of Liquid Shaping Processes	3
	ISE 5530	Fundamentals of Tool Engineering	3
	ISE 5540	Polymer Processing Fundamentals	3
	ISE 5550	Principles of Precision Engineering	3
	ISE 5560	Product Design Engineering	3
<b>5XXX Human Factors</b>			
Physical Ergonomics	ISE 5610	Ergonomics in the Product Design Process	3
	ISE 5620	Risk Assessment Musculoskeletal Disorders	3
	ISE 5630	Human Factors for Engineers	3
	ISE 5640	Occupational Safety: Design of Work Environments	3
Cognitive Ergonomics	ISE 5700	Distributed and Cooperative Work	3
	ISE 5710	Safety and Complex Systems	3
	ISE 5720	Human Systems Integration	3
	ISE 5730	Information Analysis and Synthesis	3
	ISE 5740	Human–Centered Automation	3
	ISE 5750	Resilience Engineering	3
	ISE 5760	Visualization and HCI	3
	ISE 5770	Cognitive Systems Engineering: Design & Evaluation	3

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<b>5XXX All ISE</b>			
Integrative Methodologies	ISE 5810	Lean Sigma Foundations	4
	ISE 5820	Systems Thinking in Engineering and Design	3
	ISE 5830	Decision Analysis	3
	ISE 5840	Market Engineering and Applications	3
Capstone	ISE 5910.01	Capstone design: Lean Sigma Certification, I	3
	ISE 5910.02	Capstone design: Lean Sigma Certification, II	3
<b>6XXX Operations Research</b>			
Engineering Statistical Methods	ISE 6193	Individual Studies in Integrated Systems Engineering	1 – 4
	ISE 6194	Group Studies in Integrated Systems Engineering	1 – 4
Optimization	ISE 6200	Fundamentals of Optimization	3
	ISE 6210	Integer Optimization	3
<b>6XXX Manufacturing</b>			
Production / Manufacturing / Distribution Systems	ISE 6420	Sequencing and Scheduling	3
<b>6XXX Human Factors</b>			
Physical Ergonomics	ISE 6660	Principles of Occupational Biomechanics	3
Cognitive Ergonomics	ISE 6700	Introduction to Cognitive Systems Engineering	3
	ISE 6770	Introduction to Cognitive Systems Engineering	3
<b>6XXX All ISE</b>			
Integrative Methodologies	ISE 6820	Game Theory	3
	ISE 6890	Seminar in Industrial Engineering	1
<b>7XXX Operations Research</b>			
Engineering Statistical Methods	ISE 7100	Advanced Simulation	3
	ISE 7193	Individual Studies in Integrated Systems Engineering	1 – 4
	ISE 7194	Group Studies in Integrated Systems Engineering	1 – 4
Optimization	ISE 7200	Algorithms for Nonlinear Optimization	3
	ISE 7210	Large Scale Optimization	3
	ISE 7220	Network Optimization	1 – 4
Stochastic Processes	ISE 7300	Stochastic Processes	3
<b>7XXX Human Factors</b>			
Physical Ergonomics	ISE 7610	Advanced Topics in Biomechanics: Spine	3
	ISE 7615	Biomechanics Research Practicum: Spine	3

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	ISE 7620	Advanced Topics in Biomechanics: Upper Extremity	3
	ISE 7625	Biomechanics Research Practicum: Upper Extremity	3
	ISE 7630	Advanced Topics in Biomechanics: Contemporary Issues	3
Cognitive Ergonomics	ISE 7700	Cognitive Systems Engineering: Advanced Topics	3
<b>7XXX All ISE</b>			
Integrative Methodologies	ISE 7881	Interdepartmental Seminar	1 – 4
	ISE 7891	Colloquia, Workshops, & Seminars in ISE	1 – 4
Research	ISE 7999	Research in ISE for Thesis	1 – 4
<b>8XXX Operations Research</b>			
Systems Modeling and Analysis	ISE 8099	Special Topics in Systems Engineering	1 – 4
Engineering Statistical Methods	ISE 8194	Group Studies in Integrated Systems Engineering	1 – 4
	ISE 8199	Special Topics in Engineering Statistics	1 – 4
Optimization	ISE 8299	Special Topics in Optimization	1 – 4
Stochastic Processes	ISE 8399	Special Topics in Stochastic Operations Research	1 – 4
<b>8XXX Manufacturing</b>			
Production / Manufacturing / Distribution Systems	ISE 8499	Special Topics in Production/Manufacturing Systems	1 – 4
Production / Manufacturing Processes	ISE 8599	Special Topics in Manufacturing Processes	1 – 4
<b>8XXX Human Factors</b>			
Physical Ergonomics	ISE 8699	Special Topics in Physical Ergonomics	1 – 4
Cognitive Ergonomics	ISE 8799	Special Topics in Cognitive Ergonomics	1 – 4
<b>8XXX All ISE</b>			
Integrative Methodologies	ISE 8899	Special Topics in Integrated Systems	1 – 4
Research	ISE 8998	Research in Integrated Systems Engineering	1 – 4
	ISE 8999	Research in ISE for Dissertation	1 – 4



