PART I – NEW ACADEMIC PROGRAMS AND PROGRAM CHANGES

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

1. Request to change the requirements for the Agricultural Technology Certificate in Dairy Management in the Institute of Agricultural Technology.
   a. Under the heading Requirements for Dairy Management make the following changes:
      (1) In item 1., change the total credits from ‘32’ to ‘33’.
      (2) In item 1., delete the following courses:
          ANS 215 Growth, Health and Lactation in Dairy Cattle    2
          ANS 230 Dairy Herd Management                          3
          ANS 232 Introductory Dairy Cattle Management           3
      Add the following courses:
          ANS 134 Dairy Production I                             3
          ANS 200C Dairy Cattle Genetics and Evaluation          2
          ANS 234 Dairy Production II                            3
          ANS 235L Dairy Herd Reproduction Laboratory            2
      (3) In item 2., change the total credits from ‘16’ to ‘15’ and delete the following course:
          ANS 110 Introductory Animal Agriculture                 4
      Add the following courses:
          ANS 110 Introductory Animal Agriculture                 3
          CSS 101L Introduction to Crop Science Laboratory        1
   Effective Fall 2021.

2. Request to change the requirements for the Bachelor of Science degree in Animal Science in the Department of Animal Science.
   The concentrations in the Bachelor of Science degree in Animal Science are noted on the student’s academic record when the requirements for the degree have been completed.
   a. Under the heading Requirements for the Bachelor of Science Degree in Animal Science make the following changes:
      (1) In item 1., replace paragraph two with the following:
          The University’s Tier II writing requirement for the Animal Science major is met by completing one of the following courses: Animal Science 301, 313, 314, 409, or 435. Those courses are referenced in item 3. below.
      (2) In item 3. d. delete the following course:
          ANS 232 Introductory Dairy Cattle Management            3
      Add the following course:
          ANS 134 Dairy Production I                                3
          ANS 234 Dairy Production II                               3
      (3) In item 3. f. delete the following course:
ANS 432 Advanced Dairy Cattle Management 3

Add the following course:

ANS 334 Dairy Management I 3

(4) In item 3. h. make the following changes:

(a) Change the total credits for concentrations from '23 to 33' to '20 to 40'.

(b) Change the Animal Industry concentration to the following:

Animal Industry (20 to 24 credits):
1. The following course (3 credits):
   ANS 201 Animal Products 3
   ANS 201 may not be used to fulfill requirement 3. d. above.

2. One of the following courses (2 or 3 credits):
   AFRE 203 Data Analysis for the Agri-Food System 3
   CSS 110 Computer Applications in Agronomy 2

3. One of the following courses (3 credits):
   AFRE 100 Decision-making in the Agri-Food System 3
   AFRE 130 Farm Management I 3

4. One of the following advanced management courses (3 credits):
   ANS 422 Advanced Beef Cattle Feedlot Management 3
   ANS 434 Dairy Management II 3
   ANS 442 Advanced Horse Management 3
   ANS 472 Advanced Swine Management 3
   ANS 482 Advanced Companion Animal Management 3
   FSC 432 Food Processing: Dairy Foods 3
   FSC 433 Food Processing: Muscle Foods 3

   Courses used to fulfill this requirement may not be used to fulfill requirement 3. f. above.

5. A minimum of 9 credits from the following courses:
   ANS 211 Animal and Product Evaluation 3
   ANS 305 Applied Animal Behavior 3
   ANS 305L Applied Animal Behavior Laboratory 1
   ANS 307 Animal Reproduction 3
   ANS 309 Animal Health and Disease Management 3
   ANS 313 Principles of Animal Feeding and Nutrition (W) 4
   ANS 314 Genetic Improvement of Domestic Animals (W) 4
   ANS 315 Anatomy and Physiology of Farm Animals 4
   ANS 404 Introduction to Quantitative Genetics 3
   ANS 407 Food and Animal Toxicology 3
   ANS 409 Problems, Controversies and Advancements in Reproduction (W) 4
   ANS 413 Non-Ruminant Nutrition 4
   ANS 418 Animal Agriculture and the Environment 3
   ANS 425 Animal Biotechnology 3
   ANS 427 Environmental Toxicology and Society 3
   ANS 435 Mammary Physiology (W) 4
   ANS 445 Equine Exercise Physiology 4
   ANS 455 Avian Physiology 4
   ANS 483 Ruminant Nutrition 3

   Courses used to fulfill this requirement may not be used to fulfill requirement 3. e. above.

(c) In item 3. h. under the Animal Biology and Prevetinary add the following courses under item 4.:

   ANS 305 Applied Animal Behavior 3
   ANS 305L Applied Animal Behavior Laboratory 1
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 307</td>
<td>Animal Reproduction</td>
<td>3</td>
</tr>
<tr>
<td>ANS 309</td>
<td>Animal Health and Disease Management</td>
<td>3</td>
</tr>
<tr>
<td>ANS 313</td>
<td>Principles of Animal Feeding and Nutrition (W)</td>
<td>4</td>
</tr>
<tr>
<td>ANS 314</td>
<td>Genetic Improvement of Domestic Animals (W)</td>
<td>4</td>
</tr>
<tr>
<td>ANS 315</td>
<td>Anatomy and Physiology of Farm Animals</td>
<td>4</td>
</tr>
</tbody>
</table>

Add the following note:

Courses used to fulfill this requirement may not be used to fulfill requirement 3.e. above.

(d) In the **Companion and Exotic Animal Biology** concentration delete the note in item 1. and add the following course in item 3.:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBIO 368</td>
<td>Zoo Animal Biology and Conservation</td>
<td>3</td>
</tr>
</tbody>
</table>

(e) Add the following concentration:

**Dairy Industry** (38 to 40 credits):

1. All of the following courses (24 credits):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 134</td>
<td>Dairy Production I</td>
<td>3</td>
</tr>
<tr>
<td>ANS 234</td>
<td>Dairy Production II</td>
<td>3</td>
</tr>
<tr>
<td>ANS 334</td>
<td>Dairy Management I</td>
<td>3</td>
</tr>
<tr>
<td>ANS 434</td>
<td>Dairy Management II</td>
<td>3</td>
</tr>
<tr>
<td>AFRE 130</td>
<td>Farm Management I</td>
<td>3</td>
</tr>
<tr>
<td>AFRE 203</td>
<td>Data Analysis for the Agri-Food System</td>
<td>3</td>
</tr>
<tr>
<td>AFRE 430</td>
<td>Farm Management II</td>
<td>3</td>
</tr>
<tr>
<td>ACC 230</td>
<td>Survey of Accounting Concepts</td>
<td>3</td>
</tr>
<tr>
<td>ANS 234</td>
<td>Dairy Production II</td>
<td>3</td>
</tr>
</tbody>
</table>

2. Choose a minimum of 8 credits from the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 200C</td>
<td>Dairy Cattle Genetics and Evaluation</td>
<td>2</td>
</tr>
<tr>
<td>ANS 233</td>
<td>Dairy Feed Management</td>
<td>3</td>
</tr>
<tr>
<td>ANS 235</td>
<td>Dairy Herd Reproduction</td>
<td>2</td>
</tr>
<tr>
<td>ANS 235L</td>
<td>Dairy Herd Reproduction Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>ANS 238</td>
<td>Dairy Cattle Health Management</td>
<td>3</td>
</tr>
</tbody>
</table>

3. Choose a minimum of 6 credits from the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRE 232</td>
<td>Commodity Marketing I</td>
<td>3</td>
</tr>
<tr>
<td>AFRE 315</td>
<td>Labor and Personnel Management in the Agri-Food System</td>
<td>3</td>
</tr>
<tr>
<td>AFRE 435</td>
<td>Financial Management in the Agri-Food System</td>
<td>3</td>
</tr>
<tr>
<td>ANS 409</td>
<td>Problems, Controversies, and Advancement in Reproduction (W)</td>
<td>4</td>
</tr>
<tr>
<td>ANS 418</td>
<td>Animal Agriculture and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>ANS 435</td>
<td>Mammary Physiology (W)</td>
<td>3</td>
</tr>
<tr>
<td>ANS 483</td>
<td>Ruminant Nutrition</td>
<td>3</td>
</tr>
<tr>
<td>FSC 432</td>
<td>Food Processing: Dairy Foods</td>
<td>3</td>
</tr>
</tbody>
</table>

FSC 432 may not be used to fulfill requirement 3.f. above.

Effective Fall 2021.

