PART I – NEW ACADEMIC PROGRAMS AND PROGRAM CHANGES

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

1. Request to delete the curriculum and degree requirements for the Minor in Forestry Field Applications in the Department of Forestry. The University Committee on Undergraduate Education (UCUE) will provide consultative commentary to the Provost after considering this request. The Provost will make a determination after considering the consultative commentary from the University Committee on Graduate Studies.

No new students are to be admitted to the program effective Fall 2023. No students are to be readmitted to the program effective Fall 2023. Effective Fall 2024, coding for the program will be discontinued and the program will no longer be available in the Department of Forestry. Students who have not met the requirements for the Minor in Forestry Field Applications through the Department of Forestry prior to Fall 2024 will have to change their minor.

2. Delete the curriculum and degree requirements for the Agricultural Technology Certificate in Horse Management in the Institute of Agricultural Technology. The University Committee on Undergraduate Education (UCUE) provided consultative commentary to the Provost after considering this request at its April 6, 2023 meeting. The Provost will make the determination to discontinue the program after considering the consultative commentary from the University Committee on Undergraduate Education.

No new students are to be admitted to the program effective Spring 2023. No students are to be readmitted to the program effective Spring 2023. Effective Fall 2023, coding for the program will be discontinued and the program will no longer be available in the Institute of Agricultural Technology. Students who have not met the requirements for the Agricultural Technology Certificate in Horse Management through the Institute of Agricultural Technology prior to Fall 2023 will have to change their certificate.

3. Request to change the requirements for the Agricultural Technology Certificate in Livestock Industries in the Institute of Agricultural Technology.

   a. Under the heading Requirements for Livestock Industries make the following changes:

   (1) Add the following:

      Students must complete 48 credits from the following:

   (2) In item 1., delete the following courses:

      ABM 130      Farm Management I     3
      ANS 110 Introductory Animal Agriculture    4

      Add the following courses:

      AFRE 130      Farm Management I     3
      ANS 110 Introductory Animal Agriculture     3
      ANS 110L Introductory Animal Agriculture Laboratory     1

   (3) In item 3., delete the following course:

      ANS 232 Introductory Dairy Cattle Management    3

      Add the following course:

      ANS 134 Dairy Production I     3

   (4) In item 4., change the credits required from ‘12’ to ‘12 or 13’.

   (5) Delete the following notes:
Students who do not demonstrate English proficiency through the IAT-administered Accuplacer placement test or college-level transfer credit must complete AT 045 Agricultural Communications (2 credits) or an equivalent course as approved by the program coordinator.

Students who do not demonstrate math proficiency through the IAT-administered Accuplacer placement test or college-level transfer credit must complete AT 071 Technical Mathematics (2 credits) as approved by the program coordinator.

Effective Summer 2023.

**COLLEGE OF ENGINEERING**

1. Request to change the requirements in the Bachelor of Science degree in Computer Science in the Department of Computer Science and Engineering.

   a. Under the heading Requirements for the Bachelor of Science Degree in Computer Science make the following changes:

      (1) In item 3. b. change the total credits from ‘32’ to ‘35’ and add the following course:

      CSE 425 Introduction to Computer Security 3

      (2) In item 3. c. delete the following course:

      CSE 425 Introduction to Computer Security 3

      Add the following course:

      CSE 434 Autonomous Vehicles 3

      (3) In item 3. d. change the total credits from ‘15’ to ‘12’.

      (4) In item 3. d., replace items (1) and (2) with the following:

      (1) A minimum of four courses totaling 12 or more credits. At least 6 of the 12 credits must be in courses at the 300-400 level.

      (2) Cognate in The Eli Broad College of Business consisting of this specific set of courses: ACC 230, FI 320, GBL 323 and MKT 327.

      (3) A sequence of at least three courses in a foreign language totaling at least 12 credits.

Effective Fall 2023.

2. Request to change the requirements in the Bachelor of Science degree in Civil Engineering in the Department of Civil and Environmental Engineering.

   a. Under the heading Requirements for the Bachelor of Science Degree in Civil Engineering make the following changes:

      (1) In item 3. e. Pavements delete the following course:

      CE 431 Pavement Design and Analysis 3

      Add the following course:

      CE 431 Design and Analysis for New and Rehabilitated Pavements 4

Effective Fall 2023.
1. Request to establish a **Dual Major** in **Environmental and Integrative Toxicological Sciences** in the College of Natural Science. The University Committee on Graduate Studies (UCGS) recommended approval of this request at its February 20, 2023 meeting.

   a. **Background Information:**

   Environmental and Integrative Toxicological Sciences (EITS) is a dual major program in which students must first be admitted to one of our partnering Ph.D. units. It is currently overseen by The Graduate School in conjunction with the Institute for Integrative Toxicology and will transition to the College of Natural Science Dean's office. At this time, these students are tracked via the programmatic code of this basic science department. Students from these programs, who meet certain requirements, could then join the EITS late in the first year or early in the second year of their program. Upon joining the EITS dual major program, students would then receive a new programmatic code that signifies their dual major status. This code raised several difficulties at the university, college, and program levels. The EITS would like to transition to a dual programmatic code system, similar to ESPP and EEBB. Under this new dual-code system, the student would retain their basic science code and, upon joining the EITS, receive an additional code to signify their acceptance into the dual major program. One result of this change is the EITS dual major code would become available to all Ph.D. candidates on campus. Given the EITS requirements, only qualified students are admitted. The EITS program currently partners with 17 graduate programs, as well as 5 colleges, providing training in toxicology to graduate student in those programs/colleges. The new dual coding system will expand the EITS reach across campus; however, we do not envision that many, if any, will come from other programs other than the current 17.

   The EITS program has been a successful program in training students to become leaders in the field of toxicology for over the last three decades and has been successful in holding the longest NIEHS training grant at MSU. By moving towards a dual programmatic code system, all parties involved will be able to track students' progress and major codes that have not been used due to the current system (i.e. having a new major code once admitted to EITS) will be removed from system, thus helping with accreditation.

   b. **Academic Programs Catalog Text:**

   **Dual Major**

   The dual major in environmental and integrative toxicological sciences is administered by the College of Natural Science. The dual major is available only to those students who plan to complete a Ph.D. degree program that involves environmental and integrative toxicological sciences and who have a graduate major at Michigan State University. The student does not have the option of completing a dual major in environmental and integrative toxicological sciences alone.

   The purpose of the Dual Major Ph.D. in Environmental and Integrative Toxicological Sciences (EITS) is to provide students with training in a basic science discipline and training and credentials in environmental and integrative toxicological sciences. Students accepted into a science-related Doctor of Philosophy degree programs may apply subsequently for admission to the environmental and integrative toxicological sciences program. Students who complete this multidisciplinary course of study earn the Ph.D. degree in a basic science discipline with a dual major in environmental and toxicological sciences.

   Each program that cooperates with the environmental and integrative toxicological sciences program is represented by training faculty affiliated with Michigan State University's Institute for Integrative Toxicology, through which the Doctoral Program in Environmental and Integrative Toxicological Sciences is administered in conjunction with the College of Natural Science. The program allows students substantial flexibility in choosing areas of study. Each student's course of study is planned with that individual’s particular interests, capabilities, and professional goals in mind. The student must meet the requirements for the partnering disciplinary program and the requirements for the environmental toxicology dual major.

