

COLLEGE OF ENGINEERING
DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING
DEGREE: **BACHELOR OF SCIENCE IN INDUSTRIAL AND SYSTEMS ENGINEERING**
MAJOR: **INDUSTRIAL AND SYSTEMS ENGINEERING**
FOR STUDENTS ENTERING UNDER UG CATALOG 2023-2024
CREDITS REQUIRED FOR GRADUATION: 124

FALL SEMESTER FIRST YEAR		Credits	SPRING SEMESTER FIRST YEAR		Credits
CHEM 1035 General Chemistry <i>Pre: eligible to enroll</i>	3		ENGL 1106 First-Year Writing <i>Pre: ENGL 1105</i>	3	
ENGL 1105 First-Year Writing	3		MATH 1226 Calculus of a Single Variable <i>Pre: MATH 1225</i>	4	
MATH 1225 Calculus of a Single Variable (C-) <i>Pre: Eligible to enroll</i>	4		PHYS 2305 Foundations of Physics <i>Pre: MATH 1225 or MATH 1226; Co: MATH 1226</i>	4	
ENGE 1215 Foundations of Engineering~	2		ENGE 1216 Foundations of Engineering~ <i>Pre: ENGE 1215</i>	2	
Pathways Core Concept 2, 3, 6a or 7	3		Pathways Core Concept 2, 3, 6a or 7	3	
TOTAL	15		TOTAL	16	
FALL SEMESTER SECOND YEAR		Credits	SPRING SEMESTER SECOND YEAR		Credits
Programming Elective	3		ESM 2104 Statics <i>Pre: MATH 1226; Co: MATH 2204 or MATH 2204H or MATH 2406H</i>	3	
MATH 2114 Introduction to Linear Algebra (C-)~ <i>Pre: MATH 1225 (B) or MATH 1226</i>	3		MATH 2214 Introduction to Differential Equations (C-)~ <i>Pre: (MATH 2114 or MATH 2114H or MATH 2405H), MATH 1226</i>	3	
MATH 2204 Intro Multivariable Calculus (C-)~ <i>Pre: MATH 1226</i>	3		ISE 2024 Probability Foundations for Industrial and Systems Engineers ⁽¹⁾ (C-) <i>Pre: MATH 2204 or MATH 2204H</i>	3[S, SII]	
PHYS 2306 Foundations of Physics <i>Pre: MATH 1226, PHYS 2305</i>	4		ISE 2034 Data Management for Industrial and Systems Engineers ⁽¹⁾ (C-) <i>Pre: CS 1044 or CS 1064 or CS 1114 or ECE 1574</i>	3[S, SII]	
ISE 2004 Introduction to Industrial and Systems Engineering ⁽¹⁾ (C-)	1[F, S, SI, SII]		ISE 2404 Deterministic Operations Research I ⁽¹⁾ (C-) <i>Pre: MATH 2114</i>	3[S, SII]	
ISE 2014 Engineering Economy ⁽¹⁾ (C-)	2[F, S, SI, SII]		ISE 3614 Human Factors Engineering and Ergonomics ⁽¹⁾ (C-) <i>Pre: 2004; Co: 2024</i>	3[F, S, SI]	
ISE 2214 Manufacturing Processes Laboratory ⁽¹⁾ (C-)	1[F, S, SI]				
TOTAL	17		TOTAL	18	
FALL SEMESTER THIRD YEAR		Credits	SPRING SEMESTER THIRD YEAR		Credits
STAT 4706 Probability and Statistics for Engineers (C-) <i>Pre: ISE 2024</i>	3[F, SI]		Engineering Science Elective	3	
ISE 3034 Technical Communication for Engineers (C-) <i>Pre: ENGL 1106</i>	3[F, S, SII]		ISE 3424 Discrete-Event Computer Simulation w/lab ⁽¹⁾ (C-) <i>Pre: 3414</i>	3[S, SII]	
ISE 3214 Facilities Planning And Logistics ⁽¹⁾ (C-) <i>Pre: 2014, 2404; Co: 3414</i>	3[F, SI]		ISE 3624 Industrial Ergonomics ⁽¹⁾ (C-) <i>Pre: 3614, ESM 2104</i>	3[S, SII]	
ISE 3414 Probabilistic Operations Research ⁽¹⁾ (C-) <i>Pre: 2004, 2024, (MATH 2204 or 2204H or 2406H), (MATH 2214 or 2214H), (CS 1044 or CS 1064 or CS 1114 or ECE 1574)</i>	3[F, W, SI]		ISE 4204 Production Planning and Inventory Control ⁽¹⁾ (C-) <i>Pre: 2404, 3414, STAT 4706</i>	3[S, SII]	
Pathways Core Concept 2, 3, 6a or 7	3		ISE Technical Elective	3	
TOTAL	15		TOTAL	15	
FALL SEMESTER FOURTH YEAR		Credits	SPRING SEMESTER FOURTH YEAR		Credits
ISE 4005 Project Management and System Design ⁽¹⁾ ~ (C-) <i>Pre: 2034, 2214, 3034, 3214, 3424, 3624, 4204; Co: 4404</i>	2[F]		ISE 4006 Project Management and System Design ⁽¹⁾ ~ <i>Pre: 4005</i>	2[S]	
ISE 4404 Statistical Quality Control ⁽¹⁾ <i>Pre: 3414, STAT 4706</i>	3[F]		ISE Technical Elective	3	
ISE Technical Elective	3		Technical Elective	3	
Technical Elective	3		Free Elective	3	
Pathways Core Concept 2, 3, 6a or 7	3		Pathways Core Concept 2, 3, 6a or 7	3	
TOTAL	14		TOTAL	14	

