

COLLEGE OF ENGINEERING  
DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING  
**BACHELOR OF SCIENCE IN INDUSTRIAL AND SYSTEMS ENGINEERING**  
FOR STUDENTS GRADUATING IN CALENDAR YEAR 2021  
124 CREDITS REQUIRED FOR GRADUATION

**APPROVED**  
**COMMISSION ON UNDERGRADUATE**  
**STUDIES AND POLICIES**

| FRESHMAN FALL SEMESTER 2017   |  | Credits                          | FRESHMAN SPRING SEMESTER 2018   |  | Credits               |
|---|--|----------------------------------|---|--|-----------------------|
| CHEM 1035 General Chemistry   |  | 3                                | ENGL 1106 First-Year Writing<br><i>Pre: ENGL 1105</i>   |  | 3                     |
| CHEM 1045 General Chemistry Lab<br><i>Co: CHEM 1035</i>   |  | 1                                | MATH 1226 Calculus of a Single Variable<br><i>Pre: MATH 1225 (minimum grade of C-)</i>                      |  | 4                     |
| ENGL 1105 First-Year Writing  |  | 3                                | PHYS 2305 Foundations of Physics<br><i>Pre: MATH 1225 or MATH 1226</i>                                      |  | 4                     |
| MATH 1225 Calculus of a Single Variable (C-)<br><i>Pre: Math Ready</i>  |  | 4                                | ENGE 1216 Foundations of Engineering (C-)<br><i>Pre: ENGE 1215</i>  |  | 2                     |
| ENGE 1215 Foundations of Engineering (C-)   |  | 2                                | CLE (Area 2, 3, or 7)   |  | 3                     |
| CLE (Area 2, 3, or 7)   |  | 3                                |   |  |                       |
| <b>TOTAL</b>  |  | <b>16</b>                        | <b>TOTAL</b>  |  | <b>16</b>             |
| FALL SEMESTER SOPHOMORE 2018  |  | Credits                          | SPRING SEMESTER SOPHOMORE 2019  |  | Credits               |
| CS 1044 Introduction to Programming in C or<br>CS 1064 Introduction to Programming in Python  |  | 3                                | MATH 2214 Introduction to Differential Equations (C-)<br><i>Pre: (1114 or 1114H or 2114 or 2114H), 1226</i> |  | 3                     |
| MATH 1114 Elementary Linear Algebra (C-) or<br>MATH 2114 Introduction to Linear Algebra (C-)<br><i>Pre: MATH 1225 (B) or MATH 1226</i>                      |  | 2-3                              | ESM 2104 Statics<br><i>Co: MATH 2204 or 2204H or 2406H</i>  |  | 3                     |
| MATH 2204 Intro Multivariable Calculus (C-)<br><i>Pre: MATH 1226</i>  |  | 3                                | STAT 4105 Theoretical Statistics (C-)<br><i>Pre: MATH 2204 or MATH 2204H or MATH 2406H or CMDA 2005</i>     |  | 3 <sup>[S, SI]</sup>  |
| PHYS 2306 Foundations of Physics I w/lab<br><i>Pre: MATH 1226, PHYS 2305</i>  |  | 4                                | ISE 2034 Data Management for Industrial and Systems<br>Engineers (C-)<br><i>Pre: CS 1044 or CS 1064</i>     |  | 3 <sup>[S]</sup>      |
| ISE 2004 Introduction to Industrial and Systems<br>Engineering (C-)   |  | 2 <sup>[F, SI]</sup>             | ISE 2404 Deterministic Operations Research I (C-)<br><i>Pre: MATH 1114 or 2114</i>                          |  | 3 <sup>[S, SI]</sup>  |
| ISE 2014 Engineering Economy (C-)   |  | 2 <sup>[F, S, SI,<br/>SII]</sup> | ISE 3614 Human Factors Engineering and Ergonomics<br>(C-) <i>Pre: 2004; Co: STAT 4105</i>                   |  | 3 <sup>[S, SI]</sup>  |
| ISE 2214 Manufacturing Processes Laboratory (C-)  |  | 1 <sup>[F, S, SI]</sup>          |   |  |                       |
| <b>TOTAL</b>  |  | <b>17-18</b>                     | <b>TOTAL</b>  |  | <b>18</b>             |
| FALL SEMESTER JUNIOR 2019   |  | Credits                          | SPRING SEMESTER JUNIOR 2020   |  | Credits               |
| STAT 4706 Statistics for Engr (C-)<br><i>Pre: STAT 4105</i>   |  | 3 <sup>[F, SII]</sup>            | Engineering Science Elective  |  | 3                     |
| ISE 3214 Facilities Planning & Logistics (C-)<br><i>Pre: 2014, 2404; Co: 3414</i>   |  | 3 <sup>[F, SI]</sup>             | ISE 3424 Discrete-Event Computer Simulation (C-)<br><i>Pre: 3414, STAT 4105</i>                             |  | 3 <sup>[S, SII]</sup> |
| ISE 3414 Probabilistic Operations Research (C-)<br><i>Pre: 2004, STAT 4105, (MATH 2204, 2204H or 2406H), (MATH 2214<br/>or 2214H), (CS 1044 or CS 1064)</i> |  | 3 <sup>[F, SI]</sup>             | ISE 3624 Industrial Ergonomics (C-)<br><i>Pre: 3614, ESM 2104</i>   |  | 3 <sup>[S, SII]</sup> |
| ISE Technical, Technical, or CLE (Area 2, 3, or 7) Elective<br>(select each only ONCE)  |  | 3                                | ISE 4204 Production Planning and Inventory Control<br>(C-) <i>Pre: 2404, 3414, STAT 4706</i>                |  | 3 <sup>[S, SII]</sup> |
| CLE (Area 2, 3, or 7)   |  | 3                                | ISE Technical, Technical, or CLE (Area 2, 3, or 7) Elective<br>(select each only ONCE)                      |  | 3                     |
| <b>TOTAL</b>  |  | <b>15</b>                        | <b>TOTAL</b>  |  | <b>15</b>             |
| FALL SEMESTER SENIOR 2020   |  | Credits                          | SPRING SEMESTER SENIOR 2021   |  | Credits               |
| ISE 4005 Project Management and System Design (C-)<br><i>Pre: 2034, 2214, 3214, 3424, 3624, 4204; Co: 4404</i>  |  | 3 <sup>[F]</sup>                 | ISE 4006 Project Management and System Design<br><i>Pre: 4005</i>   |  | 2 <sup>[S]</sup>      |
| ISE 4404 Statistical Quality Control<br><i>Pre: 3414, STAT 4706</i>   |  | 3 <sup>[F]</sup>                 | Technical Elective  |  | 3                     |
| ISE Technical Elective  |  | 3                                | ISE Technical Elective  |  | 3                     |
| ISE Technical, Technical, or CLE (Area 2, 3, or 7) Elective<br>(select each only ONCE)  |  | 3                                | Free Elective   |  | 2-3                   |
| CLE (Area 6)  |  | 1                                | CLE (Area 2, 3, or 7)   |  | 3                     |
| <b>TOTAL</b>  |  | <b>13</b>                        | <b>TOTAL</b>  |  | <b>13-14</b>          |

