APPROVED
COMMISSION ON UNDERGRADUATE STUDIES AND POLICIES

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 GRADUATING IN CALENDAR YEAR 2022 AND FOR STUDENT DATE OF ENTRY UNDER UG CATALOG 2020-2021
CREDITS REQUIRED FOR GRADUATION: 124

FALL SEMESTER FIRST YEAR	Credits	SPRING SEMESTER FIRST YEAR	Credits
CHEM 1035 General Chemistry *Co: MATH 1025 or MATH 1225*	3	ENGL 1106 First-Year Writing *Pre: ENGL 1105*	3
CHEM 1045 General Chemistry Lab *Co: CHEM 1035*	1	MATH 1226 Calculus of a Single Variable *Pre: MATH 1225 (C-)*	4
ENGL 1105 First-Year Writing	3	PHYS 2305 Foundations of Physics1 *Pre: (MATH 1205 or MATH 1205H or MATH 1225) or (MATH 1206 or MATH 1206H or MATH 1226). Co: 2325 or (MATH 1206 or MATH 1206H or MATH 1226)*	4
MATH 1225 Calculus of a Single Variable **(C-)** *Pre: Math Ready*	4		
ENGE 1215 Foundations of Engineering **(C–)**	2	ENGE 1216 Foundations of Engineering **(C–)** *Pre: ENGE 1215*	2
Pathways Core Concept 2, 3, 6a or 7	3	Pathways Core Concept 2, 3, 6a or 7	3
TOTAL	**16**	**TOTAL**	**16**

FALL SEMESTER SECOND YEAR	Credits	SPRING SEMESTER SECOND YEAR	Credits
CS 1044 Introduction to Programming in C **or** CS 1064 Introduction to Programming in Python **or** ECE 1574 Engineering Problem Solving with C++ *Pre: (ENGE 1024 or ENGE 1215 or ENGE 1414), (MATH 1205 or MATH 1205H or MATH 1225)*	3	MATH 2214 Introduction to Differential Equations **(C-)** *Pre: (1114 or 2114 or 2114H or 2405H), 1226*	3
		ESM 2104 Statics *Pre: MATH 1226; Co: MATH 2204 or MATH 2204H or MATH 2224 or MATH 2406H*	3
MATH 1114 Elementary Linear Algebra **(C-) or** MATH 2114 Introduction to Linear Algebra **(C-)** *Pre: MATH 1225 (B) or MATH 1226*	2-3	ISE 2024 Probability Foundations for Industrial and Systems Engineers[1] **(C-)** *Pre: MATH 2204 or MATH 2204H*	3[S, SI]
MATH 2204 Intro Multivariable Calculus **(C-)** *Pre: MATH 1226*	3	ISE 2034 Data Management for Industrial and Systems Engineers[1] **(C-)** *Pre: CS 1044 or CS 1064 or ECE 1574*	3[S, SII]
PHYS 2306 Foundations of Physics I w/lab *(Pre: MATH 1206 or MATH 1206H or MATH 1226), PHYS 2305*	4	ISE 2404 Deterministic Operations Research I[1] **(C-)** *Pre: MATH 1114 or 2114*	3[S, SII]
ISE 2004 Introduction to Industrial and Systems Engineering[1] **(C-)**	1[F, S, SI]	ISE 3614 Human Factors Engineering and Ergonomics[1] **(C-)** *Pre: 2004; Co: 2024*	3[F, S]
ISE 2014 Engineering Economy[1] **(C-)**	2[F, S, SI, SII]		
ISE 2214 Manufacturing Processes Laboratory[1] **(C-)**	1[F, S, SI]		
TOTAL	**16-17**	**TOTAL**	**18**

FALL SEMESTER THIRD YEAR	Credits	SPRING SEMESTER THIRD YEAR	Credits
STAT 4706 Probability and Statistics for Engineers **(C-)** *Pre: 4705 or 4105*	3[F,SII]	Engineering Science Elective	3
ISE 3214 Facilities Planning And Logistics[1] **(C-)** *Pre: 2014, 2404; Co: 3414*	3[F,SI]	ISE 3424 Discrete-Event Computer Simulation[1] **(C-)** *Pre: 3414, STAT 4105*	3[S, SII]
ISE 3414 Probabilistic Operations Research[1] **(C-)** *Pre: 2004, STAT 4105, (MATH 2204 or 2204H or 2406H), (MATH 2214 or 2214H), (CS 1044 or CS 1064)*	3[F, SI]	ISE 3624 Industrial Ergonomics[1] **(C-)** *Pre: 3614, ESM 2104*	3[S, SII]
ISE 3034 Technical Communication for Engineers **(C-)** *Pre: ENGL 1106*	3[F, S]	ISE 4204 Production Planning and Inventory Control[1] **(C-)** *Pre: 2404, 3414, STAT 4706*	3[S, SII]
ISE Technical, Technical, or Pathways (Core Concept 2, 3, 6a or 7) Elective (select each only ONCE)	3	ISE Technical, Technical, or Pathways (Core Concept 2, 3, 6a or 7) Elective (select each only ONCE)	3
TOTAL	**15**	**TOTAL**	**15**