General Information about Checksheet: Superscripted annotation after the course number (1) indicates core course of the degree. Additionally, [F, S, SI, SII, W] in Credits column indicates terms when a course is expected to be offered. Course offerings are subject to change and the availability of sufficient resources. Students should confirm course offerings in advance with the department.

Pathways to General Education (Pathways)

Consult the pathways courses table: <http://www.pathways.prov.vt.edu/about/pathways-guides.html>. Pathways courses need to be completed prior to graduation.

Pathways Concept 1: Discourse (6 hrs foundational, 3 hrs advanced)	<i>Foundational: ENGL 1105</i>	(3)	<i>Foundational: ENGL 1106</i>	(3)
	<i>Advanced: ISE 3034 Technical Communication for Engineers</i>			(3)
Pathways Concept 2: Critical Thinking in the Humanities (6 hrs)		(3)		(3)
Pathways Concept 3: Reasoning in the Social Sciences (6 hrs)		(3)		(3)
Pathways Concept 4: Reasoning in the Natural Sciences (8 hrs)	PHYS 2305	(4)	PHYS 2306	(4)
Pathways Concept 5: Quantitative and Computational Thinking (11 hrs)	<i>Foundational: MATH 1225</i>	(4)	<i>Foundational: MATH 1226</i>	(4)
	<i>Advanced: MATH 2214</i>			(3)
Pathways Concept 6: Critique and Practice in Design and the Arts (7 hrs)	<i>Arts (6a):</i>			(3)
	<i>Design: ENGE 1215 + ENGE 1216</i>			(4)
Pathways Concept 7: Critical Analysis of Identify and Equity in the US (3 hrs)	*Pathways 7 should be double-counted with either Pathways 2, 3 or 6a to avoid taking any additional credit hours.			(3)

Electives

The ISE degree requires:

- 3 credits of **Programming Electives** from a list,
- 3 credits of **Engineering Science Electives** from a list,
- 9 credits of **ISE Technical Electives** from a list,
- 6 credits of **Technical Electives**,
- 3 credits of **Free Electives**.