Industrial and Systems Engineering (ISE): MS Program Proposal

Attachment #3: MS Current Quarter-System Advising Sheets

Example Plan of Study Form (Quarters)

Master of Science Degree: Industrial and Systems Engineering (ISE)

**Thesis Option:** Minimum of 45 hours, including at least 33 hours of course work and at least 6 hours of thesis, ISE 999. A depth requirement (3 course minimum), breadth requirement (3 course minimum), and 3 credit hours of graduate seminar are required. All other courses taken to fulfill the 45 hour requirement are considered electives.

**Non-Thesis Option:** Minimum of 45 hours of course work, including a depth requirement (3 course minimum), breadth requirement (3 course minimum), and 3 credit hours of graduate seminar are required. All other courses taken to fulfill the 45 hour requirement are considered electives. A written exit examination, or equivalent demonstration of competency, is also required.

**Depth Requirement:** A minimum of three courses in an area of study defined by the student and his/her advisor.

Area of Study	Courses (number, title and credit hours)
Student Name (please print)	
<b>Total Depth Credit Hours:</b>	

**Breadth Requirement:** Must include one course in the category of Research Methods (minimum of 3 credit hours), and courses from two of the following three categories: 1) Operations Research, 2) Manufacturing, 3) Human Factors.

Breadth Category	Courses (number, title and credit hours)
Research Methods (3 credit hrs)	
<b>Total Breadth Credit Hours:</b>	

**Graduate Seminar:** List the courses taken to fulfill the 3 hour minimum requirement.

Graduate Seminar Courses Completed	
<b>Total Graduate Seminar Credit Hours:</b>	

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

**Electives:** List the elective courses to fulfill the 33 (thesis) or 45 (non-thesis) minimum course hour requirement.

Completed Elective Courses ( include credit hours for each course)		
<b>Total Elective Credit Hours:</b>		

**Research:** For the thesis option; number of ISE 999 hours completed (6 hours minimum) \_\_\_\_

	Approval Signatures	Date
<b>Student:</b>		
<b>Advisor:</b>		
<b>ISE Graduate Chair:</b>		

**INSTRUCTIONS**

1. This form has 3 important functions. First, it is designed to communicate the academic program requirements to newly matriculating ISE MS graduate students. This form is intended to be distributed to all new ISE MS degree-seeking students. Most commonly, this should be done at the annual New Graduate Student Orientation which takes place just prior to the start of the Autumn quarter each academic year. This form is intended to promote students to meet with their faculty advisor very early in their academic program, so that students can generate a **Plan of Study**. Therefore, students should arrange a meeting with their faculty advisor, discuss a proposed plan of study, complete the “Depth” and “Breadth” sections of this Plan of Study form.
2. Second, this form serves as a convenient checklist for the student, faculty advisor, and Graduate Studies Chair to verify that all ISE MS requirements have been met at the completion of the student’s academic program. When a student applies to graduate, they should obtain an Application to Graduate form from the ISE Graduate Coordinator. The student should then complete the Application to Graduate form, and the remaining sections of this **Plan of Study** form, and obtain their faculty advisor’s signature on both forms. The completed forms should then be submitted concurrently to the ISE Graduate Coordinator, who will seek approval signatures from the ISE Graduate Chair. The ISE Graduate Coordinator will place a copy of the completed Plan of Study form in the student’s graduate file in the ISE main office (210 Baker Systems), and return the original of both forms to the student. The student is responsible for submitting the completed Application to Graduate form to the Graduate School before the close of business on the second Friday of the quarter in which the student intends to graduate. This is an OSU Graduate School deadline.
3. Finally, this form serves an archival record of what courses/credits were used by the student to fulfill ISE MS program requirements. Extraneous courses can be identified by comparing the courses listed on this form with the full list of courses shown on the student’s official transcript, and have the potential to be transferred to a doctoral program of study.

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

**Example Plan of Study Form (Quarters: Operations Research)**

**Master of Science Degree: Industrial and Systems Engineering (ISE)**

**Thesis Option:** Minimum of 45 hours, including at least 33 hours of course work and at least 6 hours of thesis, ISE 999. A depth requirement (3 course minimum), breadth requirement (3 course minimum), and 3 credit hours of graduate seminar are required. All other courses taken to fulfill the 45 hour requirement are considered electives.

**Non-Thesis Option:** Minimum of 45 hours of course work, including a depth requirement (3 course minimum), breadth requirement (3 course minimum), and 3 credit hours of graduate seminar are required. All other courses taken to fulfill the 45 hour requirement are considered electives. A written exit examination, or equivalent demonstration of competency, is also required.