**General Information about Checksheet:** Superscripted annotation [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.

**Curriculum for Liberal Education (CLE)**

Consult the CLE Alphabetical Listing at: <http://www.cle.prov.vt.edu/guides/alpha.html>. CLE courses need to be completed prior to graduation.

|  |                  |            |                  |            |
|--|------------------|------------|------------------|------------|
| CLE Area 1: Writing and Discourse (6 hrs)                        | <b>ENGL 1105</b> | <b>(3)</b> | <b>ENGL 1106</b> | <b>(3)</b> |
| CLE Area 2: Ideas, Cultural Traditions, Values Electives (6 hrs) |                  | <b>(3)</b> |                  | <b>(3)</b> |
| CLE Area 3: Society & Human Behavior electives (6 hrs)           |                  | <b>(3)</b> |                  | <b>(3)</b> |
| CLE Area 4: Scientific Reasoning and Discovery (8 hrs)           | <b>PHYS 2305</b> | <b>(4)</b> | <b>PHYS 2306</b> | <b>(4)</b> |
| CLE Area 5: Quantitative and Symbolic Reasoning (8 hrs)          | <b>MATH 1225</b> | <b>(4)</b> | <b>MATH 1226</b> | <b>(4)</b> |
| CLE Area 6: Creativity & Aesthetic Experience elective (1 hr)    |                  |            |                  | <b>(1)</b> |
| CLE Area 7: Global Issues Elective (3 hrs) <sup>1</sup>          |                  |            |                  | <b>(3)</b> |

If a CLE course is double-counted to satisfy an Area 2 or an Area 3 requirement and the Area 7 requirement, additional credits must be taken to maintain the required minimum of 124 credits.

<sup>1</sup>A total of 6 credit hours of Area 2 and 6 credit hours of Area 3 courses must be completed. Only selected courses can simultaneously satisfy both Area 2/3 & 7 requirements (use extra care when selecting this course).

**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 or Area 6 courses that are offered only on a P/F basis (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, 2014.

**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 2021

**APPROVED**  
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In selecting electives, students should carefully note that:

- 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 1114 or 1216 or 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 & Op Eng (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 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              |
| ESM 2204 | Mechanics of Deformable Bodies |
| ESM 2304 | Dynamics                       |

## 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 CLE requirements: any given course can satisfy one requirement only.