3. Request to change the requirements for the **Master of Science** degree in **Animal Science** in the Department of Animal Science. The University Committee on Graduate Studies (UCGS) will consider this request at its meeting on September 14, 2020.

   a. Under the heading **Admission** add the following statement:

   Applicants will be evaluated for admission based on academic record, research and work experience, professional goals, and letters of reference. All applicants are required to submit scores from the General Test of the Graduate Record Examination.

   b. Under the heading **Requirements for the Master of Science Degree in Animal Science** replace the entire entry with the following:
The student may elect either Plan A (with thesis) or Plan B (without thesis). A minimum of 30 credits is required for the degree under either Plan A or Plan B. The student's major professor and guidance committee must approve the student's program of study, including thesis research for students under Plan A.

Requirements for Both Plan A and Plan B
1. Complete a set of courses related to one of the areas of specialization within the field of animal science, as approved by the major professor and guidance committee.

Additional Requirements for Plan A
1. Complete 6 to 10 credits in ANS 899 Master's Thesis Research.
2. Complete a written thesis and present it publicly at a departmental seminar prior to graduation.
3. Pass a final oral examination in defense of the thesis before the guidance committee that occurs immediately after the public seminar at which the thesis is presented.

Additional Requirements for Plan B
1. Complete no more than 6 credits in ANS 898 Master's Research.
2. Complete a project and present it publicly at a departmental seminar prior to graduation.
3. Pass a final examination or evaluation before the guidance committee that occurs immediately after the public seminar at which the project is presented.

Effective Fall 2021.

4. Request to change the requirements for the Master of Science degree in Forestry in the Department of Forestry. The University Committee on Graduate Studies (UCGS) will consider this request at its September 14, 2020 meeting.

   a. Under the heading Master of Science replace the entire entry with the following:

   In addition to meeting the requirements of the university and of the College of Agriculture and Natural Resources, students must meet the requirements specified below.

Requirements for the Master of Science Degree in Forestry

The master's degree program in forestry is available under either Plan A (with thesis) or Plan B (without thesis). A total of 30 credits is required for the degree under Plan A or Plan B. The student's program of study must be approved by either their major professor or guidance committee.

Requirements for Plan A
1. Complete the following course (2 credits):
   FOR 802 Forest Science Research
   2
2. Complete a program of study approved by the major professor and guidance committee to meet the student's educational and career goals.
3. Complete at least 6 credits and no more than 10 credits in FOR 899 Master's Thesis Research.
4. Pass an oral examination, including a public presentation, in defense of the thesis, administered by the student's guidance committee. One re-examination may be scheduled at the discretion of the guidance committee. The final oral examination must be passed within five calendar years from the date of enrollment in the first course included for degree certification.

Requirements for Plan B
1. Complete a program of study approved by the major professor and guidance committee to meet the student's educational and career goals.
2. Complete a non-thesis capstone project, practicum or other professional development experience of at least 1 credit and no more than 6 credits through enrollment in FOR 898 Master's Professional Project. Upon completion of the project, a report must be completed and submitted to the student's guidance committee.
3. Pass a final oral examination, including a public presentation, in defense of the professional project, administered by the student’s guidance committee. One re-examination may be scheduled at the discretion of the guidance committee. The final oral examination must be passed within five calendar years from the date of enrollment in the first course included for degree certification.

Effective Fall 2021.

5. Request to change the requirements for the Doctor of Philosophy degree in Forestry in the Department of Forestry. The University Committee on Graduate Studies (UCGS) will consider this request at its September 14, 2020 meeting.

a. Under the heading Doctor of Philosophy replace the entire entry with the following:

The Doctor of Philosophy degree in Forestry provides advanced education to prepare future scholars and leaders who advance knowledge about forested ecosystems and help resolve issues that challenge the provision of forest ecosystem services at local, regional and global scales. The program is research-intensive and students will produce original applied or fundamental research of quality comparable to a two to four peer-reviewed publications in a scientific journal.

In addition to meeting the requirements of the university and of the College of Agriculture and Natural Resources, students must meet the requirements specified below.

Requirements for the Doctor of Philosophy Degree in Forestry

5. Complete the following course (2 credits):
   FOR 802 Forest Science Research 2

6. Complete a program of study approved by the major professor and guidance committee to meet the student’s educational and career goals.

7. Complete at least 24 credits and no more than 36 credits in FOR 999 Doctoral Dissertation Research.

8. No more than 1/4th of the program of study can be from transfer credits. Graduate credits may be transferred from other postsecondary accredited institutions of comparable academic quality if they are appropriate to a student’s program and were completed within the time limits approved for the earning of the degree at MSU.

9. Comprehensive examinations must be completed within five years from the time when a student begins the first class at MSU that appears on the student’s doctoral program of study.

10. Successfully pass the final oral examination in defense of the dissertation.

Effective Fall 2021.

6. Request to change the requirements for the Doctor of Philosophy degree in Packaging in the School of Packaging. The University Committee on Graduate Studies (UCGS) will consider this request at its September 14, 2020 meeting.

a. Under the heading Admission in paragraph two, replace items 1. and 2. with the following:

1. Completed a master's degree program in packaging, or in a related science or engineering area, for which a thesis was required, or a completed bachelor's degree in packaging or related science or engineering area with significant intensive research experience such as having peer-reviewed journal publications as the main author, or conducting several semesters of research work.

2. A grade–point average of at least 3.40 for the bachelor’s or master's degree program.

b. Under the heading Requirements for the Doctor of Philosophy Degree in Packaging replace the entire entry with the following:

The student must:

1. One of the following courses (3 credits):
   PKG 805 Advanced Packaging Dynamics 3
   PKG 815 Permeability Shelf Life 3
2. Both of the following courses (7 credits):
   PKG  825  Polymeric Packaging Materials         4  
   PKG  860  Research Methods                            3  
3. An additional 3 credits of 800-level Packaging courses excluding PKG 890.
5. Pass both a written and an oral comprehensive examination.
6. Complete a dissertation in one of the following areas of packaging: material science applications in packaging, food packaging, healthcare packaging, mass transport applications, or the dynamics and physical distribution aspects or human factors in packaging.
7. Successfully defend the dissertation.

Effective Fall 2021.

COLLEGE OF ENGINEERING

1. Request to change the requirements for the Minor in Energy in the College of Engineering.
   a. Under the heading Requirements for the Minor in Energy make the following changes:
      (1) In item 2., add the following course:
          ECE  320  Energy Conversion and Power Electronics  3
      (2) In item 3., delete the following course:
          ECE  202  Circuits and Systems II  3
           Add the following course:
          ECE  302  Electronic Circuits  3
      (3) In item 4., add the following courses:
          CE  473  Smart and Sustainable Building Design and Operations  3
          ENE  472  Life Cycle Assessment of Energy  3
      (4) In item 5., delete the following course:
          EEP  255  Ecological Economics  3
           Add the following courses:
          CE  371  Sustainable Civil and Environmental Engineering Systems  3
          EEM  255  Ecological Economics  3
      (5) In item 6., delete the following courses:
          ECE  305  Electromagnetic Fields and Waves I  4
          ECE  320  Energy Conversion and Power Electronics  3
          EEP  255  Ecological Economics  3
          ENE  481  Environmental Chemistry: Equilibrium Concepts  3
          ISP  221  Earth Environment and Energy  3
           Add the following courses:
          CE  473  Smart and Sustainable Building Design and Operations  3
          CEM  485  Modern Nuclear Chemistry  3
          CSUS  259  Sustainable Energy and Society  3
          EEM  255  Ecological Economics  3
2. Request to change the requirements in the Master of Science degree in Materials Science and Engineering in the Department of Chemical Engineering and Materials Science. The University Committee on Graduate Studies (UCGS) will consider this request at its September 14, 2020 meeting.

   a. Under the heading Admission add the following text:

      Students entering the program with a bachelor degree in a field other than Materials Science and Engineering may be required to complete additional collateral courses to fulfill deficiencies in their academic background. Collateral course work does not count towards the requirements for the degree program.

   b. Under the heading Requirements for the Master of Science Degree in Materials Science and Engineering replace the entire entry with the following:

      The students must complete a total of 30 credits for the degree under Plan A (with thesis) or Plan B (without thesis), and meet the requirements specified below.

      **Requirements for Both Plan A and Plan B:**

      | CREDITS |
      |-----------------------------|
      | Core Courses. All of the following courses (12 credits): |
      | MSE 851 Thermodynamics of Solids 3 |
      | MSE 855 Advanced Rate Theory and Diffusion 3 |
      | MSE 860 Advanced Theory of Solids 3 |
      | MSE 870 Electron Microscopy in Materials Science 3 |
      | Or |
      | MSE 881 Advanced Spectroscopy and Diffraction Analysis of Materials 3 |

      **Additional Requirements for Plan A**

      1. Complete the following course:
         CHE 892 Seminar 2
      2. Complete 6 credits of MSE 899 Master’s Thesis Research
      3. One course at the 400-level or above in mathematics or statistics as approved by the student's academic advisor.
      4. Submit a written thesis and oral presentation, administered by the student's advisory committee.
      5. A minimum of 16 credits must be at the 800-level or above as approved by the student's academic advisor.