**Depth Requirement:** A minimum of three courses in an area of study defined by the student and his/her advisor.

Area of Study	Courses (number, title and credit hours)
Operations Research	ISE 720 Linear Programming (3)
<b>Student Name</b> (please print)	ISE 730 Stochastic Processes in Systems Eng. I (3)
Mr./Ms. Example Plan	ISE 885 Operations Research Practicum (3)
<b>Total Depth Credit Hours:</b>	9

**Breadth Requirement:** Must include one course in the category of Research Methods (minimum of 3 credit hours), and courses from two of the following three categories: 1) Operations Research, 2) Manufacturing, 3) Human Factors.

Breadth Category	Courses (number, title and credit hours)
Research Methods (3 credit hrs)	ISE 610 Design of Engineering Experiments (3)
Operations Research	ISE 820 Non-Linear Programming (3)
Human Factors	ISE 770 Cognitive Engineering (3)
<b>Total Breadth Credit Hours:</b>	9

**Graduate Seminar:** List the courses taken to fulfill the 3 hour minimum requirement.

Graduate Seminar Courses Completed	
ISE 890 (1)	
ISE 890 (1)	
ISE 890 (1)	
<b>Total Graduate Seminar Credit Hours:</b>	3

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

**Electives:** List the elective courses to fulfill the 33 (thesis) or 45 (non-thesis) minimum course hour requirement.

Completed Elective Courses ( include credit hours for each course)		
<b>Total Elective Credit Hours:</b>		

**Research:** For the thesis option; number of ISE 999 hours completed (6 hours minimum) \_\_\_\_

	Approval Signatures	Date
<b>Student:</b>		
<b>Advisor:</b>		
<b>ISE Graduate Chair:</b>		

**INSTRUCTIONS**

- This form has 3 important functions. First, it is designed to communicate the academic program requirements to newly matriculating ISE MS graduate students. This form is intended to be distributed to all new ISE MS degree-seeking students. Most commonly, this should be done at the annual New Graduate Student Orientation which takes place just prior to the start of the Autumn quarter each academic year. This form is intended to promote students to meet with their faculty advisor very early in their academic program, so that students can generate a **Plan of Study**. Therefore, students should arrange a meeting with their faculty advisor, discuss a proposed plan of study, complete the "Depth" and "Breadth" sections of this Plan of Study form.
- Second, this form serves as a convenient checklist for the student, faculty advisor, and Graduate Studies Chair to verify that all ISE MS requirements have been met at the completion of the student's academic program. When a student applies to graduate, they should obtain an Application to Graduate form from the ISE Graduate Coordinator. The student should then complete the Application to Graduate form, and the remaining sections of this **Plan of Study** form, and obtain their faculty advisor's signature on both forms. The completed forms should then be submitted concurrently to the ISE Graduate Coordinator, who will seek approval signatures from the ISE Graduate Chair. The ISE Graduate Coordinator will place a copy of the completed Plan of Study form in the student's graduate file in the ISE main office (210 Baker Systems), and return the original of both forms to the student. The student is responsible for submitting the completed Application to Graduate form to the Graduate School before the close of business on the second Friday of the quarter in which the student intends to graduate. This is an OSU Graduate School deadline.
- Finally, this form serves an archival record of what courses/credits were used by the student to fulfill ISE MS program requirements. Extraneous courses can be identified by comparing the courses listed on this form with the full list of courses shown on the student's official transcript, and have the potential to be transferred to a doctoral program of study.

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

**Example Plan of Study Form (Quarters: Manufacturing)  
Master of Science Degree: Industrial and Systems Engineering (ISE)**

**Thesis Option:** Minimum of 45 hours, including at least 33 hours of course work and at least 6 hours of thesis, ISE 999. A depth requirement (3 course minimum), breadth requirement (3 course minimum), and 3 credit hours of graduate seminar are required. All other courses taken to fulfill the 45 hour requirement are considered electives.

**Non-Thesis Option:** Minimum of 45 hours of course work, including a depth requirement (3 course minimum), breadth requirement (3 course minimum), and 3 credit hours of graduate seminar are required. All other courses taken to fulfill the 45 hour requirement are considered electives. A written exit examination, or equivalent demonstration of competency, is also required.

**Depth Requirement:** A minimum of three courses in an area of study defined by the student and his/her advisor.

<b>Area of Study</b>	<b>Courses (number, title and credit hours)</b>
Manufacturing	ISE 650.02 Tool Engineering (4)
<b>Student Name</b> (please print)	ISE 650.03 Manufacturing Process Simulation (4)
Mr./Ms. Example Plan	ISE 651.01 Machining Processes and Machine Tools (4)
<b>Total Depth Credit Hours:</b>	12

**Breadth Requirement:** Must include one course in the category of Research Methods (minimum of 3 credit hours), and courses from two of the following three categories: 1) Operations Research, 2) Manufacturing, 3) Human Factors.