   In partial fulfillment of the environmental toxicology major, the student must complete the biomedical toxicology track, the food toxicology and ingredient safety track, or the environmental toxicology track. Course requirements for the biomedical toxicology track are designed for doctoral students in biomedical disciplines. The food toxicology and ingredient safety track require courses
in toxicology and risk assessment and regulation of food-borne ingredients. Course requirements for the environmental toxicology track are designed for doctoral students in engineering, chemistry and other fields who may have less background in mammalian biology.

When all requirements for the degree have been met, both the chairperson of the department or program that administers the student’s disciplinary major and the director of the Dual Major Ph.D. in Environmental and Integrative Toxicological Sciences program will recommend the student for the degree.

Where course requirements for a disciplinary major and for the environmental toxicology major overlap, a given course may be counted toward both requirements.

In addition to meeting the requirements of the University and of the College of Natural Science, students must meet the requirements specified below.

**Admission**

A student must be accepted for graduate study into a department or program that offers the student the opportunity to meet EITS admissions requirements, such as a science-based discipline, before applying for admission to the Dual Major Ph.D. in Environmental and Integrative Toxicological Sciences. Admission requires the approval of the environmental and integrative toxicological sciences graduate committee and the program director.

The student must:

1. have earned at least a bachelor’s degree;
2. have completed, with a minimum grade–point average of 3.0, sufficient credits in the biological, chemical, and physical sciences to indicate probable success in the program.
3. have a dissertation project related to toxicology.
4. have at least two guidance committee members affiliated with the Institute for Integrative Toxicology.

In special cases, an applicant with deficiencies in background courses may be admitted on a provisional basis. Students admitted on a provisional basis will not be considered for an advanced degree until they have fulfilled the provisional requirements. Course work required to remedy deficiencies will not count towards the dual major degree.

**Guidance Committee**

At least two members of the student’s guidance committee must be faculty affiliated with the Institute for Integrative Toxicology. At least one member of the committee must be from a department or disciplinary program other than the one that administers the student’s disciplinary major.

**Requirements for the Dual Major Ph.D. Degree in Environmental in Environmental and Integrative Toxicological Sciences**

1. The topic of the doctoral dissertation research must be in the broad area of environmental and integrative toxicological sciences and be acceptable to the environmental and integrative toxicological sciences faculty.
2. The student must complete the requirements for one of the three tracks with a grade–point average of at least 3.0.
3. The student must attend and participate in at least 12 EITS approved seminars in toxicological sciences.

Effective Fall 2023.
2. Request to establish a Bachelor of Science degree in Integrated Science-Secondary Education in the College of Natural Science. The University Committee on Undergraduate Education (UCUE) recommended approval of this request at its February 16, 2023 meeting. The Teacher Education Council (TEC) recommended approval of this request at its March 13, 2023 meeting.

The concentrations in the Bachelor of Science degree in Integrated Science-Secondary Education are noted on the student's academic record when the requirements for the degree have been completed.

a. **Background Information**:

A new undergraduate degree program is required to meet the new Standards for the Preparation of High School (7-12) Science Teachers approved by the Michigan Department of Education in February 2022 ([https://www.michigan.gov/mde/-/media/Project/Websites/mde/educator_services/prep/standards/HS_Science_Teacher_Preparation_Standards.pdf?rev=cc6a0c7226b94c78a81b47fff2f69122&hash=398961EB0190C07472D28B34664A7232](https://www.michigan.gov/mde/-/media/Project/Websites/mde/educator_services/prep/standards/HS_Science_Teacher_Preparation_Standards.pdf?rev=cc6a0c7226b94c78a81b47fff2f69122&hash=398961EB0190C07472D28B34664A7232)).

Going forward, all candidates seeking certification to teach science at the secondary level in Michigan must complete a degree program aligned with the new standards, which will prepare them to teach life science (biology), chemistry, earth and space science, and physics. The Integrated Science-Secondary Education degree program will replace the four existing science subject matter teaching majors for secondary teaching certification: Biological Science-Secondary Education, Chemistry, Physical Science-Secondary Education, and Physics.

Public education in the State of Michigan and across the country is facing a significant shortage of qualified science teachers. Through collaboration, MSU's College of Natural Science and the College of Education Teacher Preparation Program have a strong history of training highly qualified science teachers. This new program was developed in response to two significant policy changes to allow MSU to continue training high school science teachers. In February 2022, the Michigan Department of Education approved new standards for secondary science teachers (grades 7-12) that require all new science teachers to have the disciplinary content knowledge to teach subjects across the natural sciences (life science, chemistry, earth and space science, and physics). None of NatSci's existing teaching majors are fully aligned with the new standards. At the same time, MSU's Teacher Preparation Program made the decision to shorten the program length from five years to four years to reduce the costs associated with preparing to become a teacher and to get new teachers into the classroom sooner. This new program will allow MSU to continue its success in preparing highly qualified high school science teachers.

Development of strong science content knowledge is essential to preparing teacher candidates to teach science at the secondary level. Students in this degree program will build disciplinary science content knowledge in courses offered by units in the College of Natural Science. The College of Natural Science will administer and provide academic advising to support the Integrated Science-Secondary Education major. The Dean's Office currently provides oversight for the existing interdisciplinary science teaching majors (Biological Science-Secondary Education and Physical Science-Secondary Education), which will be replaced by the new major.

The educational objective of this program is to support future science teachers in 1) building foundational science content knowledge and 2) developing the elements of effective teaching practice so that they can become highly effective high school science teachers who equitably serve diverse student populations.

Preparing the next generation of high school science teachers is a priority for the College of Natural Science and the College of Education. The two colleges are committed to collaborating in this effort. Increasing the number of well-qualified high school science teachers is critical to preparing Michigan’s students for higher education and other post-secondary training to meet Michigan’s workforce needs.

b. **Academic Programs Catalog Text**:

The Bachelor of Science Degree in Integrated Science-Secondary Education is designed for persons who want a broad background in biology, chemistry, earth and space science, and physics and to understand the interrelationships between these disciplines. This major is designed primarily for persons who plan to teach science (life science, chemistry, earth and space science, or physics) in secondary schools.
### Requirements for the Bachelor of Science Degree in Integrated Science-Secondary Education

**Credits**

1. The University requirements for bachelor's degrees as described in the Undergraduate Education section of this catalog; 120 credits, including general elective credits, are required for the Bachelor of Science degree in Integrated Science-Secondary Education.

   The University's Tier II writing requirement for the Integrated Science-Secondary Education major is met by completing Integrated Science Education 401. That course is referenced in item 3. below.

   Students who are enrolled in the College of Natural Science may complete the alternative track to Integrative Studies in Biological and Physical Sciences that is described in item 1. under the heading Graduation Requirements in the College statement. Certain courses referenced in requirement 3. below may be used to satisfy the alternative track.

   Students may substitute Teacher Education 101 and 102 for two ISS requirements.

   Students may substitute Teacher Education 341 for the first-level IAH requirement (courses numbered 201 through 210). Those courses are referenced in item 3. below.

2. The requirements of the College of Natural Science for the Bachelor of Science degree.

   The credits earned in certain courses referenced in requirement 3. below may be counted toward College requirements as appropriate.