Only Free electives and courses offered on a P/F basis only (e.g., FA 2004) may be taken under the P/F grading option.

Change of Major Requirements: Please see: <https://eng.vt.edu/em>

Foreign Language Requirements: Students must have had 2 years of a foreign language in high school or one year at the college level (6 credits) of the same language. College-level credits used to meet this requirement do not count towards the degree.

Satisfactory Progress Towards Degree: University Policy 91 outlines university-wide minimum criteria to determine if students are making satisfactory progress towards the completion of their degrees. The ISE Department fully supports this policy.

In addition, upon completion of two semesters as an ISE major, students must have

- a minimum in-major GPA of 2.0 or better (in-major GPA is determined from all ISE and required STAT classes);
- completed ISE 2004 and ISE 2014 (with a C- or better in each).

Statement of Hidden Prerequisites: Prerequisites for each course are listed after the course title. Students must earn a C- or better in ISE, STAT, and MATH courses which are pre-requisites for subsequent ISE courses. Prerequisites may change from what is indicated. Be sure to consult the University Catalog or check with your advisor for the most current requirements. There are no hidden pre-requisites in this program of study.

Course Availability: Course offerings are subject to change; students should consult an ISE academic advisor or the University Timetable for course offerings each semester.

Graduation Requirements: Each student must complete at least 124 semester credit hours with a minimum overall GPA of 2.00 and a minimum in-major GPA of 2.00. (In-major GPA is determined from ISE and required STAT classes).

~Additional Checksheet Comments:

- ENGE 1414 (4 cr) may be substituted for ENGE 1215 (2 cr) + ENGE 1216 (2 cr).
- MATH 2405H (5 cr) may be substituted for MATH 2114 (3 cr).
- MATH 2405H (5 cr) + MATH 2406H (5 cr) may be substituted for MATH 2114 (3 cr) + MATH 2204 (3 cr) + MATH 2214 (3 cr).
- ENGE 4735 (3 cr) + ENGE 4736 (3 cr) may be substituted for ISE 4005 (3 cr) + ISE 4006 (3 cr). Students will need to meet the prerequisites of ISE 4005-4006 to be eligible to take ENGE 4735-4736. These courses will also count in the in-major GPA.

INDUSTRIAL AND SYSTEMS ENGINEERING ELECTIVE REQUIREMENTS

For students entering under UG catalog 2023-2024

In selecting electives, students should carefully note the following:

- All courses listed under Programming Electives, Engineering Science Electives, ISE Technical Electives, and Technical Electives are 3-credit courses.
- Some courses may not be available to all students due to prerequisite requirements and/or major restrictions.
- Courses with substantial duplication of courses required for the BSISE will not qualify for credit.
- Students pursuing a Minor may need to select specific courses as ISE Technical Electives, Technical Electives, Engineering Science Electives, or Free Electives to satisfy the Minor requirements.
- Technical Elective courses cannot double-count for Engineering Science Elective credit (and vice-versa).

1. Programming Electives (3 credits required). Students must take one of the following:

- CS 1044 Introduction to Programming in C
- CS 1064 Introduction to Programming in Python
- CS 1114 Introduction to Software Design
- ECE 1574 Engineering Problem Solving with C++ *Pre: (ENGE 1024 or ENGE 1215 or ENGE 1414), (MATH 1205 or MATH 1205H or MATH 1225)*

2. Engineering Science Electives (3 credits required)

The purpose of this requirement is for students to broaden their knowledge of engineering science outside of ISE.

- Courses must be selected from the list below (unless prior approval has been obtained from the ISE Undergraduate Program Director).
 - ECE 2054 Applied Electrical Theory *Pre: PHYS 2306. Co: MATH 2214*
 - ECE 3054 Electrical Theory *Pre: PHYS 2305. Co: MATH 2214*
 - ESM 2204 Mechanics of Deformable Bodies *Pre: (2104 or 2114), (MATH 2204 or MATH 2204H)*
 - ESM 2304 Dynamics *Pre: 2104 or 2114, (MATH 2204 or MATH 2204H). Co: MATH 2214*
 - MSE 2034 Elements of Materials Engineering *Pre: CHEM 1035. Co: PHYS 2305*

3. ISE Technical Electives (9 credits required)

The purpose of this requirement is to enable students to develop expertise in a particular area of ISE.