      **Additional Requirements for Plan B**

      1. Complete the following course:
         CHE 892 Seminar 2
      2. One course at the 400-level or above in mathematics or statistics as approved by the student's academic advisor.
      3. At least 6 to 9 credits completed in a coordinated technical minor as approved by the student's academic advisor.
      4. Additional elective credits as approved by the student's academic advisor.
      5. A minimum of 18 credits at the 800-level or above as approved by the student's academic advisor.
      6. Pass a final examination or evaluation.

      Effective Fall 2021.
3. Request to change the requirements in the Master of Science degree in Civil Engineering in the Department of Civil and Environmental Engineering. The University Committee on Graduate Studies (UCGS) will consider this request at its September 14, 2020 meeting.

a. Under the heading Requirements for the Master of Science Degree in Civil Engineering replace the entire entry with the following:

The student must complete a total of 30 credits for the degree under either Plan A (with thesis) or Plan B (without thesis).

A student under Plan A must complete at least 20 credits at the 800-level or above, including 4 credits of Civil Engineering 899, but not more than 6 credits. Up to 10 credits of 400-level course work may be counted toward the degree. The student's program must be approved by the guidance committee.

A student under Plan B must complete at least 18 credits at the 800-level or above, including the completion of a research or design project through enrollment of at least 1 credit, but no more than 4 credits in Civil Engineering 892. Up to 12 credits of 400-level course work may be counted toward the degree. The student's program must be approved by the guidance committee.

Effective Fall 2021.

4. Request to change the requirements in the Master of Science degree in Environmental Engineering in the Department of Civil and Environmental Engineering. The University Committee on Graduate Studies (UCGS) will consider this request at its September 14, 2020 meeting.

a. Under the heading Requirements for the Master of Science Degree in Environmental Engineering replace the entire entry with the following:

The student must complete a total of 30 credits for the degree under either Plan A (with thesis) or Plan B (without thesis).

A student under Plan A must complete at least 20 credits at the 800-level or above, including 4 credits of Environmental Engineering 899. Up to 10 credits of 400-level course work may be counted toward the degree. The student's program must be approved by the guidance committee.

A student under Plan B must complete at least 18 credits at the 800-level or above, including the completion of a research or design project through enrollment of at least 1 credit, but no more than 4 credits in Environmental Engineering 892. Up to 12 credits of 400-level course work may be counted toward the degree. The student's program must be approved by the guidance committee.

Effective Fall 2021.

COLLEGE OF HUMAN MEDICINE

1. Request to change the requirements for the Master of Public Health degree in Public Health in the College of Human Medicine. The University Committee on Graduate Studies (UCGS) will consider this request at its September 14, 2020 meeting.

a. Under the heading Admission make the following changes:

(1) Renumber items 1. and 2. to items 2. and 3. and add the following item 1.:

1. submit an Application to Graduate Study at Michigan State University with application fee.

(2) Delete the original item 3.

(3) Replace items 4., 5., and 6. with the following:
4. submit three letters of recommendation from professional or academic references.
5. submit a personal statement describing interest in and understanding of public health, including professional career goals, and how their experiences, personal and professional, have influenced that interest;
6. submit official transcripts from all post-secondary institutions attended;

(4) Add the following item 8.:
8. submit official English language proficiency test scores to institution code 1465 (TOEFL, IELTS, MELAB) if applying as an international applicant.

(5) Replace the second paragraph with the following:
The MPH Admission Committee integrates the academic information, letters of recommendation, and personal statement to make the final admissions decision based on the following considerations:

(6) Delete paragraph three.

b. Under the heading Requirements for the Master of Public Health Degree in Public Health make the following changes:

(1) Delete item 5.

Effective Fall 2021.

2. Request to change the requirements for the Doctor of Philosophy degree in Epidemiology in the Department of Epidemiology and Biostatistics. The University Committee on Graduate Studies (UCGS) will consider this request at its September 14, 2020 meeting.

a. Under the heading Admission replace item 1. with the following:

1. an applicant must have earned a bachelor's, master of science or a master of public health in epidemiology degree with at least 40 credits.

b. Under the heading Requirements for the Doctor of Philosophy degree in Epidemiology replace the entire entry with the following:

Students must complete 51 credits for the degree with no more than 6 credits at the 400-level.

1. All of the following courses (7 credits):
   EPI 805 Readings in the Historical Roots of Epidemiological Thought 3
   EPI 828 Seminar in Responsible Conduct of Research 1
   EPI 910 Themes in Contemporary Epidemiology 3

2. Two of the following courses (6 credits):
   EPI 855 Biostatistical Modeling in Genomic Data Analysis 3
   EPI 920 Advanced Methods in Epidemiology and Applied Statistics 3
   EPI 950 Advanced Biostatistical Methods in Epidemiology 3
   EPI 952 Duration and Severity Analysis 3
   EPI 953 Analytical Strategies for Observational Studies 3

3. Complete a minimum of 15 credits of elective course work from the following list of approved courses. Additional courses may be chosen with advisor approval.
   EPI 815 Epidemiology of Cardiovascular Disease 3
   EPI 816 Perinatal Epidemiology 3
   EPI 823 Cancer Epidemiology 3
   EPI 835 Neuroepidemiology 3
   EPI 890 Independent Study in Epidemiology and Biostatistics 1 to 3
   EPI 910 Themes in Contemporary Epidemiology 3
   EPI 920 Advanced Methods in Epidemiology and Applied Statistics 3
   EPI 950 Advanced Biostatistical Methods in Epidemiology 3
   EPI 952 Duration and Severity Analysis 3
EPI 953 Analytical Strategies for Observational Studies  3
EPI 977 Social Epidemiology  3
EPI 979 Advanced Topics of Infectious Disease Epidemiology  3
STT 847 Analysis of Survival Data  3

4. Attend all MSU Graduate School Responsible Conduct of Research (RCR) Workshops.
5. Attendance at 80% of all presentations in the departmental epidemiology seminar series during the period of course work.
6. Attendance at 80% of Ph.D. Journal Club meetings.
7. Present at one Ph.D. Journal Club meeting.
8. Pass a Qualifying Examination at the end of the first year of study.
10. Successfully complete 24 credits of Epidemiology 999 Doctoral Dissertation Research.
11. Successfully defend the oral defense of the doctoral dissertation.

Effective Fall 2021.

3. Request to change the requirements for the Minor in Global Public Health and Epidemiology in the Department of Epidemiology and Biostatistics.

a. Under the heading Requirements for the Minor in Global Public Health and Epidemiology replace the entire entry with the following:

Students must complete 19 or 20 credits:
1. One of the following courses (3 or 4 credits):
   STT 200 Statistical Methods  3
   STT 201 Statistical Methods  4
2. All of the following courses (16 credits):
   EPI 200 A Multidisciplinary Approach to Problems in Global Public Health and Epidemiology  3
   EPI 280 Applied Analytic Methods in Health Studies I  3
   EPI 380 Applied Analytic Methods in Health Studies II  3
   EPI 390 Disease in Society: Introduction to Epidemiology and Public Health  4
   HM 101 Introduction to Public Health  3

Effective Fall 2021.

COLLEGE OF NATURAL SCIENCE

1. Request to change the name of the Bachelor of Science degree in Biological Science-Interdepartmental to Biological Science Secondary Education in the College of Natural Science. The Teacher Education Council (TEC) will consider this request at its September 2020 meeting.

Students admitted to the major prior to Fall 2021 will be awarded a Bachelor of Science Degree in Biological Science-Interdepartmental.

Students admitted to the major Fall 2021 and forward will be awarded a Bachelor of Science Degree in Biological Science Secondary Education.

Effective Fall 2021.

2. Request to change the name of the Bachelor of Science degree in Physical Science-Interdepartmental to Physical Science Secondary Education in the College of Natural Science. The Teacher Education Council (TEC) will consider this request at its September 2020 meeting.

Students admitted to the major prior to Fall 2021 will be awarded a Bachelor of Science Degree in Physical Science-Interdepartmental.

Students admitted to the major Fall 2021 and forward will be awarded a Bachelor of Science Degree in Physical Science Secondary Education.