3. The following requirements for the major:

   a. One of the following groups of courses (9 or 10 credits):

<table>
<thead>
<tr>
<th>Group</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BS 161</td>
<td>Cell and Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BS 162</td>
<td>Organismal and Population Biology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BS 171</td>
<td>Cell and Molecular Biology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>BS 172</td>
<td>Organismal and Population Biology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BS 181H</td>
<td>Honors Cell and Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BS 182H</td>
<td>Honors Organismal and Population Biology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BS 191H</td>
<td>Honors Cell and Molecular Biology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>BS 192H</td>
<td>Honors Organismal and Population Biology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>LB 144</td>
<td>Biology I: Organismal Biology</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>LB 145</td>
<td>Biology II: Cellular and Molecular Biology</td>
<td>5</td>
</tr>
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</table>

   b. One of the following groups of courses (9 or 10 credits):

<table>
<thead>
<tr>
<th>Group</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CEM 141</td>
<td>General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>CEM 142</td>
<td>General and Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CEM 161</td>
<td>Chemistry Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CEM 162</td>
<td>Chemistry Laboratory II</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>CEM 151</td>
<td>General and Descriptive Chemistry</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>CEM 152</td>
<td>Principles of Chemistry</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CEM 161</td>
<td>Chemistry Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CEM 162</td>
<td>Chemistry Laboratory II</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>CEM 181H</td>
<td>Honors Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>CEM 182H</td>
<td>Honors Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>CEM 185H</td>
<td>Honors Chemistry Laboratory I</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>LB 171</td>
<td>Principles of Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>LB 171L</td>
<td>Introductory Chemistry Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>LB 172</td>
<td>Principles of Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>LB 172L</td>
<td>Principles of Chemistry II-Reactivity Laboratory</td>
<td>1</td>
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</table>

   c. One of the following groups of courses (8 or 10 credits):

<table>
<thead>
<tr>
<th>Group</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PHY 173</td>
<td>Studio Physics for Scientists and Engineers I</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>PHY 174</td>
<td>Studio Physics for Scientists and Engineers II</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>PHY 183</td>
<td>Physics for Scientists and Engineers I</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PHY 184</td>
<td>Physics for Scientists and Engineers II</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PHY 191</td>
<td>Physics Laboratory for Scientists, I</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>PHY 192</td>
<td>Physics Laboratory for Scientists, II</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>PHY 221</td>
<td>Studio Physics for Life Scientists I</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PHY 222</td>
<td>Studio Physics for Life Scientists II</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>PHY 231</td>
<td>Introductory Physics I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PHY 232</td>
<td>Introductory Physics II</td>
<td>3</td>
</tr>
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</table>
d. All of the following courses (14 credits):

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBIO 355</td>
<td>Ecology</td>
<td>3</td>
</tr>
<tr>
<td>ISE 322</td>
<td>Foundational Earth Systems for Secondary Science Education</td>
<td>4</td>
</tr>
<tr>
<td>ISE 401</td>
<td>Science Laboratories for Secondary Schools (W)</td>
<td>4</td>
</tr>
<tr>
<td>ISE 420</td>
<td>Integrated Science Research</td>
<td>3</td>
</tr>
</tbody>
</table>

e. The following Professional Education Courses in the College of Education (36 credits):

1. All of the following courses from the shared professional sequence (18 credits):

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEP 240</td>
<td>Diverse Learners in Multicultural Perspective</td>
<td>3</td>
</tr>
<tr>
<td>TE 101</td>
<td>Social Foundations of Justice and Equity in Education</td>
<td>3</td>
</tr>
<tr>
<td>TE 102</td>
<td>Pedagogy and Politics of Justice and Equity in Education</td>
<td>3</td>
</tr>
<tr>
<td>TE 150</td>
<td>Reflections on Learning</td>
<td>3</td>
</tr>
<tr>
<td>TE 302</td>
<td>Literacy and Adolescent Learners in School and Community Contexts</td>
<td>3</td>
</tr>
<tr>
<td>TE 341</td>
<td>Teaching and Learning of (Bilingual) Learners</td>
<td>3</td>
</tr>
</tbody>
</table>

2. All of the following courses from the subject-specific professional sequence (18 credits):

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE 321</td>
<td>Clinical Experience in Science Education I</td>
<td>3</td>
</tr>
<tr>
<td>TE 421</td>
<td>Clinical Experience in Science Education II</td>
<td>3</td>
</tr>
<tr>
<td>TE 422</td>
<td>Seminar in Science Education I</td>
<td>3</td>
</tr>
<tr>
<td>TE 423</td>
<td>Seminar in Science Education II</td>
<td>3</td>
</tr>
<tr>
<td>TE 424</td>
<td>Student Teaching Internship in Science Education</td>
<td>6</td>
</tr>
</tbody>
</table>

f. One of the following concentrations:

**Biology**

1. One course from group (a) and one course from group (b) (6 to 8 credits):

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH 124</td>
<td>Survey of Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>MTH 132</td>
<td>Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>MTH 152H</td>
<td>Honors Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>LB 118</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MTH 126</td>
<td>Survey of Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>MTH 133</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MTH 153H</td>
<td>Honors Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>LB 119</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>STT 201</td>
<td>Statistical Methods</td>
<td>4</td>
</tr>
<tr>
<td>STT 231</td>
<td>Statistics for Scientists</td>
<td>3</td>
</tr>
<tr>
<td>STT 351</td>
<td>Probability and Statistics for Engineering</td>
<td>3</td>
</tr>
<tr>
<td>STT 421</td>
<td>Statistics I</td>
<td>3</td>
</tr>
</tbody>
</table>

2. One of the following groups of courses (3 or 6 credits):

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEM 144</td>
<td>Organic Chemistry and Applications</td>
<td>3</td>
</tr>
<tr>
<td>CEM 251</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CEM 252</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CEM 351</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CEM 352</td>
<td>Organic Chemistry II</td>
<td>3</td>
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</table>

3. All of the following courses (8 credits):

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBIO 341</td>
<td>Fundamental Genetics</td>
<td>4</td>
</tr>
<tr>
<td>IBIO 355L</td>
<td>Ecology Laboratory (W)</td>
<td>1</td>
</tr>
<tr>
<td>IBIO 445</td>
<td>Evolution (W)</td>
<td>3</td>
</tr>
</tbody>
</table>

4. One of the following courses (3 or 4 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB 401</td>
<td>Comprehensive Biochemistry</td>
<td>4</td>
</tr>
<tr>
<td>FW 417</td>
<td>Wetland Ecology and Management</td>
<td>3</td>
</tr>
<tr>
<td>IBIO 408</td>
<td>Histology</td>
<td>4</td>
</tr>
<tr>
<td>IBIO 425</td>
<td>Cells and Development (W)</td>
<td>4</td>
</tr>
<tr>
<td>MMG 301</td>
<td>Introductory Microbiology</td>
<td>3</td>
</tr>
</tbody>
</table>
NEU 300 Neurobiology 3
PLB 415 Plant Physiology 3
PLB 418 Plant Systematics 3
PLB 441 Plant Ecology 3
PSL 250 Introductory Physiology 4
PSL 310 Physiology for Pre-Health Professionals 4

Chemistry
(1) One course from group (a) and one course from group (b)
(6 to 8 credits):
(a) MTH 132 Calculus I 3
MTH 152H Honors Calculus I 3
LB 118 Calculus I 4
(b) MTH 133 Calculus II 4
MTH 153H Honors Calculus II 3
LB 119 Calculus II 4
(2) One of the following groups of courses (6 credits):
(a) CEM 251 Organic Chemistry I 3
CEM 252 Organic Chemistry II 3
(b) CEM 351 Organic Chemistry I 3
CEM 352 Organic Chemistry II 3
(3) All of the following courses (9 credits):
CEM 255 Organic Chemistry Laboratory 2
CEM 262 Quantitative Analysis 3
CEM 383 Introductory Physical Chemistry I 3
CEM 444 Chemical Safety 1
(4) One of the following courses (3 or 4 credits):
BMB 401 Comprehensive Biochemistry 4
CEM 311 Inorganic Chemistry 3
CEM 384 Introductory Physical Chemistry II 3