- Courses must be selected from the list below.
- C- restrictions (p. 1) apply to all listed course prerequisites.
- [F] or [S] indicates the term when a course is expected to be offered. Course offerings are subject to change and the availability of sufficient resources: check the Timetable of Classes for actual course offerings each semester.
- A maximum of 6 credits of ISE 4974 or ISE 4994 is allowed without prior approval from the ISE Undergraduate Program Director.
 - ISE 3004 Industrial Cost Control *Pre: 2014 or ME 2024 or ME 3024 [S]*
 - ISE 3204 Manufacturing Processes *Pre: ENGE 1216 or ENGE 1414 [F]*
 - ISE 3434 Deterministic Operations Research II *Pre: 2004, 2404, MATH 2204 [F]*
 - ISE 4004 Theory of Organization *Pre: Senior Standing [F]*
 - ISE 4015 Management Systems Theory, Applications, and Design I [S]
 - ISE 4214 Lean Manufacturing *Pre: 4204 [F]*
 - ISE 4264 Industrial Automation *Pre: 2204 or 2214 or 3204 [S]*
 - ISE 4304 Global Issues in Industrial Management *Pre: Senior Standing [S]*
 - ISE 4414 Industrial Quality Control *Pre: 4404 [S]*
 - ISE 4424 Logistics Engineering *Pre: 3414 [F]*
 - ISE 4434 Supply Chain Engineering *Pre: 2404, 3414 [S]*
 - ISE 4624 Work Physiology *Pre: 3624 [F]*
 - ISE 4644 Risk and Hazard Control *Pre: 3614 [F]*
 - ISE 4654 Principles of Industrial Hygiene [S]
 - ISE 4804 System Dynamics Modeling of Industrial Systems [S]
 - ISE 4974 Independent Study (Hours and credits established by faculty supervising work)
 - ISE 4984 Special Study (Hours and credits established when course is proposed/offered)
 - ISE 4994 Undergraduate Research (Hours and credits established by faculty supervising work)

4. Technical Electives (6 credits required)

The purpose of this requirement is for students to further develop technical skills and to provide the opportunity to focus on a particular technical area by taking electives with significant technical content.

- The courses must be on an A-F basis, unless prior approval (for P/F basis) has been obtained from the ISE Undergraduate Program Director.
- Up to 3 credits can be obtained via ISE Technical Elective courses not being used for ISE Technical Elective credit.
- Courses must be selected as follows:
 - Any 3000 or 4000 level course from AOE, BMES, BSE, CEE, CEM, CHE, CHEM, CMDA, CS, ECE, ESM, MATH, ME, MSE, MINE, NSEG, PHYS, STAT **except for the following**: CEE 4804, CHEM 4014, CS 3604, CS 4214, MATH 4044, MATH 4625-6, MATH 4644, MATH 4664, ME 4454, STAT 3005, STAT 3006, STAT 3604, STAT 3615, STAT 3704, STAT 4105, STAT 4604, STAT 4705, STAT 4714.
 - ENGR 3124 and/or ENGR 4134.
 - Engineering Science Elective courses not used for Engineering Science Elective credit can only be used for Tech Elective credit if they are at the 3000 or 4000 level.
 - Other courses are allowed only with prior approval from the ISE Undergraduate Program Director.

5. Free Electives (3 credits required)

The purpose of this requirement is to enable students to enhance knowledge and skills by providing breadth in areas outside of ISE.

- Students may not use a given course to satisfy both Free Elective and Pathways requirements: any given course can satisfy one requirement only.