<b>Breadth Category</b>	<b>Courses (number, title and credit hours)</b>
Research Methods (3 credit hrs)	ISE 610 Design of Engineering Experiments (3)
Manufacturing	ISE 682 Product Design Fundamentals (4)
Human Factors	ISE 770 Cognitive Engineering (3)
<b>Total Breadth Credit Hours:</b>	10

**Graduate Seminar:** List the courses taken to fulfill the 3 hour minimum requirement.

<b>Graduate Seminar Courses Completed</b>	
ISE 890 (1)	
ISE 890 (1)	
ISE 890 (1)	
<b>Total Graduate Seminar Credit Hours:</b>	3

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

**Electives:** List the elective courses to fulfill the 33 (thesis) or 45 (non-thesis) minimum course hour requirement.

Completed Elective Courses ( include credit hours for each course)		
<b>Total Elective Credit Hours:</b>		

**Research:** For the thesis option; number of ISE 999 hours completed (6 hours minimum) \_\_\_\_

	Approval Signatures	Date
<b>Student:</b>		
<b>Advisor:</b>		
<b>ISE Graduate Chair:</b>		

**INSTRUCTIONS**

- This form has 3 important functions. First, it is designed to communicate the academic program requirements to newly matriculating ISE MS graduate students. This form is intended to be distributed to all new ISE MS degree-seeking students. Most commonly, this should be done at the annual New Graduate Student Orientation which takes place just prior to the start of the Autumn quarter each academic year. This form is intended to promote students to meet with their faculty advisor very early in their academic program, so that students can generate a **Plan of Study**. Therefore, students should arrange a meeting with their faculty advisor, discuss a proposed plan of study, complete the "Depth" and "Breadth" sections of this Plan of Study form.
- Second, this form serves as a convenient checklist for the student, faculty advisor, and Graduate Studies Chair to verify that all ISE MS requirements have been met at the completion of the student's academic program. When a student applies to graduate, they should obtain an Application to Graduate form from the ISE Graduate Coordinator. The student should then complete the Application to Graduate form, and the remaining sections of this **Plan of Study** form, and obtain their faculty advisor's signature on both forms. The completed forms should then be submitted concurrently to the ISE Graduate Coordinator, who will seek approval signatures from the ISE Graduate Chair. The ISE Graduate Coordinator will place a copy of the completed Plan of Study form in the student's graduate file in the ISE main office (210 Baker Systems), and return the original of both forms to the student. The student is responsible for submitting the completed Application to Graduate form to the Graduate School before the close of business on the second Friday of the quarter in which the student intends to graduate. This is an OSU Graduate School deadline.
- Finally, this form serves an archival record of what courses/credits were used by the student to fulfill ISE MS program requirements. Extraneous courses can be identified by comparing the courses listed on this form with the full list of courses shown on the student's official transcript, and have the potential to be transferred to a doctoral program of study.

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

**Example Plan of Study Form (Quarters: Human Factors)  
Master of Science Degree: Industrial and Systems Engineering (ISE)**

**Thesis Option:** Minimum of 45 hours, including at least 33 hours of course work and at least 6 hours of thesis, ISE 999. A depth requirement (3 course minimum), breadth requirement (3 course minimum), and 3 credit hours of graduate seminar are required. All other courses taken to fulfill the 45 hour requirement are considered electives.

**Non-Thesis Option:** Minimum of 45 hours of course work, including a depth requirement (3 course minimum), breadth requirement (3 course minimum), and 3 credit hours of graduate seminar are required. All other courses taken to fulfill the 45 hour requirement are considered electives. A written exit examination, or equivalent demonstration of competency, is also required.

**Depth Requirement:** A minimum of three courses in an area of study defined by the student and his/her advisor.

<b>Area of Study</b>	<b>Courses (number, title and credit hours)</b>
Human Factors (Physical Ergonomics)	ISE 660 Principles of Occupational Biomechanics and Industrial Ergonomics (3)
<b>Student Name</b> (please print)	ISE 664 Industrial Accident Prevention and Control (3)
Mr./Ms. Example Plan	ISE 665 Analysis & Design of Workplace Environments (3)
<b>Total Depth Credit Hours:</b>	9

**Breadth Requirement:** Must include one course in the category of Research Methods (minimum of 3 credit hours), and courses from two of the following three categories: 1) Operations Research, 2) Manufacturing, 3) Human Factors.