Physics
(1) One course from group (a) and one course from group (b)
(6 to 8 credits):
(a) MTH 132 Calculus I 3
MTH 152H Honors Calculus I 3
LB 118 Calculus I 4
(b) MTH 133 Calculus II 4
MTH 153H Honors Calculus II 3
LB 119 Calculus II 4
(2) One of the following groups of courses (3 or 6 credits):
(a) CEM 144 Organic Chemistry and Applications 3
(b) CEM 251 Organic Chemistry I 3
CEM 252 Organic Chemistry II 3
(c) CEM 351 Organic Chemistry I 3
CEM 352 Organic Chemistry II 3
(3) All of the following courses (14 credits):
CMSE 201 Computational Modeling and Data Analysis I 4
MTH 234 Multivariable Calculus 4
MTH 235 Differential Equations 3
PHY 215 Thermodynamics and Modern Physics 3
(4) One of the following courses (3 or 4 credits):
PHY 321 Classical Mechanics I 3
PHY 431 Optics I 3
PHY 440 Electronics 4
PHY 481 Electricity and Magnetism I 3

Earth Science
(1) One course from group (a) and one course from group (b)
(6 to 8 credits):
(a) MTH 124 Survey of Calculus I 3
MTH 132 Calculus I 3
MTH 152H Honors Calculus I 3
LB 118 Calculus I 4
(b) MTH 126 Survey of Calculus II 3
MTH 133 Calculus II 4
MTH 153H Honors Calculus II 3
LB 119 Calculus II 4
### Part I - New Academic Programs and Program Changes – continued

April 18, 2023

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>STT 201</td>
<td>Statistical Methods</td>
<td>4</td>
</tr>
<tr>
<td>STT 231</td>
<td>Statistics for Scientists</td>
<td>3</td>
</tr>
<tr>
<td>STT 351</td>
<td>Probability and Statistics for Engineering</td>
<td>3</td>
</tr>
<tr>
<td>STT 421</td>
<td>Statistics I</td>
<td>3</td>
</tr>
</tbody>
</table>

(2) One of the following groups of courses (3 or 6 credits):

- (a) CEM 144 Organic Chemistry and Applications 3
- (b) CEM 251 Organic Chemistry I 3
- CEM 252 Organic Chemistry II 3
- (c) CEM 351 Organic Chemistry I 3
- CEM 352 Organic Chemistry II 3

(3) The following course (4 credits):

- GLG 201 The Dynamic Earth 4

(4) Two of the following courses (6 to 8 credits):

- GLG 303 Oceanography 3
- GLG 304 Physical and Biological History of the Earth 4
- GLG 321 Mineralogy and Geochemistry 4
- GLG 361 Igneous and Metamorphic Geochemistry and Petrology 4
- GLG 401 Global Tectonics and Earth Structure (W) 4
- GLG 411 Hydrogeology 3
- GLG 412 Glacial Geology and the Record of Climate Change 4
- GLG 421 Environmental Geochemistry 4
- GLG 435 Geomicrobiology 4
- GLG 440 Planetary Geology 3

Effective Fall 2023.

3. Request to establish a **Bachelor of Science** degree in **Mathematics-Secondary Education** in the Department of Mathematics. The University Committee on Undergraduate Education (UCUE) recommended approval of this request at its February 16, 2023 meeting. The Teacher Education Council (TEC) recommended approval of this request at its March 13, 2023 meeting.

   **a. Background Information:**

   Based on an extensive discussion with representatives from the College of Education, and agreement by the Mathematics Undergraduate Studies Committee, this proposal will create a new major, a Bachelor of Science Degree in Mathematics-Secondary Education. The new 6-12 teacher certificate standards ([https://www.michigan.gov/](https://www.michigan.gov/)) in the state of Michigan necessitate the need for the new program along with the university’s desire to have students complete the Bachelor’s degree in 4 years while completing the teacher certification requirements.

   The former pathway, a 4-year bachelor’s and one year of graduate study, will no longer be an option. Based on current requirements of the Bachelor of Science Degree in Mathematics, it is not possible for a student to complete all requirements for the existent Mathematics BS and teacher certification requirements in 4 years. Therefore, the proposed new degree offers the core requirements needed to adequately prepare students pursuing Secondary Education in Mathematics, and providing the option of becoming certified to teach Mathematics at the Secondary level.

   **b. Academic Programs Catalog Text:**

   The Bachelor of Science Degree in Mathematics-Secondary Education adequately prepares students to teach mathematics at the secondary level. Students gain a thorough foundation of mathematics, both in content and practice, and a comprehensive understanding of educational pedagogy and instructional methods.
1. The University requirements for bachelor's degrees as described in the Undergraduate Education section of this catalog: 120 credits, including general elective credits, are required for the Bachelor of Science degree in Mathematics-Secondary Education.

The University's Tier II writing requirement for the Mathematics-Secondary Education major is met by completing Mathematics 309 and 396. Those courses are referenced in item 3. below.

Students may substitute Teacher Education 101 and 102 for two ISS requirements.

Students may substitute Teacher Education 341 for one IAH requirement.

2. The requirements of the College of Natural Science for the Bachelor of Science degree.

The credits earned in certain courses referenced in requirement 3. below may be counted toward College requirements as appropriate.

3. The following requirements for the major:

a. The following courses outside the Department of Mathematics (19 to 23 credits):

(1) One course of at least 3 credits in biological science, entomology, Microbiology, physiology, plant biology, or integrative biology. At least 2 credits in laboratory in biological science, chemistry, microbiology, physics, physiology, plant biology, or integrative biology.

This requirement is met by fulfilling the course requirements in item 3. a. (2) (c) below and 1 additional credit if not taking CEM 185H.

(2) One course from each of the following groups (8 or 10 credits):

(a) CEM 141 General Chemistry 4
CM 151 General and Descriptive Chemistry 4
CM 181H Honors Chemistry I 4
LB 171 Principles of Chemistry I 4

(b) CEM 142 General and Inorganic Chemistry 3
CM 152 Principles of Chemistry 3
CM 182H Honors Chemistry II 4
LB 172 Principles of Chemistry II 3

(c) CEM 161 Chemistry Laboratory I 1
CM 185H Honors Chemistry Laboratory I 2
LB 171L Introductory Chemistry Laboratory I 1

(d) One of the following groups of courses (8 to 10 credits):

(i) PHY 183 Physics for Scientists and Engineers I 4
PHY 184 Physics for Scientists and Engineers II 4

(ii) PHY 193H Honors Physics I – Mechanics 4
PHY 294H Honors Physics II – Electromagnetism 4

(iii) LB 273 Physics I 4
LB 274 Physics II 4

(iv) PHY 173 Physics I 5
PHY 174 Physics II 5

b. The following courses in the Department of Mathematics (33 to 37 credits):

(1) One course from each of the following two groups (7 or 8 credits):

(a) MTH 132 Calculus I 3
MTH 152H Honors Calculus 3
LB 118 Calculus I 4

(b) MTH 133 Calculus II 4
MTH 153H Honors Calculus II 4
LB 119 Calculus II 4

(2) One of the following courses (4 credits):

MTH 234 Multivariable Calculus 4
MTH 254H Honors Multivariable Calculus 4
LB 220 Calculus III 4

(3) One of the following two groups of courses (4 or 7 credits):