Effective Fall 2021.
3. Request to change the requirements for the Bachelor of Science degree in Biomedical Laboratory Science in the Biomedical Laboratory Diagnostics Program.

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

      (1) In item 3.c. under the Clinical Chemistry concentration, add the following course in item (2):

         PHM 321 Common Drugs 3

      (2) In item 3.c. under the Immunology concentration, change the total credits from ‘10 or 11’ to ‘9 or 10’ and replace item (1) with the following:

         The following course (1 credit):
         BLD 452L Immunodiagnostics Laboratory 1

      (3) In item 3.c. under the Medical Microbiology concentration, under item (2), delete the following courses:

         EPI 290 History of Scientific Reasoning and Critical Thinking in Global Public Health and Epidemiology 3
         IBIO 316 General Parasitology 3

      (4) In item 3.c. under the Hematology and Hemostasis concentration, change the total credits from ‘9 to 11’ to ‘7 to 9’ and delete the following courses from item (1):

         BLD 435L Immunohematology Laboratory 1
         BLD 452L Immunodiagnostics Laboratory 1

         In item (3) delete the following course:

         BLD 835 Hemostasis, Thrombosis and Effective Resource Management 3

         Add the following course:

         IBIO 341 Fundamental Genetics 4

Effective Fall 2021.

4. Request to change the requirements for the Bachelor of Arts degree in Chemistry in the Department of Chemistry. The Teacher Education Council (TEC) will consider this request at its September 14, 2020 meeting.

   a. Under the heading Requirements for the Bachelor of Arts Degree in Chemistry make the following changes:

      (1) In item 3. a. make the following changes:

         (a) Change the total credits from ‘21 to 27’ to ‘21 to 27’.

         (b) In item (1) delete the following course:

         ZOL 141 Introductory Human Genetics 3

         Add the following courses:

         IBIO 150 Integrating Biology: From DNA to Populations 3
         MMG 141 Introductory Human Genetics 3
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September 17, 2020

(c) In item (4) add the following:

(d) PHY 173 Studio Physics for Scientists and Engineers I 5
(d) PHY 174 Studio Physics for Scientists and Engineers II 5
(e) PHY 221 Studio Physics for Life Scientists I 4
(e) PHY 222 Studio Physics for Life Scientists II 4

(d) Replace item (5) with the following:

One of the following courses (3 or 4 credits):
BMB 401 Comprehensive Biochemistry 4
BMB 461 Advanced Biochemistry I 3

Effective Fall 2021.

5. Request to change the requirements for the Bachelor of Science degree in Chemistry in the Department of Chemistry. The Teacher Education Council (TEC) will consider this request at its September 14, 2020 meeting.

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

(1) In item 3. a. make the following changes:

(a) Change the total credits from ‘29 to 36’ to ‘28 to 33’.

(b) In item (1) delete the following courses:

BS 162 Organismal and Population Biology 3
BS 182H Honors Organismal and Population Biology 3
ENT 205 Pests, Society and Environment 3
LB 144 Biology I: Organismal Biology 4
MMG 201 Fundamentals to Microbiology 3
PLB 105 Plant Biology 3
PSL 250 Introductory Physiology 4
ZOL 141 Introductory Human Genetics 3

(c) In item (5) delete the following course:

MTH 255H Honors Differential Equations 3

(d) In item (6) add the following item (d):

PHY 173 Studio Physics for Scientists and Engineers I 5
PHY 174 Studio Physics for Scientists and Engineers II 5

(d) Replace item (7) with the following:

The following course (3 credits):
BMB 461 Advanced Biochemistry I 3

(2) In item 3. b. change the total credits from ‘45 or 46’ to ‘46 or 47’.

(3) In item 3. b. (3) change the total credits from ‘30’ to ‘31’ and add the following course:

CEM 444 Chemical Safety 1

Effective Fall 2021.
6. Request to change the requirements for the Bachelor of Science degree in Chemical Physics in the Department of Chemistry.

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

      (1) In item 3. a. change the total credits from '47 to 56' to '51 to 60' and make the following changes:

         (a) In item (1) change the total credits from '3 or 4' to '3 to 5' and delete the following course:

             ZOL 141 Introductory Human Genetics 3

             Add the following courses:

             IBIO 150 Integrating Biology: From DNA to Populations 3
             MMG 141 Introductory Human Genetics 3

         (b) Add a new item (2) and renumber items (2) through (10) respectively:

             The following course (4 credits):
             CMSE 201 Computational Modeling and Data Analysis I 4

         (c) In item (6) delete the following course:

             MTH 255H Honors Differential Equations 3

         (d) In item (8) delete the following courses:

             MTH 428H Honors Analysis I 3
             MTH 443 Boundary Value Problems for Engineers 3

             Add the following course:

             MTH 327H Honors Introduction to Analysis 3

         (e) Add the following item (d):

             PHY 173 Studio Physics for Scientists and Engineers I 5
             PHY 174 Studio Physics for Scientists and Engineers II 5

         (f) In item (11) add the following course:

             PHY 493 Introduction to Elementary Particle Physics 3

      (2) In item b. change the total credits from '28 to 30' to '29 to 31' and make the following changes:

         (a) In item (4) change the credits of 'CEM 495' from '2' to '3'.

         (b) In item (5) change the credits from '6' to '7' and add the following course:

             CEM 444 Chemical Safety 1

Effective Fall 2021.
7. Request to establish a Master of Science degree in Data Science in the Department of Statistics and Probability. The University Committee on Graduate Studies (UCGS) recommended approval of this request at its May 13, 2020 meeting.

a. Background Information:

Data science is an interdisciplinary field whose purpose is the extraction of actionable insights from data in its many forms. Data science employs theories and techniques drawn from various disciplines, including statistics, mathematics, computer science, and information science. It is a field, which is evolving rapidly, under the action of practitioners who are developing new methodologies for their data analysis needs, often with little heed to solid foundations. At the same time, academics are identifying and studying the fields expanding specificities, to the point that data science may already warrant being called a discipline in its own right.

The rationale for offering this program at MSU is three-fold. First, there is a tremendous need for data scientists, particularly at the MS level, in almost every industry. Most industries report the need for staggering numbers of such scientists over the next 10 years. For example, McKinsey Global Institute reports that data science is the #1 job in America with an average base salary in excess of $105,000. While there are data science programs at other universities, these cannot meet the vast need and demand for data scientists.

MSU has a unique collaboration of three departments: (1) statistics, (2) computer science and engineering, and (3) computational mathematics, science, and engineering – that offer three complementary perspectives on data science. This will ensure our students emerge from the program with a rigorous statistical and mathematical foundation of data science, the ability to develop and apply efficient data science algorithms to problems, and the ability to develop appropriate data science models for a wide variety of applications.

This master’s in data science program will be coupled with an interdisciplinary research center in data science. By coupling this instructional program with a data science research center, MSU will become highly competitive for many federal and other research funding opportunities in data science without introducing any additional costs. The benefit to students comes from exposure to cutting-edge projects.

b. Academic Programs Catalog Text:

The Master of Science degree in Data Science is designed to provide students with an interdisciplinary blend of statistics, computer science, and computational science and mathematics which provides the necessary training to assimilate, process, analyze, and interpret data from diverse sources.

Admission

To be considered for admission to the master’s degree, a student must:

1. Have a four-year bachelor’s degree in a relevant quantitative discipline.
2. Demonstrate sufficient quantitative preparation through work or other relevant experiences.

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

Requirements for the Master of Science Degree in Data Science

A total of 30 credits is required for the degree under Plan B (without thesis). The student’s program of study must be approved by the student’s guidance committee and must meet the requirements specified below.

1. All of the following courses (18 credits):
   - CMSE 830 Foundations of Data Science 3
   - CMSE 831 Computational Optimization 3
   - CSE 482 Big Data Analysis 3
   - CSE 881 Data Mining 3
   - STT 810 Mathematical Statistics for Data Scientists 3
   - STT 811 Applied Statistical Modeling for Data Scientists 3
2. Complete 9 credits of elective courses from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMSE 402</td>
<td>Data Visualization Principles and Techniques</td>
<td>3</td>
</tr>
<tr>
<td>CMSE 822</td>
<td>Parallel Computing</td>
<td>3</td>
</tr>
<tr>
<td>CMSE 890</td>
<td>Selected Topics in Computational Mathematics, Science, and Engineering</td>
<td>1 to 4</td>
</tr>
<tr>
<td>CSE 802</td>
<td>Pattern Recognition and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CSE 830</td>
<td>Design and Theory of Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CSE 847</td>
<td>Machine Learning</td>
<td>3</td>
</tr>
<tr>
<td>STT 802</td>
<td>Statistical Computation</td>
<td>3</td>
</tr>
<tr>
<td>STT 812</td>
<td>Statistical Learning and Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STT 873</td>
<td>Statistical Learning and Data Mining</td>
<td>3</td>
</tr>
<tr>
<td>STT 874</td>
<td>Introduction to Bayesian Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STT 875</td>
<td>R Programming for Data Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

CMSE 890 must be approved by the student’s guidance committee. Other courses may be available to fulfill this requirement with advisor approval.