<b>Breadth Category</b>	<b>Courses (number, title and credit hours)</b>
Research Methods (3 credit hrs)	ISE 610 Design of Engineering Experiments (3)
Manufacturing	ISE 682 Product Design Fundamentals (4)
Human Factors	ISE 770 Cognitive Engineering (3)
<b>Total Breadth Credit Hours:</b>	10

**Graduate Seminar:** List the courses taken to fulfill the 3 hour minimum requirement.

<b>Graduate Seminar Courses Completed</b>	
ISE 890 (1)	
ISE 890 (1)	
ISE 890 (1)	
<b>Total Graduate Seminar Credit Hours:</b>	3

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

**Electives:** List the elective courses to fulfill the 33 (thesis) or 45 (non-thesis) minimum course hour requirement.

Completed Elective Courses ( include credit hours for each course)		
<b>Total Elective Credit Hours:</b>		

**Research:** For the thesis option; number of ISE 999 hours completed (6 hours minimum) \_\_\_\_

	Approval Signatures	Date
<b>Student:</b>		
<b>Advisor:</b>		
<b>ISE Graduate Chair:</b>		

**INSTRUCTIONS**

10. This form has 3 important functions. First, it is designed to communicate the academic program requirements to newly matriculating ISE MS graduate students. This form is intended to be distributed to all new ISE MS degree-seeking students. Most commonly, this should be done at the annual New Graduate Student Orientation which takes place just prior to the start of the Autumn quarter each academic year. This form is intended to promote students to meet with their faculty advisor very early in their academic program, so that students can generate a **Plan of Study**. Therefore, students should arrange a meeting with their faculty advisor, discuss a proposed plan of study, complete the "Depth" and "Breadth" sections of this Plan of Study form.
11. Second, this form serves as a convenient checklist for the student, faculty advisor, and Graduate Studies Chair to verify that all ISE MS requirements have been met at the completion of the student's academic program. When a student applies to graduate, they should obtain an Application to Graduate form from the ISE Graduate Coordinator. The student should then complete the Application to Graduate form, and the remaining sections of this **Plan of Study** form, and obtain their faculty advisor's signature on both forms. The completed forms should then be submitted concurrently to the ISE Graduate Coordinator, who will seek approval signatures from the ISE Graduate Chair. The ISE Graduate Coordinator will place a copy of the completed Plan of Study form in the student's graduate file in the ISE main office (210 Baker Systems), and return the original of both forms to the student. The student is responsible for submitting the completed Application to Graduate form to the Graduate School before the close of business on the second Friday of the quarter in which the student intends to graduate. This is an OSU Graduate School deadline.
12. Finally, this form serves an archival record of what courses/credits were used by the student to fulfill ISE MS program requirements. Extraneous courses can be identified by comparing the courses listed on this form with the full list of courses shown on the student's official transcript, and have the potential to be transferred to a doctoral program of study.



Industrial and Systems Engineering (ISE): MS Program Proposal

Attachment #4: MS Semester-System Advising Sheets

**Example Plan of Study Form for Semesters:  
Master of Science Degree in Industrial and Systems Engineering (ISE)**  
Student Name (please print): \_\_\_\_\_

**Thesis Option:** Minimum of 30 hours, including at least 22 hours of course work and at least 4 hours of thesis research credit hours. A Sub-discipline requirement (6 hour minimum), breadth requirement (6 hour minimum), and 2 credit hours of graduate seminar are required. All other courses taken to fulfill the 30 hour requirement are considered electives.

**Non-Thesis Option:** Minimum of 30 hours of course work, including a depth requirement (6 hour minimum), breadth requirement (6 hour minimum), and 2 credit hours of graduate seminar are required. All other courses taken to fulfill the 30 hour requirement are considered electives. A written exit examination, or equivalent demonstration of competency, is also required.

**Primary Sub-discipline Requirement:** A minimum of 6 course hours from one of the following three ISE sub-disciplines; Operations Research, Manufacturing, or Human Factors.

Primary Sub-discipline	Courses (number, title and credit hours)
<b>Total Credit Hours:</b>	

**Secondary Sub-discipline Requirement:** A minimum of 3 course hours is required from a second sub-discipline within the ISE (must be a different than the Primary Sub-discipline; Operations Research, Manufacturing, or Human Factors).

Secondary Sub-discipline	Course (number, title and credit hours)

**Mathematical, Statistical, or Numerical Methods Requirement:** A minimum of 3 course hours focused on Mathematical, Statistical, or Numerical Methods is required.

Math/Stat/Numerical Methods Course (number, title and credit hours)

**Graduate Seminar:** List the course(s) taken to fulfill the 2 hour minimum requirement.

Graduate Seminar Course(s) Completed	
<b>Total Graduate Seminar Credit Hours:</b>	

**Electives:** List the courses completed to fulfill the 22 (thesis) or 30 (non-thesis) minimum course hour requirement.

Completed Elective Courses ( include credit hours for each course)

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

<b>Total Elective Credit Hours:</b>		

**Research:** For the thesis option, record the number of Thesis Research hours completed (4 hours minimum) \_\_\_\_\_

	<b>Approval Signatures</b>	<b>Date</b>
<b>Student:</b>		
<b>Advisor:</b>		
<b>ISE Graduate Chair:</b>		