(a) MTH 299 Transitions 4
MTH 309 Linear Algebra I 3

(b) MTH 317H Honors Linear Algebra 4
(4) All of the following courses (12 credits):
   MTH 304 Algebra and Calculus for Secondary Education 3
   MTH 305 Discrete and Computational Mathematics for Secondary Education 3
   MTH 330 Higher Geometry 3
   MTH 396 Capstone in Mathematics for Secondary Education (W) 3

(5) One of the following courses (3 credits):
   MTH 310 Abstract Algebra I and Number Theory 3
   MTH 418H Honors Algebra I 3

(6) One of the following courses (3 credits):
   MTH 320 Analysis I 3
   MTH 327H Honors Introduction to Analysis 3

c. The following computational and statistics courses from outside the Department of Mathematics (7 credits):
   (1) One of the following courses (4 credits):
       CMSE 201 Computational Modeling and Data Analysis I 4
       CSE 231 Introduction to Programming I 4
   (2) The following course (3 credits):
       STT 430 Introduction to Probability and Statistics 3

d. The following Professional Education Courses in the Department of Teacher Education (36 credits):
   (1) All of the following courses from the shared professional sequence (18 credits):
       CEP 240 Diverse Learners in Multicultural Perspective 3
       TE 101 Social Foundations of Justice and Equity in Education 3
       TE 102 Pedagogy and Politics of Justice and Equity in Education 3
       TE 150 Reflections on Learning 3
       TE 302 Literacy and Adolescent Learners in School and Community Contexts 3
       TE 341 Teaching and Learning of (Bi)Multilingual Learners 3
   (2) All of the following courses from the subject-specific professional sequence (18 credits):
       TE 314 Clinical Experiences in Mathematics Education I 3
       TE 414 Clinical Experiences in Mathematics Education II 3
       TE 415 Seminar in Mathematics Education I 3
       TE 416 Seminar in Mathematics Education II 3
       TE 417 Student Teaching Internship in Mathematics Education 6

Effective Fall 2023.
4. Request to change the requirements for the Bachelor of Science degree in Actuarial Science in the Department of Mathematics. The University Committee on Undergraduate Education (UCUE) will consider this request at its April 6, 2023 meeting.

   a. Delete the section Admission.

   b. Under the heading Requirements for the Bachelor of Science Degree in Actuarial Science make the following changes:

      (1) Add the following new item 3. l.:

      One of the following courses (4 credits):
      CSE 231  Introduction to Programming I    4
      CMSE 201  Computational Modeling and Data Analysis I    4
      STT 180  Introduction to Data Science    4

      (2) In item 3. k., delete the following course:

      CSE 231  Introduction to Programming I    4

   Effective Fall 2023.

5. Request to change the requirements in the Master of Science degree in Microbiology and Molecular Genetics in the Department of Microbiology and Molecular Genetics. The University Committee on Graduate Studies (UCGS) will consider this request at its April 17, 2023 meeting.

   a. Under the heading Admission delete the phrase:

      "and grades of 3.0 or above in science and mathematics courses'.

   b. Under the heading Requirements for the Master of Science Degree in Microbiology and Molecular Genetics replace the entire entry with the following:

      The student must complete 30 credits under Plan A (with thesis) or Plan B (without thesis). The student’s program of study must be approved by the student’s guidance committee.

      Requirements for Both Plan A and Plan B

      1. Complete the following course (1 credit):
         MMG 892  Seminar      1

      2. Complete the following course (1 to 3 credits):
         MMG 991  Topics in Microbiology    1 to 3

      3. Complete four courses at the 800-level, excluding topics and seminar courses, covering areas of genetics, microbiology, and biochemistry. At least two of these courses must be offered by the Department of Microbiology and Molecular Genetics.

      Students may select from the following courses:
      BMB 801  Molecular Biology     3
      BMB 802  Metabolic Regulation and Signal Transduction     3
      BMB 803  Protein Structure and Function     2
      BMB 805  Protein Structure, Design, and Mechanism     3
      MMG 801  Integrative Microbial Biology     4
      MMG 803  Topics in Integrative Microbial Biology     2
      MMG 813  Molecular Virology     3
      MMG 825  Cell Structure and Function     3
      MMG 833  Microbial Genetics     3
      MMG 835  Eukaryotic Molecular Genetics     3
      MMG 852  Molecular Immunology     1
      MMG 853  Cellular Immunology     1
      MMG 854  Applied Immunology     1
      MMG 861  Advanced Microbial Pathogenesis     3
      MMG 991  Topics in Microbiology     1 to 3
Other courses may be used if approved by the Director of Graduate Studies.

4. Present and pass an oral examination in defense of the master's degree that covers both course work and thesis, research, or project.

**Additional Requirements for Plan A**

1. Complete a minimum of 5 credits of MMG 899 Master's Thesis Research.
2. Successfully complete the oral examination in defense of thesis.

**Additional Requirements for Plan B**

1. Complete a minimum of 7 credits of MMG 890 Special Problems in Microbiology.
2. Preparation and presentation of the final research report.

Effective Fall 2023.

**COLLEGE OF VETERINARY MEDICINE**

1. Request to change the requirements for the Minor in Pharmacology and Toxicology in the Department of Pharmacology and Toxicology.

   a. Under the heading **Requirements for the Minor in Pharmacology and Toxicology** make the following changes:

      (1) Change the total credits from '18' to '15'.

      (2) Delete item 3.

      (3) Change item 4. to item 3. and add the following courses:

      - PHM 211 Pharmacology and Toxicology in Society 2
      - PHM 454 Leadership and Teams for Scientists and Health Professionals 3
      - STT 231 Statistics for Scientists 3

Effective Fall 2023.
PART II - NEW COURSES AND CHANGES

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

FW 293  Undergraduate Seminar in Fisheries and Wildlife
Fall of every year. Spring of every year. 1(0-2) P: FW 101 or concurrently R: Open to undergraduate students in the Fisheries and Wildlife major or in the Lyman Briggs Fisheries and Wildlife Coordinate major. R: Open to undergraduate students in the Department of Fisheries and Wildlife.
Professional development and discussion of current case studies to prepare students for a career in Fisheries and Wildlife.
Effective Fall Semester 2014 Effective Spring Semester 2024

FW 434
FW 334  Human Dimensions of Fisheries and Wildlife Management  (W)
Human Dimensions of Fisheries and Wildlife Management
Fall of every year. 3(2-2) P: (IBIO 355) and completion of Tier I writing requirement P: (BS 162) and completion of Tier I writing requirement RB: IBIO 355 R: Open to juniors or seniors or approval of department. R: Not open to freshmen or approval of department.
Sociological implications of public policy and planning processes in fisheries and wildlife management. Principles and application of social science in fisheries and wildlife conservation and management.
SA: FW 434
Effective Fall Semester 2016 Effective Spring Semester 2024

FW 445  Biodiversity Conservation Policy and Practice
Spring of every year. Spring of every year. 3(3-0) Interdepartmental with James Madison College. P: Completion of Tier I Writing Requirement RB: ((EC 201 or concurrently) or (EC 202 or concurrently) or (EC 251H or concurrently) or (EC 252H or concurrently)) and an interest in Conservation Biology
Social, economic, and policy considerations. Approaches to conserve biodiversity.
Effective Fall Semester 2014 Effective Spring Semester 2024

FSC 481  Fermented Beverages
Fall of every year. 3(2-2) 3(3-0) R: Open to juniors. Approval of department.
Origin and history of alcoholic beverages produced by fermentation; types of products and methods of production; relationships among agricultural practices, processing and sensory attributes; responsible consumption of alcoholic beverages.
Effective Fall Semester 2013 Effective Spring Semester 2024