3. Completion of a 3-credit capstone course involving an applied, industrial, or governmental data science project. Students may complete this requirement by enrollment in Computer Science and Engineering 890, Computational Mathematics, Science, and Engineering 890, or Statistics and Probability 890. The student’s topic area must be approved by the student’s guidance committee.

4. Completion of a final examination or evaluation.

Effective Fall 2021.
PART II - NEW COURSES AND CHANGES

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

ANS 132  Dairy Farm Management Seminar
Fall of every year. 4(2-0) R: Open to students in the Institute of Agricultural Technology.
Challenges and opportunities in the dairy industry.
SA: ANS 054
Effective Fall 2013 Effective Fall 2020

ANS 134  Dairy Production I
Fall of every year. 3(2-2)
NEW
Introduction to dairy production and the dairy industry.
SA: ANS 232
Effective Fall 2020

ANS 200C  Introductory Judging of Dairy Cattle
Dairy Cattle Genetics and Evaluation
Spring of every year. 1 to 2 credits. 2(2-0) A student may earn a maximum of 3 credits in all enrollments for this course. P: ANS 134 R: A student may earn a maximum of 8 credits from the following courses: ANS 200A, ANS 200C, ANS 200D, ANS 200E, ANS 300A, ANS 300C, ANS 300D, ANS 300E, and ANS 300F.
SA: ANS 200B
Effective Fall 2013 Effective Fall 2020

ANS 200F  Dairy Farm Evaluation
Fall of every year. 1(0-2) P: ANS 232 or concurrently R: A student may earn a maximum of 8 credits from the following courses: ANS 200A, ANS 200C, ANS 200D, ANS 200E, ANS 300A, ANS 300C, ANS 300D, ANS 300E, and ANS 300F.
Evaluation of dairy farm management. Preparation for collegiate competition. Field trip required.
DELETE COURSE
Effective Fall 2020

ANS 215  Growth, Health and Lactation in Dairy Cattle
Fall of every year. 2(2-0) RB: ANS 295 and ANS 232 R: Open to students in the Institute of Agricultural Technology.
DELETE COURSE
Effective Fall 2020

ANS 230  Dairy Herd Management
Fall of every year. 3(2-2) P: ANS 232 RB: ANS 132 and ANS 295 and ANS 215 R: Open to students in the Institute of Agricultural Technology.
SA: ANS 032
DELETE COURSE
Effective Fall 2020

ANS 232  Introductory Dairy Cattle Management
Fall of every year. 3(2-2) Not open to students with credit in ANS 432.
Principles and techniques of dairy herd management including calf and heifer care plus lactating and dry cow management.
DELETE COURSE
Effective Fall 2020
ANS 233  Dairy Feed Management
Fall of every year. 3(2-2) P: ANS 203 P: ANS 134 RB: ANS 203 R: Open to students in the Institute of Agricultural Technology.
SA: ANS 051
Effective Fall 2013 Effective Fall 2020

ANS 234  Dairy Production II
Fall of every year. 3(2-2) P: ANS 134
NEW Introduction to biology and management practices related to growth, lactation, and health of dairy animals.
SA: ANS 215
Effective Fall 2020

ANS 235  Dairy Herd Reproduction
Spring of every year. 2(2-0) P: ANS 235 P: ANS 134 RB: ANS 232 or concurrently RB: ANS 295 R: Open to students in the Institute of Agricultural Technology.
Application of reproductive principles to dairy production. Field trip required.
Effective Summer 2014 Effective Fall 2020

ANS 235L  Dairy Herd Reproduction Laboratory
Fall of every year. Spring of every year. 2(0-4) P: ANS 235 or concurrently
NEW Reproductive anatomy and physiology, semen handling, artificial insemination in dairy cattle, palpation of female reproductive tract, ultrasound, embryo transfer, and in-vitro fertilization.
Effective Spring 2021

ANS 238  Dairy Health Management
Dairy Cattle Health Management
Spring of every year. 3(2-2) P: ANS 232 or concurrently P: ANS 134 R: Open to students in the Institute of Agricultural Technology.
Detection of dairy cattle disease. Infections and metabolic problems.
Effective Fall 2013 Effective Fall 2020

ANS 300C  Advanced Dairy Cattle Judging
Dairy Cattle Judging Team
Fall of every year. 2 credits. 2(0-4) P: ANS 200C R: Not open to freshmen. R: A student may earn a maximum of 8 credits from the following courses: ANS 200A, ANS 200C, ANS 200D, ANS 200E, ANS 300A, ANS 300C, ANS 300D, ANS 300E, and ANS 300F.
Effective Fall 2013 Effective Fall 2020

ANS 300E  Animal Welfare Judging
Fall of every year. 4(0-2) 2(0-4) A student may earn a maximum of 6 credits in all enrollments for this course. P: ANS 200E P: ANS 200E or concurrently RB: (ANS 110) and (ANS 305 or IBIO 313) R: Not open to freshmen. R: A student may earn a maximum of 8 credits from the following courses: ANS 200A, ANS 200C, ANS 200D, ANS 200E, ANS 200F, ANS 300A, ANS 300C, ANS 300D, ANS 300E, and ANS 300F.
Effective Summer 2017 Effective Fall 2020
ANS 300F  Advanced Dairy Farm Evaluation
Dairy Challenge Experiences
Spring of every year. 2(0-4) P: (ANS 200F and ANS 432) and (ANS 430 or concurrently) P: ANS 434 or concurrently RB: ANS 313 RB: ANS 434 R: Not open to freshmen or sophomores. Approval of department. R: Approval of department. A student may earn a maximum of 8 credits from the following courses: ANS 200A, ANS 200C, ANS 200D, ANS 200E, ANS 300A, ANS 300C, ANS 300D, ANS 300E, and ANS 300F.
Evaluation of factors important in successful management of a dairy farm business. Represent Michigan State University in intercollegiate competition. Field trips required. Effective Fall 2013 Effective Fall 2020

ANS 334  Dairy Management I
Fall of every year. 3(2-2) P: ANS 234 RB: ANS 313
NEW Analysis of dairy farm production practices, procedures, and decision-making. Financial analysis of biological and management practices. Field trips required. SA: ANS 230, ANS 432 Effective Fall 2020

ANS 430  Dairy Systems Management
Spring of every year. 3(2-3) P: ANS 313 and ANS 432 R: Not open to freshmen or sophomores. Decision-making strategies for dairy farms. Emphasis on herd replacements, personnel, health, facilities, nutrient management and other issues associated with dynamic markets and business environments. Field trips required. DELETE COURSE Effective Fall 2020

ANS 432  Advanced Dairy Cattle Management
Fall of every year. 3(2-2) P: ANS 232 RB: ANS 313 R: Not open to freshmen or sophomores. Management techniques for operating a dairy herd. Mastitis control, reproductive and nutrition management, records, and general herd health. Field trips required. DELETE COURSE Effective Fall 2020

ANS 434  Dairy Management II
Spring of every year. 3(2-2) P: ANS 334
NEW Integration, analysis, and problem solving related to dairy production. Field trips required. SA: ANS 430, ANS 432 Effective Fall 2020

ENT 404  Fundamentals of Entomology
Fall of every year. 3(2-1) 4(2-4) P: BS 162 or PLB 105 or LB 144
Insect classification, identification, diversity, physiology and ecology. Importance of insects to humans and the environment. Insect collection required. Effective Fall 2013 Effective Fall 2020

FSC 422  Advanced Professional Seminar in Food Science
Spring of every year. 1(1-0) P: FSC 222 RB: Advanced course work in food science R: Open to students in the Food Science Major. Preparation for success in food science careers, marketing tools, business communication skills, and contemporary topics in food science. DELETE COURSE Effective Summer 2019
FSC 843  Exposure Science and Environmental Epidemiology
Exposure Science and Epidemiology
Fall of even years, Spring of odd years. 3(3-0) RB: Statistics, basic biological and chemical science
Effective Fall 2019 Effective Fall 2020