**INSTRUCTIONS**

1. This form has 3 important functions. First, it is designed to communicate the academic program requirements to newly matriculating ISE MS graduate students. This form is intended to be distributed to all new ISE MS degree-seeking students. Most commonly, this should be done at the annual New Graduate Student Orientation which takes place just prior to the start of the Autumn semester each academic year. This form is intended to promote students to meet with their faculty advisor very early in their academic program, so that students can generate a **Proposed Plan of Study**. Therefore, students should arrange a meeting with their faculty advisor, discuss a proposed plan of study, complete the "Proposed" sections of this Plan of Study form, and obtain their faculty advisor's signature. The student should also sign the form, and then submit it to the ISE Graduate Program Coordinator. The ISE Graduate Coordinator will seek an approval signature from the ISE Graduate Chair, place a copy in the student's graduate file in the ISE main office (210 Baker Systems), and return the original to the student. It is also the student's responsibility to provide a copy of the Proposed Plan of Study form to their faculty advisor. The student's Proposed Plan of Study must be approved prior to registration for their second quarter of study.
2. Second, this form serves as a convenient checklist for the student, faculty advisor, and Graduate Studies Chair to verify that all ISE MS requirements have been met at the completion of the student's academic program. When a student applies to graduate, they should obtain an Application to Graduate form from the ISE Graduate Coordinator. The student should then complete the Application to Graduate form, and the **Actual/Final** sections of this **Plan of Study** form, and obtain their faculty advisor's signature on both forms. The completed forms should then be submitted concurrently to the ISE Graduate Coordinator, who will seek approval signatures from the ISE Graduate Chair. The ISE Graduate Coordinator will place a copy of the completed Plan of Study form in the student's graduate file in the ISE main office (210 Baker Systems), and return the original of both forms to the student. The student is responsible for submitting the completed Application to Graduate form to the Graduate School before the close of business on the second Friday of the semester in which the student intends to graduate. This is an OSU Graduate School deadline.
3. Finally, this form serves an archival record of what courses/credits were used by the student to fulfill ISE MS program requirements. Extraneous courses can be identified by comparing the courses listed on this form with the full list of courses shown on the student's official transcript, and have the potential to be transferred to a doctoral program of study.

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

**Example Plan of Study Form for Semesters: Operations Research  
Master of Science Degree in Industrial and Systems Engineering (ISE)**

**Student Name** (please print): \_\_\_\_\_

**Thesis Option:** Minimum of 30 hours, including at least 22 hours of course work and at least 4 hours of thesis research credit hours. A Sub-discipline requirement (6 hour minimum), breadth requirement (6 hour minimum), and 2 credit hours of graduate seminar are required. All other courses taken to fulfill the 30 hour requirement are considered electives.

**Non-Thesis Option:** Minimum of 30 hours of course work, including a depth requirement (6 hour minimum), breadth requirement (6 hour minimum), and 2 credit hours of graduate seminar are required. All other courses taken to fulfill the 30 hour requirement are considered electives. A written exit examination, or equivalent demonstration of competency, is also required.

**Primary Sub-discipline Requirement:** A minimum of 6 course hours from one of the following three ISE sub-disciplines; Operations Research, Manufacturing, or Human Factors.

Primary Sub-discipline	Courses (number, title and credit hours)
Operations Research	ISE 5100 Discrete Event Simulation (3)
	ISE 5200 Linear Optimization (3)
<b>Total Credit Hours:</b>	6

**Secondary Sub-discipline Requirement:** A minimum of 3 course hours is required from a second sub-discipline within the ISE (must be a different than the Primary Sub-discipline; Operations Research, Manufacturing, or Human Factors).

Secondary Sub-discipline	Course (number, title and credit hours)
Human Factors	ISE 6770 Introduction to Cognitive Systems Engineering (3)

**Mathematical, Statistical, or Numerical Methods Requirement:** A minimum of 3 course hours focused on Mathematical, Statistical, or Numerical Methods is required.

Math/Stat/Numerical Methods Course (number, title and credit hours)
ISE 5110 Design of Engineering Experiments (3)

**Graduate Seminar:** List the course(s) taken to fulfill the 2 hour minimum requirement.

Graduate Seminar Course(s) Completed	
ISE 6890 Seminar in ISE (1)	
ISE 6890 Seminar in ISE (1)	
<b>Total Graduate Seminar Credit Hours:</b>	2

**Electives:** List the courses completed to fulfill the 22 (thesis) or 30 (non-thesis) minimum course hour requirement.

Completed Elective Courses ( include credit hours for each course)		
<b>Total Elective Credit Hours:</b>		

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

**Research:** For the thesis option, record the number of Thesis Research hours completed (4 hours minimum) \_\_\_\_\_

	<b>Approval Signatures</b>	<b>Date</b>
<b>Student:</b>		
<b>Advisor:</b>		
<b>ISE Graduate Chair:</b>		