FALL SEMESTER FOURTH YEAR	Credits	SPRING SEMESTER FOURTH YEAR	Credits
ISE 4005 Project Management and System Design[1] **(C-)** *Pre: 2034, 2214, 3034, 3214, 3424, 3624, 4204; Co: 4404*	2[F]	ISE 4006 Project Management and System Design[1] *Pre: 4005*	2[S]
ISE 4404 Statistical Quality Control[1] *Pre: 3414, STAT 4105, STAT 4706*	3[F]	Technical Elective	3
ISE Technical Elective	3	ISE Technical Elective	3
ISE Technical, Technical, or Pathways (Core Concept 2, 3, 6a or 7) Elective (select each only ONCE)	3	Free Elective	2-3
Pathways Core Concept 2, 3, 6a or 7	3	Pathways Core Concept 2, 3, 6a or 7	3
TOTAL	**14**	**TOTAL**	**13-14**

General Information about Checksheet: Superscripted annotation after the course number (1) indicates core course of the degree. Additionally, [F, S, SI, SII] 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/table.html. Pathways courses need to be completed prior to graduation.

Pathway 1: Discourse (6 hrs foundational, 3 hrs advanced)	*Foundational:* **ENGL 1105**	**(3)**	*Foundational:* **ENGL 1106**	**(3)**
	Advanced: **ISE 3034** Technical Communication for Engineers			**(3)**
Pathway 2: Critical Thinking in the Humanities (6 hrs)		**(3)**		**(3)**
Pathway 3: Reasoning in the Social Sciences (6 hrs)		**(3)**		**(3)**
Pathway 4: Reasoning in the Natural Sciences (8 hrs)	**CHEM 1035 + CHEM 1045**	**(4)**	**PHYS 2305**	**(4)**
Pathway 5: Quantitative and Computational Thinking (11 hrs)	*Foundational:* **MATH 1225**	**(4)**	*Foundational:* **MATH 1226**	**(4)**
	Advanced: **MATH 2214**			**(3)**
Pathway 6: Critique and Practice in Design and the Arts (7 hrs)	*Arts (6a):*			**(3)**
	Design: **ENGE 1215 + ENGE 1216**			**(4)**
Pathway 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:

- 9 credits of **ISE Technical Electives** from a list,
- 6 credits of **Technical Electives**,
- 3 credits of **Engineering Science Electives** from a list, and
- 2-3 credits of **Free Electives** (2 credits required if MATH 2114 is taken, 3 credits required if MATH 1114 taken).

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: http://www.enge.vt.edu/undergraduate-changing-majors.html

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).

INDUSTRIAL AND SYSTEMS ENGINEERING ELECTIVE REQUIREMENTS
For students graduating in calendar year 2022 and for student date of entry under UG catalog 2020-21

In selecting electives, students should carefully note that:

- All courses listed under 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.

ISE Technical Electives (9 credits required)

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

- Courses must be selected from the list below ([F] or [S] indicates term when a course is expected to be offered).
- A maximum of 6 credits of ISE 4974 or ISE 4994 is allowed without prior approval from the ISE Undergraduate Program Director.

ISE 2204 Manufacturing Processes (Pre: ENGE 1104 or ENGE 1114 or ENGE 1216 or ENGE 1414) [F]
ISE 3004 Industrial Cost Control (Pre: ISE 2014 or ME 2024) [S]
ISE 3434 Deterministic Operations Research II (Pre: ISE 2004, 2404, (MATH 2204 or 2224)) [F]
ISE 4004 Theory of Organization [F]
ISE 4015 Management Systems Theory, Applications, and Design I [F]
ISE 4214 Lean Manufacturing (Pre: ISE 4204) [F]
ISE 4264 Industrial Automation (Requires Laboratory Work) (Pre: ISE 2204 or 2214) [S]
ISE 4304 Global Issues in Industrial Management [S]
ISE 4414 Industrial Quality Control (Pre: ISE 4404) [S]
ISE 4424 Logistics Engineering (Pre: ISE 3414) [F]
ISE 4434 Supply Chain Engineering (Pre: ISE 2404, 3414) [S]
ISE 4624 Work Physiology (Pre: ISE 3624) [S]
ISE 4644 Occupational Safety and Hazard Control (Pre: ISE 3614) [F]
ISE 4654 Principles of Industrial Hygiene [S]
ISE 4804 System Dynamics Modeling of Industrial Systems [F]
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)

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, MINE 4524, MINE 4554, STAT 3005, STAT 3006, STAT 3604, STAT 3615, STAT 3704, STAT 4604, STAT 4705, STAT 4714.
  - ENGR 3124 and ENGR 4134.
  - Other courses are allowed only with prior approval from the ISE Undergraduate Program Director.

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 3054 Electrical Theory (Pre: PHYS 2305. Co: MATH 2214)
ESM 2204 Mechanics of Deformable Bodies (Pre: (2104 or 2114), (MATH 2224 or MATH 2224H or MATH 2204 or MATH 2204H))
ESM 2304 Dynamics (Pre: 2104 or 2114, (MATH 2224 or MATH 2224H or MATH 2204 or MATH 2204H). Co: MATH 2214)
MSE 2034 Elements of Materials Engineering (Pre: CHEM 1035. Co: PHYS 2305)

Free Electives (2 credits required if MATH 2114 is taken, 3 credits required if MATH 1114 taken)

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.