HRT 841  Foundation in Computational and Plant Sciences
Fall of every year. 3(3-0) Interdepartmental with Biochemistry and Molecular Biology and Computational Mathematics, Science, & Engineering and Crop and Soil Sciences and Plant Biology.
NEW Computational modeling applied to plant biology. Data analysis, algorithmic thinking, model building, bioinformatics, and molecular biology using coding and computational resources.
Effective Fall 2020

COLLEGE OF ENGINEERING

BE 469  Sustainable Bioenergy Systems
Spring of every year. 3(3-0) Interdepartmental with Chemical Engineering. P: BE 230 or CHE 201 P: ((BE 230 or CHE 201) and (BE 351 or CHE 321)) or (ME 201 and ENE 481) RB: CSS 467 and CHE 468 R: Open to juniors or seniors in the College of Engineering. Biorefinery analysis and system design. Life cycle assessment to evaluate sustainability of bioenergy systems. Current policy regulating the bioeconomy and system economics. Product commercialization.
Effective Fall 2013 Effective Fall 2020

CE 275  GIS for civil and environmental engineers
Fall of every year. Spring of every year. 1(1-3) P: (EGR 100 and EGR 102) and (CE 274 or concurrently)
NEW Basic operations in GIS software with applications to civil and environmental engineering
Effective Fall 2021

CE 341  Transportation Engineering
Fall of every year. Spring of every year. 3(3-0) P: ((MTH 234 or concurrently) or (MTH 254H or concurrently)) or (LB 220 or concurrently)) or (CE 372 or concurrently) or (STT 200 or concurrently)) R: Open to juniors or seniors in the Department of Civil and Environmental Engineering or in the Urban and Regional Planning Major.
Overview of transportation system issues and problems. Fundamentals of highway design and operations. Planning and evaluation of transportation system alternatives. Fundamentals of transportation planning, traffic flow and level-of-service, traffic signal design, geometric design of highways, and highway safety. SA: CE 346
Effective Fall 2016 Effective Fall 2021
CE 371  Sustainable Civil and Environmental Engineering Systems  
Fall of every year. Spring of every year. 3(3-0) Interdepartmental with Environmental Engineering.  
P: ((MTH 234 or concurrently) or (LB 220 or concurrently) or (MTH 254H or concurrently)) and  
ENE 280  P: (MTH 234 or concurrently) or (LB 220 or concurrently) or (MTH 254H or concurrently)  
R: Open to juniors or seniors in the Civil Engineering Major or in the Environmental Engineering Major.  
Principles and tools of sustainable design and engineering economics in Civil and  
Environmental Engineering.  
SA: CE 272  
Effective Fall 2017 Effective Fall 2021

CE 372  Risk Analysis in Civil and Environmental Engineering  
Fall of every year. Spring of every year. 2(2-0) 3(2-2) P: (MTH 234 or concurrently) or (LB 220 or  
concurrently) or (MTH 254H or concurrently) R: Open to juniors in the Civil Engineering Major or in  
the Environmental Engineering Major and open to seniors in the Civil Engineering Major or in the  
Environmental Engineering Major.  
Applications of probability, statistics, uncertainty and risk analysis to topics in civil and  
environmental engineering, characterization of system safety, and comparison tests for  
engineering quality control and environmental analyses. Applications of probability,  
statistics, uncertainty and risk analysis to topics in civil and environmental engineering,  
characterization of system safety, and comparison tests for engineering quality control  
and environmental analyses, and hands-on lab exercises for data analyses and  
visualization.  
SA: CE 272  
Effective Fall 2017 Effective Fall 2021

CE 473  Smart and Sustainable Building Design and Operations  
Spring of odd years. 3(3-0) Interdepartmental with Environmental Engineering. P: CE 371  or  
approval of department  
NEW  
Elements of the design and operation of smart and sustainable buildings, current and  
future energy-related challenges of existing buildings, methods for improving the energy  
performance and sustainability of buildings, green building standards, codes, and  
certifications, building energy modeling, human-building interactions, and smart building- 
electric grid integration methods  
Effective Spring 2021

CE 485  Landfill Design  
Spring of every year. 3(3-0) Interdepartmental with Environmental Engineering. P: ENE 280 and  
CE 312  P: ENE 280 and CE 321 RB: CE 312  
Geotechnical and environmental design of solid waste landfills.  
Effective Spring 2020 Effective Fall 2020

CE 496  Review for the CE and ENE Fundamentals of Engineering Exams  
Fall of every year. Spring of every year. 1(1-0) P: CE 495 or concurrently  
NEW  
Review of general, civil, and environmental engineering topics in preparation for sitting  
the NCEES Fundamentals of Engineering Exam  
Request the use of the Pass-No Grade (P-N) system.  
Effective Fall 2021
ENE 280  Principles of Environmental Engineering and Science
Fall of every year. Spring of every year. 3(3-0) Interdepartmental with Civil Engineering. P: (CEM 141 or CEM 151 or LB 171) and ((MTH 132 or concurrently) or (MTH 152H or concurrently)) or (LB 418 or concurrently)) P: (CEM 141 or CEM 151 or LB 171) and (MTH 133 or MTH 153H or LB 119)


Effective Fall 2013 Effective Fall 2021

ENE 472  Life Cycle Assessment of Energy Technologies
Spring of every year. 3(2-2) Interdepartmental with Civil Engineering. P: CE 371 or approval of department R: Open to students in the College of Engineering.

NEW The use of life-cycle assessment (LCA) for energy technologies to evaluate trade-offs between various energy options and guide energy choices.

Effective Spring 2021

ENE 480  Environmental Measurements Laboratory
Fall of every year. 1(0-3) 2(1-3) Interdepartmental with Civil Engineering. P: (CEM 161 or CEM 185H or LB 171L) and ENE 280 and (CEM 142 or CEM 152 or CEM 182H or LB 172) and ((ENE 481 or concurrently) or (ENE 483 or concurrently)) and Completion of Tier I Writing Requirement R: Open to juniors or seniors or graduate students in the College of Engineering.

Basic chemical and microbiological methods used in the analysis of environmental media. Laboratory safety, quality assurance, quality control, and statistics used in laboratory analysis. Related technical communication, laboratory report writing.

Effective Fall 2018 Effective Fall 2021

ENE 481  Environmental Chemistry: Equilibrium Concepts
Fall of every year. 3(3-0) Interdepartmental with Civil Engineering. P: ((CEM 141 and CEM 142) or (CEM 151 and CEM 152) or (CEM 181H and CEM 182H) or (LB 171 and LB 172)) and (ENE 280 or BE 230 or GLG 201 or GLG 301 or approval of department) P: ((CEM 141 and CEM 142) or (CEM 151 and CEM 152) or (CEM 181H and CEM 182H) or (LB 171 and LB 172)) and (ENE 280 or BE 230 or GLG 201 or GLG 301 or approval of department) and ((CHE 201 or concurrently) or (CEM 251 or concurrently)) R: Open to sophomores or juniors or seniors or graduate students in the Department of Biosystems and Agricultural Engineering or in the Department of Chemical Engineering and Materials Science or in the Department of Civil and Environmental Engineering or in the Department of Earth and Environmental Sciences.

Chemistry of natural environmental systems and pollutants. Equilibrium concepts and calculations for acid-base, solubility, complexion, redox and phase partitioning reactions and processes. Applications to ecosystem analysis, pollutant fate and transport, and environmental protection. Chemistry of environmental systems and air, water, and soil pollutants as applied to environmental engineering.

Effective Fall 2013 Effective Fall 2021

ENE 489  Air Pollution: Science and Engineering
Spring of every year. 3(3-0) Interdepartmental with Civil Engineering. P: ((CEM 141 or CEM 151 or LB 171) and (MTH 133 or MTH 153H or LB 119)) and (ENE 280 or BE 230) and (CE 321 or CHE 311) P: (CEM 141 or CEM 151 or LB 171) and (MTH 133 or MTH 153H or LB 119) and (ENE 280 or BE 230) and (CE 321 or CHE 311) and (CE 372 or CHE 316) and (ME 201 or concurrently) or (BE 351 or concurrently) or (CHE 321 or concurrently) R: Open to juniors or seniors or graduate students in the College of Engineering.

Basic physical and chemical principles governing indoor and atmospheric air pollution. Elements of air pollution meteorology, climate change, atmospheric transformations and transport. Air pollution sources and methods for their control. The role of local, state and federal government in air pollution control. Basic physical and chemical principles governing indoor and atmospheric air pollutant fate, transport and control technologies.