**INSTRUCTIONS**

1. This form has 3 important functions. First, it is designed to communicate the academic program requirements to newly matriculating ISE MS graduate students. This form is intended to be distributed to all new ISE MS degree-seeking students. Most commonly, this should be done at the annual New Graduate Student Orientation which takes place just prior to the start of the Autumn semester each academic year. This form is intended to promote students to meet with their faculty advisor very early in their academic program, so that students can generate a **Proposed Plan of Study**. Therefore, students should arrange a meeting with their faculty advisor, discuss a proposed plan of study, complete the “Proposed” sections of this Plan of Study form, and obtain their faculty advisor’s signature. The student should also sign the form, and then submit it to the ISE Graduate Program Coordinator. The ISE Graduate Coordinator will seek an approval signature from the ISE Graduate Chair, place a copy in the student’s graduate file in the ISE main office (210 Baker Systems), and return the original to the student. It is also the student’s responsibility to provide a copy of the Proposed Plan of Study form to their faculty advisor. The student’s Proposed Plan of Study must be approved prior to registration for their second quarter of study.
2. Second, this form serves as a convenient checklist for the student, faculty advisor, and Graduate Studies Chair to verify that all ISE MS requirements have been met at the completion of the student’s academic program. When a student applies to graduate, they should obtain an Application to Graduate form from the ISE Graduate Coordinator. The student should then complete the Application to Graduate form, and the **Actual/Final** sections of this **Plan of Study** form, and obtain their faculty advisor’s signature on both forms. The completed forms should then be submitted concurrently to the ISE Graduate Coordinator, who will seek approval signatures from the ISE Graduate Chair. The ISE Graduate Coordinator will place a copy of the completed Plan of Study form in the student’s graduate file in the ISE main office (210 Baker Systems), and return the original of both forms to the student. The student is responsible for submitting the completed Application to Graduate form to the Graduate School before the close of business on the second Friday of the semester in which the student intends to graduate. This is an OSU Graduate School deadline.
3. Finally, this form serves an archival record of what courses/credits were used by the student to fulfill ISE MS program requirements. Extraneous courses can be identified by comparing the courses listed on this form with the full list of courses shown on the student’s official transcript, and have the potential to be transferred to a doctoral program of study.

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

**Example Plan of Study Form for Semesters: Manufacturing  
Master of Science Degree in Industrial and Systems Engineering (ISE)**

**Student Name** (please print): \_\_\_\_\_

**Thesis Option:** Minimum of 30 hours, including at least 22 hours of course work and at least 4 hours of thesis research credit hours. A Sub-discipline requirement (6 hour minimum), breadth requirement (6 hour minimum), and 2 credit hours of graduate seminar are required. All other courses taken to fulfill the 30 hour requirement are considered electives.

**Non-Thesis Option:** Minimum of 30 hours of course work, including a depth requirement (6 hour minimum), breadth requirement (6 hour minimum), and 2 credit hours of graduate seminar are required. All other courses taken to fulfill the 30 hour requirement are considered electives. A written exit examination, or equivalent demonstration of competency, is also required.

**Primary Sub-discipline Requirement:** A minimum of 6 course hours from one of the following three ISE sub-disciplines; Operations Research, Manufacturing, or Human Factors.

Primary Sub-discipline	Courses (number, title and credit hours)
Manufacturing	ISE 5510 Fundamentals of Liquid State Processing (3)
	ISE 5520 Fundamentals of Solid State Processing (3)
<b>Total Credit Hours:</b>	6

**Secondary Sub-discipline Requirement:** A minimum of 3 course hours is required from a second sub-discipline within the ISE (must be a different than the Primary Sub-discipline; Operations Research, Manufacturing, or Human Factors).

Secondary Sub-discipline	Course (number, title and credit hours)
Human Factors	ISE 6770 Introduction to Cognitive Systems Engineering (3)

**Mathematical, Statistical, or Numerical Methods Requirement:** A minimum of 3 course hours focused on Mathematical, Statistical, or Numerical Methods is required.

Math/Stat/Numerical Methods Course (number, title and credit hours)
ISE 5110 Design of Engineering Experiments (3)

**Graduate Seminar:** List the course(s) taken to fulfill the 2 hour minimum requirement.

Graduate Seminar Course(s) Completed	
ISE 6890 Seminar in ISE (1)	
ISE 6890 Seminar in ISE (1)	
<b>Total Graduate Seminar Credit Hours:</b>	2

**Electives:** List the courses completed to fulfill the 22 (thesis) or 30 (non-thesis) minimum course hour requirement.

Completed Elective Courses ( include credit hours for each course)		
<b>Total Elective Credit Hours:</b>		

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

**Research:** For the thesis option, record the number of Thesis Research hours completed (4 hours minimum) \_\_\_\_\_

	<b>Approval Signatures</b>	<b>Date</b>
<b>Student:</b>		
<b>Advisor:</b>		
<b>ISE Graduate Chair:</b>		