CSS 829  Computational and Applied Plant Breeding
Advanced Plant Breeding II
Spring of odd years. 3(3-0) Interdepartmental with Horticulture. P: HRT 819 and STT 814 P: HRT 819
Theoretical and applied methods of genetics and statistics in plant breeding; selection theory and methods; heritability; genotype-environment interaction; methods to enhance genetic progress and efficiency through statistical genetics, genomics, and marker assisted selection.
Effective Spring Semester 2024 Effective Fall Semester 2023
COLLEGE OF ENGINEERING

BME 850  Dynamical Systems in Computational Biology
Spring of even years. 3(3-0) RB: Recommended: Calculus I, Introduction to Biology, and general familiarity with cell biology basics and ordinary differential equations.
NEW A thorough understanding of fundamental principles in Dynamical Systems is essential for modern Computational Biology. This course will provide an accessible introduction to Nonlinear Dynamics with examples of applications in Cell Biology. Beginning with one-dimensional flows on the line, we will introduce bifurcations, phase plane analysis for two-dimensional systems, oscillations, and limit cycles. We will discuss the application of these concepts in Systems Biology, with simplified models of gene regulation, signal amplification in cell signaling networks, and the cell cycle.
Effective Spring Semester 2024

BE 201  Drafting in Biosystems Engineering
Fall of every year. 1(0-2) P: (BE 101 or concurrently or approval of department) and ((MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 118 or concurrently)) and EGR 100 R: Open to undergraduate students in the Department of Biosystems and Agricultural Engineering.
NEW Basic operations of drawings with application to Biosystems Engineering. Visualization and practical reading of drawings for engineering of biological systems.
Effective Fall Semester 2023

BE 334  Biosystems Engineering Laboratory Practice
Biosystems Engineering Laboratory Practice (W)
Fall of every year. 3(2-2) P: (BE 101 or concurrently) and (BS 171 or BS 172) and PHY 184 P: ((BE 101 or concurrently) and completion of Tier I writing requirement) and (BS 171 or BS 172L) and PHY 184 R: Open to juniors or seniors in the Department of Biosystems and Agricultural Engineering. C: BE 332 concurrently.
Sensors and instrumentation for measuring and analyzing properties of biological materials and systems.
Effective Fall Semester 2013 Effective Fall Semester 2023

BE 351  Thermodynamics for Biological Engineering
Fall of every year. 3(3-0) P: (BE 101 or concurrently) and (MTH 235 or MTH 255H or LB 220) and (BS 161 or BS 181H or LB 145) P: (BE 101 or concurrently) and (MTH 235 or MTH 340 or MTH 347H) and (BS 161 or BS 181H or LB 145) R: Open to juniors or seniors in the College of Engineering. Not open to students with credit in CHE 321 or ME 201.
Effective Fall Semester 2013 Effective Fall Semester 2023

BE 485  Biosystems Design Techniques
Biosystems Design Techniques (W)
Fall of every year. 3(2-2) P: BE 332 and BE 334 and BE 350 and BE 351 and BE 360 and BE 385 or approval of department P: (BE 332 and BE 334 and BE 350 and BE 351 and BE 360 and BE 385) or approval of department and completion of Tier I writing requirement R: Open to juniors or seniors in the Biosystems Engineering major.
Engineering design process. Problem identification, analysis, design, modeling, materials, cost estimation, and final specifications. Safety, environmental, and ethical considerations.
SA: BE 486
Effective Fall Semester 2013 Effective Fall Semester 2023
BE 487  Bioystems Design Project (W)
Biosystems Design Project
Spring of every year. 3(0-6) 3(2-2) P: (BE 485) and completion of Tier I Writing requirement P: BE 485 R: Open to seniors in Biosystems Engineering major. R: Open to seniors in the GR BS1Biosystems Engineering Major.
Individual or team design project selected in BE 485. Information expansion, development of alternatives, and evaluation, selection, and completion of a design project.
SA: AE 488
Effective Fall Semester 2013 Effective Fall Semester 2023

CE 431  Pavement Design and Analysis
Design and Analysis for New and Rehabilitated Pavements
Fall of every year. 3(3-0) 4(4-0) P: CE 337 R: Open to juniors or seniors or graduate students in the College of Engineering.
Effective Fall Semester 2017 Effective Fall Semester 2023

CSE 102  Algorithmic Thinking and Programming
Fall of every year. Spring of every year. Summer of every year. 3(2-2) P: (MTH 103 or MTH 103B or MTH 116 or MTH 124 or MTH 132 or MTH 152H or LB 118) or designated score on Mathematics Placement test P: (MTH 103 or MTH 103B or MTH 116 or MTH 124 or MTH 132 or MTH 152H or LB 118 or LB 117) or designated score on Mathematics Placement test Not open to students with credit in CSE 231.
Fundamentals of computing, algorithms and programming, using a high-level language such as Python.
Effective Fall Semester 2020 Effective Fall Semester 2023

CSE 300  Social, Ethical, and Professional Issues in Computer Science
Social, Ethical, and Professional Issues in Computing
Fall of every year. Spring of every year. 1(1-0) P: CSE 232 R: Open to undergraduate students in the Computational Data Science Major or in the Computer Science Major. R: Open to undergraduate students in the College of Engineering.
Professional responsibilities and informed judgments in computing practice based on legal and ethical principles. Local and global impacts of computing solutions on individuals, organizations, and society.
Effective Fall Semester 2020 Effective Fall Semester 2023

CSE 425  Introduction to Computer Security
Fall of every year. Spring of every year. 3(3-0) P: (CSE 422 or concurrently) or (ECE 442 or concurrently) P: CSE 325 R: Open to juniors or seniors in the College of Engineering or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major.
Theory and practice of computer security engineering.
Effective Fall Semester 2020 Effective Fall Semester 2023
LYMAN BRIGGS COLLEGE

LB 118  Calculus I
Fall of every year. Spring of every year. 4(4-0) P: (LB 117 or MTH 114 or MTH 116) or designated score on Mathematics Placement test P: (LB 117) or (MTH 103 and MTH 114) or (MTH 103B and MTH 114) or (MTH 116 or designated score on Mathematics Placement test) R: Open to students in the Lyman Briggs College. Not open to students with credit in MTH 152H or MTH 132 or MTH 163H. Not open to students with credit in MTH 152H or MTH 132.
Limits, continuity, differentiation, integration, and elementary applications.
SA: LBS 118
Effective Fall Semester 2013 Effective Spring Semester 2023

LB 172  Principles of Chemistry II
Fall of every year. Spring of every year. 3(4-0) P: LB 171 or CEM 141 or CEM 151 or CEM 181H P: Open to undergraduate students in the Lyman Briggs College. R: Open to undergraduate students in the Lyman Briggs College or in the Lyman Briggs College. Not open to students with credit in CEM 152 or CEM 182H or CEM 142. C: LB 172L concurrently.
Gases, properties of solutions, introduction to solid state chemistry, molecular orbital theory, chemical equilibria, chemical kinetics, acid/base equilibria, solubility equilibria, entropy, free energy, electrochemistry, redox reactions, nuclear chemistry.
SA: LBS 172, LBS 266
Effective Spring Semester 2014 Effective Fall Semester 2023

LB 172L  Principles of Chemistry II - Reactivity Laboratory
Fall of every year. Spring of every year. 1(0-3) P: (LB 171 or CEM 141 or CEM 152 or CEM 182H) and (LB 171L or CEM 161 or CEM 185H) P: (CEM 152 or CEM 182H) and (LB 171L or CEM 161) and (LB 172 or concurrently) R: Open to students in the Lyman Briggs College. Not open to students with credit in CEM 162. C: LB 172 concurrently.
Synthesis and characterization of chemical systems.
SA: LBS 172L, LBS 266L
Effective Spring Semester 2014 Effective Fall Semester 2023