Effective Fall 2013 Effective Fall 2021
CMSE 830 Foundations of Data Science
Fall of every year. 3(3-0) RB: (CMSE 201 or CSE 231 or CMSE 801) and (MTH 235 or MTH 340 or MTH 347H) and (MTH 309 or MTH 314 or MTH 317H) and STT 810) R: Not open to doctoral students in the Computational Mathematics, Science and Engineering.
NEW Core mathematical principles that underlie the algorithms and methods used in data science. Applications to problems in data analysis.
Effective Spring 2020

CMSE 831 Computational Optimization
Spring of every year. 3(3-0) RB: (CMSE 201 or CMSE 801 or CSE 231) and (MTH 235 or MTH 340 or MTH 347H) and ((MTH 309 or MTH 314 or MTH 317H) and STT 810)
NEW Applications and algorithms for finite-dimensional linear and non-linear optimization problems.
Effective Spring 2020

CSE 404 Introduction to Machine Learning
Fall of every year. 3(3-0) Interdepartmental with Computational Mathematics, Science, & Engineering and Statistics and Probability. P: (CSE 331) and (STT 351 or STT 380 or STT 430 or STT 441) P: (CSE 331) and (STT 351 or STT 380 or STT 430 or STT 441) and MTH 314 RB: Basic linear algebra P: Open to juniors or seniors in the College of Engineering or in the Computer Science Minor or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major. R: Open to juniors or seniors in the College of Engineering or in the Computer Science Minor or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Data Science Major.
Core principles and techniques of all machine learning including model design and programming algorithms. Core principles and techniques for machine learning including algorithms, model design, and programming.
Effective Fall 2019 Effective Fall 2021

ECE 817 Advanced Electrical Drives
Fall of every year. 3(3-0) RB: ECE 313 and ECE 320 Not open to students with credit in ECE 424.
NEW Modeling and control of AC motors
Effective Fall 2021

ECE 818 Robotics
Spring of every year. 3(3-0) RB: ECE 313 or ME 451 RB: ECE 313 or ME 451 or equivalent P: Open only to graduate students in the College of Engineering. R: Open to graduate students in the College of Engineering. Not open to students with credit in ECE 417.
Robot modeling, kinematics, dynamics, trajectory planning, programming, sensors, controller design. Robot modeling, kinematics, dynamics, trajectory planning, sensors, controller design, motion planning.
Effective Summer 2002 Effective Fall 2020

ECE 821 Advanced Power Electronics and Applications
Fall of every year. 3(3-0) RB: Power and computer engineering areas. Not open to students with credit in ECE 425.
Power semiconductor devices, circuits, control, and applications. Converter and inverter analysis and design, DSP (Digital Signal Processor) control and implementation. Automotive and utility applications.
Effective Fall 2002 Effective Fall 2021

ECE 825 Alternating Current Electrical Machines and Drives
Spring of even years. 3(3-0) P: ECE 817 RB: ECE 320 Analysis, modeling and design of synchronous, induction, and switched reluctance machines. Design drives for motion control and power system applications.
SA: EE 825
Effective Summer 1990 Effective Fall 2021
ECE 827  Power Electronic Systems for Renewable Energy, Transportation, and Utility Applications  
Spring of odd years. 3(3-0) P: ECE 821  
NEW  
Effective Spring 2022

ECE 830  Embedded Cyber-Physical Systems  
Fall of every year. 3(3-0) RB: Undergraduate degree in Electrical Engineering, Computer Engineering, or related major. ECE 331 or equivalent, basic programming (equivalent to that covered in CSE 231), operating system (UNIX and Windows), and application software skills. Background in probability and statistics equivalent to that covered in STT 351. R: Open to students in the Department of Electrical and Computer Engineering. Not open to students with credit in ECE 430.  
NEW  
Effective Fall 2020

ECE 842  Performance Modeling of Communication Networks  
Fall of every year. 3(3-0) RB: ECE 280 or STT 351 R: Open to students in the Department of Electrical and Computer Engineering. Not open to students with credit in ECE 442.  
NEW  
Fundamental theories and protocols for communication networks, with an emphasis on statistical performance modeling of Medium Access Control, Data Link Control, Routing, and Transport Layer Protocols. Network analysis and design using optimization techniques and statistical tools including Markov Processes, Queueing Theory, and emerging machine learning methodologies such as Reinforcement Learning. Simulation based and application-driven hands on class projects in support of lecture material.  
Effective Fall 2020

ECE 924  Power Electronic Systems for Renewable Energy, Transportation, and Utility Applications  
Spring of even years. 3(3-0) P: ECE 821  
NEW  
DELETE COURSE  
Effective Spring 2022

COLLEGE OF HUMAN MEDICINE

EM 634  Special Topics in Emergency Medicine  
Fall of every year. Spring of every year. Summer of every year. 3(3-0) A student may earn a maximum of 3 credits in all enrollments for this course. P: HM 556 R: Open to graduate-professional students in the College of Human Medicine.  
NEW  
Knowledge and skills to manage acute medical emergencies in adult and pediatric patients.  
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 Spring 2020
EPI 919  COVID-19 Epidemiology and Public Health  
Fall of every year. Spring of every year. Summer of every year. 3(3-0) R: Open to graduate students in the Department of Epidemiology and Biostatistics or approval of department. 
NEW  
Application of epidemiologic and public health principles to COVID-19.  
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 2020

FM 614  Breastfeeding and Lactation  
Fall of every year. Spring of every year. Summer of every year. 3(3-0) A student may earn a maximum of 3 credits in all enrollments for this course. P: HM 556 R: Open to graduate-professional students in the College of Human Medicine. 
NEW  
Skills and knowledge necessary to advise and assist breastfeeding infants and their mothers including management of common difficulties.  
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 Spring 2020

HM 625  Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, Asexual+ Health Care  
Fall of every year. Spring of every year. Summer of every year. 3(3-0) P: HM 556 R: Open to graduate-professional students in the College of Human Medicine. 
NEW  
LGBTQIA+ history and culture, identification of own biases, and skills in engaging the LGBTQIA+ community in a clinical setting.  
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 Spring 2020

HM 626  Special Topics in Neurologic Conditions  
Fall of every year. Spring of every year. Summer of every year. 3(3-0) A student may earn a maximum of 3 credits in all enrollments for this course. P: HM 556 R: Open to graduate-professional students in the College of Human Medicine. 
NEW  
Case-based overview of common neurologic conditions, diagnosis, treatment.  
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 Spring 2020

HM 825  Transition to Graduate Academic Writing  
Fall of every year. Spring of every year. Summer of every year. 1(1-0) RB: completion of Tier 2 writing assignment or undergraduate degree R: Approval of college. 
NEW  
Identify, analyze, and incorporate scholarly articles and published research studies to develop and organize writing skills within the genre of academic writing and scholarship.  
Request the use of the Pass-No Grade (P-N) system.  
Effective Summer 2020
PART II - NEW COURSES AND CHANGES – continued - 25
September 17, 2020

HM 847  Public Health in Ghana: Methods for Community Practice
Public Health in Ghana: A One Health Perspective
Summer of every year. 4(4-0) 5(5-0) Interdepartmental with Osteopathic Medicine. P: HM 848 RB: Academic or professional background in public health and/or public health related discipline; undergraduate level health-related discipline. P: Open to students in the Public Health Major and open to juniors or seniors. Approval of college; application required. R: Approval of college; application required.
Overview of major public health issues and the health care system, both Western and traditional, in Ghana. Health status indicators and determinants; major programs/strategies; organization of the health care system, access to and payment for care; role, image and status of health care providers; interface between Western and traditional medicine; basic qualitative and quantitative field research methods for community health. Major public health issues in Ghana from a One Health perspective; interface between Western and traditional health care beliefs and practices in Ghana; community engagement experience employing participatory research methods with emphasis on social justice and ethical conduct of research.
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 2015 Effective Summer 2021

HM 862  Global Pandemics and Public Health Systems, Law, and Community Impacts
Fall of every year. Spring of every year. 3(3-0) P: HM 101 R: Open to students in the Public Health Major and open to juniors or seniors and open to graduate students. Approval of department.
Effective Summer 2020

MED 492  Basics and Methods in Biomedical Research
Fall of every year. Spring of every year. 2 to 4 credits. P: {{(BS 161 or BS 181H) and (BS 171 or BS 191H)} or LB 145} and ((MTH 103 or MTH 110 or MTH 116) or designated score on Mathematics Placement test ) and (CEM 252 or CEM 352) P: {{(BS 161 or BS 181H) and (BS 171 or BS 191H)} or LB 145} and ((MTH 103 or MTH 116) or designated score on Mathematics Placement test ) and (CEM 252 or CEM 352) R: Approval of department.
Introduction to research concepts, strategies, methods and laboratory techniques in biomedical research. Laboratory safety, regulations, quality control and quality assurance. Online presentations and hands-on experience.
Effective Spring 2015 Effective Summer 2020

COLLEGE OF NATURAL SCIENCE

BMB 479  Special Topics in Biochemistry II
Fall of every year. Summer of every year. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. P: BMB 461 R: Open to undergraduate students in the Biochemistry and Molecular Biology/Biotechnology Major or in the Biochemistry and Molecular Biology major or in the Lyman Briggs Biochemistry and Molecular Biology Coordinate Major or in the Lyman Briggs-Biochemistry/Biotechnology Coordinate Major or approval of department.
NEW   Special topics in biochemistry and molecular biology
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 Fall 2020
CEM 383  Introductory Physical Chemistry I  
Fall of every year. 3(4-0) P: (CEM 142 or CEM 152 or CEM 182H or LB 172) and (MTH 133 or MTH 153H or MTH 126 or LB 119) RB: PHY 184 or PHY 232 or PHY 232C or PHY 294H or LB 274. RB: PHY 184 or PHY 232 or PHY 232C or PHY 294H or LB 274 or PHY 174 or PHY 222 or PHY 242.  
Physical chemistry of macroscopic systems: thermodynamics, kinetics, electrochemistry.  
SA: CEM 391.  