**INSTRUCTIONS**

1. This form has 3 important functions. First, it is designed to communicate the academic program requirements to newly matriculating ISE MS graduate students. This form is intended to be distributed to all new ISE MS degree-seeking students. Most commonly, this should be done at the annual New Graduate Student Orientation which takes place just prior to the start of the Autumn semester each academic year. This form is intended to promote students to meet with their faculty advisor very early in their academic program, so that students can generate a **Proposed Plan of Study**. Therefore, students should arrange a meeting with their faculty advisor, discuss a proposed plan of study, complete the "Proposed" sections of this Plan of Study form, and obtain their faculty advisor's signature. The student should also sign the form, and then submit it to the ISE Graduate Program Coordinator. The ISE Graduate Coordinator will seek an approval signature from the ISE Graduate Chair, place a copy in the student's graduate file in the ISE main office (210 Baker Systems), and return the original to the student. It is also the student's responsibility to provide a copy of the Proposed Plan of Study form to their faculty advisor. The student's Proposed Plan of Study must be approved prior to registration for their second quarter of study.
2. Second, this form serves as a convenient checklist for the student, faculty advisor, and Graduate Studies Chair to verify that all ISE MS requirements have been met at the completion of the student's academic program. When a student applies to graduate, they should obtain an Application to Graduate form from the ISE Graduate Coordinator. The student should then complete the Application to Graduate form, and the **Actual/Final** sections of this **Plan of Study** form, and obtain their faculty advisor's signature on both forms. The completed forms should then be submitted concurrently to the ISE Graduate Coordinator, who will seek approval signatures from the ISE Graduate Chair. The ISE Graduate Coordinator will place a copy of the completed Plan of Study form in the student's graduate file in the ISE main office (210 Baker Systems), and return the original of both forms to the student. The student is responsible for submitting the completed Application to Graduate form to the Graduate School before the close of business on the second Friday of the semester in which the student intends to graduate. This is an OSU Graduate School deadline.
3. Finally, this form serves an archival record of what courses/credits were used by the student to fulfill ISE MS program requirements. Extraneous courses can be identified by comparing the courses listed on this form with the full list of courses shown on the student's official transcript, and have the potential to be transferred to a doctoral program of study.

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

**Example Plan of Study Form for Semesters: Human Factors  
Master of Science Degree in Industrial and Systems Engineering (ISE)**

**Student Name** (please print): \_\_\_\_\_

**Thesis Option:** Minimum of 30 hours, including at least 22 hours of course work and at least 4 hours of thesis research credit hours. A Sub-discipline requirement (6 hour minimum), breadth requirement (6 hour minimum), and 2 credit hours of graduate seminar are required. All other courses taken to fulfill the 30 hour requirement are considered electives.

**Non-Thesis Option:** Minimum of 30 hours of course work, including a depth requirement (6 hour minimum), breadth requirement (6 hour minimum), and 2 credit hours of graduate seminar are required. All other courses taken to fulfill the 30 hour requirement are considered electives. A written exit examination, or equivalent demonstration of competency, is also required.

**Primary Sub-discipline Requirement:** A minimum of 6 course hours from one of the following three ISE sub-disciplines; Operations Research, Manufacturing, or Human Factors.

Primary Sub-discipline	Courses (number, title and credit hours)
Human Factors (Physical Ergonomics)	ISE 5620 Risk Assessment Tools for Occupational Musculoskeletal Disorders (3)
	ISE 6660 Principles of Occupational Biomechanics (3)
<b>Total Credit Hours:</b>	6

**Secondary Sub-discipline Requirement:** A minimum of 3 course hours is required from a second sub-discipline within the ISE (must be a different than the Primary Sub-discipline; Operations Research, Manufacturing, or Human Factors).

Secondary Sub-discipline	Course (number, title and credit hours)
Manufacturing	ISE 5450 Industrial Ecology

**Mathematical, Statistical, or Numerical Methods Requirement:** A minimum of 3 course hours focused on Mathematical, Statistical, or Numerical Methods is required.

Math/Stat/Numerical Methods Course (number, title and credit hours)
ISE 5110 Design of Engineering Experiments (3)

**Graduate Seminar:** List the course(s) taken to fulfill the 2 hour minimum requirement.

Graduate Seminar Course(s) Completed	
ISE 6890 Seminar in ISE	(1)
ISE 6890 Seminar in ISE	(1)
<b>Total Graduate Seminar Credit Hours:</b>	2

**Electives:** List the courses completed to fulfill the 22 (thesis) or 30 (non-thesis) minimum course hour requirement.

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

Completed Elective Courses ( include credit hours for each course)		
<b>Total Elective Credit Hours:</b>		

**Research:** For the thesis option, record the number of Thesis Research hours completed (4 hours minimum) \_\_\_\_\_

	Approval Signatures	Date
<b>Student:</b>		
<b>Advisor:</b>		
<b>ISE Graduate Chair:</b>		

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