LB 271  Organic Chemistry
Fall of every year. Spring of every year. 3(3-0) P: CEM 141 or CEM 151 or CEM 181H or LB 171 R: Open to undergraduate students in the Lyman Briggs College. Not open to students with credit in CEM 251. Not open to students with credit in CEM 251 or CEM 351.
Common classes of organic compounds including their nomenclature, structure, bonding, reactivity, spectroscopic characterization, and the relationship of organic chemistry concepts as they are related to chemistry practices.
Effective Fall Semester 2020 Effective Fall Semester 2023

LB 273  Physics I
Fall of every year. 4(3-3) P: LB 118 or MTH 132 or MTH 152H P: (LB 118 or concurrently) or (MTH 132 or concurrently) or (MTH 152H or concurrently) R: Open to students in the Lyman Briggs College. Not open to students with credit in PHY 183 or PHY 231 or PHY 193b or PHY 194 or PHY 251. Not open to students with credit in PHY 183 or PHY 183b or PHY 231 or PHY 231c or PHY 193 or PHY 233b or PHY 221 or PHY 241 or PHY 191 or PHY 251.
Basic physics principles and problem solving techniques. Mechanical systems (Newton's laws, momentum and energy conservation, rotational motion, gravity), elementary thermodynamics, oscillations and waves, and atomic nuclei. Laboratory techniques, instrumentation, and selected experiments in classical and modern physics.
SA: LBS 271, LBS 271L, LBS 164 SA: LBS 271, LBS 271L
Effective Spring Semester 2014 Effective Fall Semester 2023
LB 274  Physics II  
Spring of every year. 4(3-3) P: LB 273 or PHY 183 or PHY 183B or PHY 193H or PHY 233B P: (LB 273 or PHY 183 or PHY 183B or PHY 193H or PHY 221 or PHY 241) or (PHY 231 and PHY 233B) or (PHY 231C and PHY 233B) RB: LB 119 or MTH 133 or MTH 153H R: Open to students in the Lyman Briggs College. Not open to students with credit in PHY 184 or PHY 232 or PHY 294h or PHY 192 or PHY 252. Not open to students with credit in PHY 184 or PHY 232 or PHY 294h or PHY 192 or PHY 252 or PHY 184B or PHY 232C or PHY 234B or PHY 222 or PHY 242.

Basic physics principles and problem solving techniques. Principles of electromagnetic theory, circuits, special relativity, quantum physics, optics, atomic and subatomic physics. Laboratory error analysis and selected experiments in classical and modern physics.

SA: LBS 267, LBS 272, LBS 272L SA: LBS 272L, LBS 272

Effective Spring Semester 2014 Effective Fall Semester 2023

LB 493  Field Experience  
Fall of every year. Spring of every year. Summer of every year. 1 to 10 credits. 1 to 12 credits. A student may earn a maximum of 10 credits in all enrollments for this course. A student may earn a maximum of 12 credits in all enrollments for this course. R: Open to students in the Lyman Briggs College. R: Open to undergraduate students in the.

Experiential learning related to the public or private practice of science and technology.

Request the use of the Pass-No Grade (P-N) system.

Request the use of ET-Extension to postpone grading.

The work for the course must be completed and the final grade reported within 1 semester after the end of the semester of enrollment.

SA: LBS 493

Effective Spring Semester 2014 Effective Fall Semester 2023

GLG 809  Integrative Earth Sciences  
Fall of every year. 1(1-0)
NEW

This course covers key topics in the Earth and Environmental Sciences as represented by the research foci of the current faculty and research staff including, for example, geophysics, geochemistry, hydrology, and paleontology.

Effective Fall Semester 2023

IBIO 483  Environmental Physiology  (W)  
Environmental Physiology  
Spring of every year. 4(4-0) 3(3-0) P: ((BS 161 or LB 145 or BS 181H) and completion of Tier I writing requirement) and (BS 162 or LB 144 or BS 182H) and (CEM 141 or CEM 151 or CEM 181H or LB 171) P: (BS 161 or LB 145 or BS 181H) and (BS 162 or LB 144 or BS 182H) and (CEM 141 or CEM 151 or CEM 181H or LB 171)

Aspects of physiology important to the environmental relations of vertebrates and invertebrates: energetics, thermal relations, osmotic-ionic relations, and exercise physiology. Physiological adaptation to environments and consequences of environmental change in vertebrates and invertebrates: energetics, thermal relations, osmotic-ionic relations, extreme habitat physiology, and physiological response to climate change.

SA: ZOL 483

Effective Spring Semester 2023 Effective Spring Semester 2024

ISB 206  Foundations in Community & Sustainability  
Fall of every year. Spring of every year. 3(3-0) A student may earn a maximum of 3 credits in all enrollments for this course. R: Open to undergraduate students. R: Open to undergraduate students. A student may earn a maximum of 3 credits
NEW

Investigations and analysis of the environmental and social impacts of sustainability both locally and globally.

Effective Fall Semester 2024

COLLEGE OF NATURAL SCIENCE

GLG 809  Integrative Earth Sciences  
Fall of every year. 1(1-0)
NEW

This course covers key topics in the Earth and Environmental Sciences as represented by the research foci of the current faculty and research staff including, for example, geophysics, geochemistry, hydrology, and paleontology.

Effective Fall Semester 2023

IBIO 483  Environmental Physiology  (W)  
Environmental Physiology  
Spring of every year. 4(4-0) 3(3-0) P: ((BS 161 or LB 145 or BS 181H) and completion of Tier I writing requirement) and (BS 162 or LB 144 or BS 182H) and (CEM 141 or CEM 151 or CEM 181H or LB 171) P: (BS 161 or LB 145 or BS 181H) and (BS 162 or LB 144 or BS 182H) and (CEM 141 or CEM 151 or CEM 181H or LB 171)

Aspects of physiology important to the environmental relations of vertebrates and invertebrates: energetics, thermal relations, osmotic-ionic relations, and exercise physiology. Physiological adaptation to environments and consequences of environmental change in vertebrates and invertebrates: energetics, thermal relations, osmotic-ionic relations, extreme habitat physiology, and physiological response to climate change.

SA: ZOL 483

Effective Spring Semester 2023 Effective Spring Semester 2024

ISB 206  Foundations in Community & Sustainability  
Fall of every year. Spring of every year. 3(3-0) A student may earn a maximum of 3 credits in all enrollments for this course. R: Open to undergraduate students. R: Open to undergraduate students. A student may earn a maximum of 3 credits
NEW

Investigations and analysis of the environmental and social impacts of sustainability both locally and globally.