CEM 384  Introductory Physical Chemistry II  
Spring of every year. 3(4-0) P: (CEM 142 or CEM 152 or CEM 182H or LB 172) and (MTH 133 or MTH 153H or MTH 126 or LB 119) and (PHY 184 or PHY 232 or PHY 232C or PHY 294H or LB 274) P: (CEM 142 or CEM 152 or CEM 182H or LB 172) and (MTH 133 or MTH 153H or MTH 126 or LB 119) and (PHY 184 or PHY 232 or PHY 232C or PHY 294H or LB 274 or PHY 174 or PHY 222 or PHY 242) RB: CEM 383.  
Physical chemistry of microscopic systems: quantum mechanics, spectroscopy.  

CEM 483  Quantum Chemistry  
Fall of every year. 3(4-0) P: (MTH 235 or MTH 347H or MTH 340) and (PHY 184 or PHY 294H or LB 274 or PHY 232) and (CEM 142 or CEM 152 or CEM 181H or LB 172) P: (MTH 235 or MTH 235 or MTH 347H or MTH 340) and (PHY 184 or PHY 294H or LB 274 or PHY 232 or LB 172) P: (MTH 235 or MTH 235 or MTH 347H or MTH 340) and (PHY 184 or PHY 294H or LB 274 or PHY 184B or PHY 174) and (CEM 142 or CEM 152 or CEM 181H or LB 172).  
Postulates of quantum mechanics and the application to model systems, atoms and molecules.  Introduction to molecular spectroscopy.  
SA: CEM 362, CEM 461.  
Effective Fall 2015. Effective Fall 2020.

ISB 210L  Science and Society: Impacts of Daily Decisions Lab  
Fall of every year. Spring of every year. Summer of every year. 2(1-2) P: MTH 101 or MTH 103 or MTH 103B.  
NEW  Students will investigate and analyze the environmental and personal impacts of daily decisions (fuels, energy, food, water, consumer goods, etc.)  
Effective Fall 2020.

MTH 201  Elementary Mathematics for Teachers I  
Fall of every year. Spring of every year. Summer of every year. 3(3-0) P: (MTH 103 or MTH 116 or MTH 124 or MTH 132 or MTH 152H or LB 118 or MTH 101 or MTH 102) or designated score on Mathematics Placement test.  
R: Open to students in the Child Development major or in the Education Major or in the Special Education-Learning Disabilities Major or in the Teacher Certification Internship Year Studies Program.  
Mathematics needed for K-9 teaching. Place value and models for arithmetic, mental math, word problems, and algorithms. Factors, primes, proofs, and prealgebra. Fractions, ratios, rates, and percentages. Negative, rational, and real numbers. Special emphasis on the appropriate sequential order for teaching. Mathematics needed for teaching grades PreK - 6. Place value, algorithms for whole numbers, decimals, and fractions with an emphasis on children’s mathematical thinking.  

MTH 202  Elementary Mathematics for Teachers II  
Fall of every year. Spring of every year. Summer of every year. 3(3-0) P: MTH 201 P: Open to students in the Education Major or in the Special Education-Learning Disabilities Major or in the Teacher Certification Internship Year Studies Program.  
A continuation of MTH 201. Measurement, elementary geometry, and elementary number theory with an emphasis on children’s mathematical thinking.  
MMG 999  Doctoral Dissertation Research
Fall of every year. Spring of every year. Summer of every year. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open to graduate students in the Genetics Major or in the Microbiology and Molecular Genetics Major.
Doctoral dissertation research.
Request the use of the Pass-No Grade (P-N) system.
Effective Summer 2014  Effective Spring 2019

PLB 416L  Plant Physiology Laboratory
Spring of every year. 2(1-3) P: (CEM 143 or CEM 351 or CEM 251) and (BS 161 or LB 145 or BS 181H) and (PLB 415 or concurrently) and (BS 171 or BS 191H or approval of department) P: (CEM 143 or CEM 351 or CEM 251) and (BS 161 or LB 145 or BS 181H) and (PLB 415 or concurrently) and (BS 171 or BS 191H or LB 145 or approval of department)
Experimental methods and experiment design in plant physiology and molecular biology, with emphasis in photosynthesis, water relations, plant growth, plant development, genetics and gene regulation. Communication of scientific information in written and graphical format.
Effective Fall 2017  Effective Spring 2021

PLB 495  Botanical Garden Internship
Internship in Plant Biology
Fall of every year. Spring of every year. Summer of every year. 2 to 8 credits. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. A student may earn a maximum of 12 credits in all enrollments for this course. R: Approval of department.  R: Approval of department; application required.
Activities, functions and organization of botanical gardens. Principles of live plant curation. Supervised professional experience related to plant biology in industry, government, or non-profit settings.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 3 semesters after the end of the semester of enrollment.
SA: BOT 495
Effective Fall 2014  Effective Fall 2020

PLB 814  Advanced Principles and Applications of Epigenetics. (D)
Spring of odd years. 3(3-0) Interdepartmental with Integrative Biology. P: IBIO 341 or CSS 350 or approval of college R: Not open to undergraduate students or approval of college. Not open to students with credit in PLB 480.
NEW
This course will cover epigenetics and epigenomics including the molecular mechanisms of epigenetic modifications of eukaryotic genomes; how the epigenome, in concert with the genome, controls versatile biological processes and cell fates, including stem cells, reprogramming and differentiation; and the association of epigenetic modifications with cancer and other human diseases, as well as traits associated with plant development and production. A set of 15 lectures will cover various areas of epigenetics. A recent research publication related to each of the lecture will be discussed.
Effective Spring 2021

STT 380  Probability and Statistics for Data Science
Fall of every year. Spring of every year. 4(4-0) P: ((MTH 234 or concurrently) or (MTH 254H or concurrently) or (LB 220 or concurrently)) and (MTH 314 or concurrently) P: ((MTH 234 or concurrently) or (MTH 254H or concurrently) or (LB 220 or concurrently)) and (MTH 314 or concurrently) and STT 180
Fundamental concepts and methods in probability and statistics from a data science perspective.
Effective Fall 2019  Effective Fall 2020
COLLEGE OF OSTEOPATHIC MEDICINE

OST 620  Patient Safety and Quality Improvement
Fall of every year. Spring of every year. Summer of every year. 2 to 3 credits. A student may earn a maximum of 4 credits in all enrollments for this course. R: Open to students in the College of Osteopathic Medicine.

NEW Patient Safety and Quality Improvement may be taken as 3-credit hour, 2-week virtual elective course that provides students with a foundational learning of patient safety and quality improvement. The rotation can be either a 3rd or 4th year elective that will consist of modules/videos on patient safety and quality improvement as well as scheduled video interactive lectures with the IOR. The student will also complete the certificate program in Quality and Safety offered by the Institute for Healthcare Improvement's (IHI) Open School.
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 Fall 2020

OST 621  Leadership in Healthcare
Fall of every year. Spring of every year. Summer of every year. 3(2-2) R: Open to students in the College of Osteopathic Medicine.

NEW Leadership in Healthcare is a three-credit hour, two-week elective course that provides students with an opportunity to engage in a curriculum that enables a growth mindset for aspiring leaders. Through a comprehensive curriculum, focused on building personal leadership tools, students will be exposed to various leadership theorists, professionally relevant media and publications, expert panelists, and group discussions, that seek to enhance one’s leadership acumen in the healthcare field.
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 Fall 2020