Effective Fall Semester 2024
ISB 230   Foundations of biological science for teacher education
Fall of every year. Spring of every year. 3(3-0) A student may earn a maximum of 3 credits in all enrollments for this course. R: Open to undergraduate students in the Department of Teacher Education. A student may earn a maximum of 3 credits.
NEW   Using science practices to explore core ideas in biological and chemical systems by focusing on crosscutting concepts.
Effective Fall Semester 2024

ISE 322   Foundational Earth Systems for Secondary Science Education
Spring of every year. 4(3-1) R: Open to undergraduate students or approval of department.
NEW   Exploration of natural, physical, and chemical processes in the Universe, the planets and the Earth, while developing of skills necessary to instruct others on these processes.
Effective Spring Semester 2024

ISP 231   Foundations of physical science for teacher education
Fall of every year. Spring of every year. 3(3-0) A student may earn a maximum of 3 credits in all enrollments for this course. P: MTH 101 or MTH 103 R: Open to undergraduate students in the Department of Teacher Education. A student may earn a maximum of 3 credits.
NEW   Using science practices to explore core ideas in physical systems by focusing on crosscutting concepts.
Effective Fall Semester 2024

MTH 304  Algebra for Elementary and Middle School Teachers
Algebra & Calculus for Secondary Educators
Fall of every year. 3 credits. Interdepartmental with Teacher Education P: (MTH 201 and MTH 202 and MTH 203) and completion of Tier I writing requirement R: Open to undergraduate students in the Department of Teacher Education. R: Approval of department.
Algebra needed for understanding connections between topics of algebra and the mathematics taught in elementary and middle school. Algebra, functions and calculus needed for understanding connections between topics of collegiate math and the mathematics taught in grades 7-12.
Effective Fall Semester 2013 Effective Fall Semester 2023

MTH 305  Functions and Calculus for Elementary and Middle School Teachers (W)
Discrete and Computational Mathematics for Secondary Educators
Spring of every year. 3(3-0) Interdepartmental with Teacher Education P: (MTH 304) and completion of Tier I writing requirement R: Approval of department.
Functions and calculus needed for understanding connections between topics of calculus and the mathematics taught in middle school. Discrete and Computational mathematics needed for understanding connections between topics of collegiate math and the mathematics taught in grades 7-12.
Effective Fall Semester 2013 Effective Fall Semester 2023

MTH 458  Financial Mathematics for Actuaries II
Computational Methods in Mathematical Finance and Insurance
Fall of every year. 3(3-0) Interdepartmental with Statistics and Probability. P: MTH 361 and STT 441 RB: MTH 235 or MTH 340 or MTH 347H
Effective Fall Semester 2015 Effective Fall Semester 2023
MTH 849  Partial Differential Equations  
Spring of every year. 3(3-0) P: MTH 847 or approval of department  
RB: MTH 414 and MTH 421  
RB: (MTH 828) and MTH 828 or equivalent  
Cauchy-Kowalewski theorem, Characteristics, Initial-boundary value problems for  
parabolic and hyperbolic equations. Energy methods, boundary-value problems for  
elliptic equations, potential theory, Green's function, maximum principles, Schauder's  
method, Sobolev spaces and embedding theorems, weak solutions of second order  
equations in divergence form (existence, uniqueness, and regularity), Fredholm  
alternative, maximum principle, calculus of variations, Euler-Lagrange equations.  
Effective Summer Semester 1985 Effective Spring Semester 2024

MTH 935  Complex Manifolds I  
Fall of odd years. Spring of even years. 3(3-0) RB: MTH 829 and MTH 869  
Riemann surfaces, Serre duality, Riemann-Roch theorem. Weierstrass points, Abel's  
theorem, Plucker formulas. Hermitian metrics, connections, curvature, Hodge theorem.  
Kaehler metrics, Kodaira vanishing theorem, Chern classes.  
Effective Fall Semester 1995 Effective Spring Semester 2020

MMG 852  Molecular Immunology  
Fall of every year. 1(1-0) RB: This is an advanced immunology course that requires basic  
knowledge of molecular biology, cell biology, physiology and genetics. Prior completion of an  
undergraduate level immunology course (e.g. MMG451) is highly recommended. The students are  
expected to be familiar with basic nomenclatures used in the field of immunology.  
NEW  
Protein structures and functions of immune receptors and molecules, gene expression  
and regulation, DNA rearrangements and antigen receptors diversifications.  
SA: MMG 851  
Effective Fall Semester 2023

MMG 853  Cellular Immunology  
Fall of every year. 1(1-0) RB: This is an advanced immunology course that requires basic  
knowledge of molecular biology, cell biology, physiology, and genetics. Prior completion of an  
undergraduate level immunology course (e.g. MMG451) is highly recommended. The students are  
expected to be familiar with basic nomenclatures used in the field of immunology.  
NEW  
Cells in the immune system, lymphocytes development and differentiation, cellular  
interactions in immune responses.  
SA: MMG 851  
Effective Fall Semester 2023

MMG 854  Applied Immunology  
Fall of every year. 1(1-0) RB: This is an advanced immunology course that requires basic  
knowledge of molecular biology, cell biology, physiology, and genetics. Prior completion of an  
undergraduate level immunology course (e.g. MMG451) is highly recommended. The students are  
expected to be familiar with basic nomenclatures used in the field of immunology.  
NEW  
Immunity against bacterial and viral infections, and cancer cells. Vaccines,  
Transplantation and Immunotherapies. Immunodeficiency and autoimmune diseases.  
SA: MMG 851  
Effective Fall Semester 2023

PHY 862  Accelerator Systems  
Fall of every year. Spring of every year. 3(3-0) RB: PHY 422 and PHY 482 R: Open to graduate  
students in the College of Engineering or in the College of Natural Science.  
Introduction to large accelerator systems, including the physics and engineering of  
accelerators and key components of accelerators.  
Effective Summer Semester 2020 Effective Spring Semester 2024

PHY 983  Nuclear Astrophysics  
Fall of every year. Spring of every year. 3(3-0) RB: PHY 410 and PHY 472 and PHY 482  
Low energy reaction theory, survey of astrophysics, physics of nuclei and reaction  
relevant to astrophysics, nuclear reaction rates in stellar environments, stellar evolution,  
solar neutrinos, big bang nucleosynthesis, dark matter, supernova explosions, r-process,  
hot CNO and rp-process, cosmochronology  
Effective Fall Semester 2003 Effective Spring Semester 2024
STT 200  Statistical Methods
Fall of every year. Spring of every year. Summer of every year. 3(4-0) P: (MTH 102 or MTH 103 or MTH 116 or LB 117 or MTH 124 or MTH 132 or LB 118) or designated score on Mathematics Placement test P: (MTH 102 or MTH 103 or MTH 116 or LB 117 or MTH 124 or MTH 132 or LB 118 or MTH 101) or designated score on Mathematics Placement test R: Open to undergraduate students. Not open to students with credit in STT 201 or STT 421.
Data analysis, probability models, random variables, estimation, tests of hypotheses, confidence intervals, and simple linear regression.
Effective Spring Semester 2023 Effective Summer Semester 2023

COLLEGE OF OSTEOPATHIC MEDICINE

OST 601  Transitions II: Classroom to Bedside
Summer of every year. 5 credits. A student may earn a maximum of 10 credits in all enrollments for this course. R: Open to graduate-professional students in the College of Osteopathic Medicine.
Selected topics designed to assist the COM student in transitioning from the classroom to the clinical learning environment.
Request the use of the Pass-No Grade (P-N) system.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 1 semester after the end of the semester of enrollment.
Effective Summer Semester 2019 Effective Summer Semester 2023

OST 695  Global Health: Costa Rica Clinical Immersion
Fall of every year. Spring of every year. Summer of every year. 1 to 30 credits. A student may earn a maximum of 30 credits in all enrollments for this course. RB: Fluency in Spanish to interact with patients R: Open to graduate-professional students in the College of Osteopathic Medicine and open to undergraduate students or approval of college.
NEW
Observation of and supervised participation in host country's healthcare delivery system. Etiology, treatment, and control of endemic disease. Exploration of local culture and history.
Request the use of the Pass-No Grade (P-N) system.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 2 semesters after the end of the semester of enrollment.
Effective Summer Semester 2023