1. Request to change the requirements for the Bachelor of Science degree in Entomology in the Department of Entomology.

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

      (1) In item 1., replace paragraph three with the following:

      Students who are enrolled in the Entomology major may complete an alternative track to Integrative Studies in Biological and Physical Sciences by completing Entomology's mathematics and chemistry requirements and Biological Science 162. These courses meet the laboratory requirement.

      (2) In item 3. a., delete the following courses:

      - ZOL 355 Ecology 3
      - ZOL 355L Ecology Laboratory (W) 1

      Add the following courses:

      - ENT 470 General Nematology 3
      - IBIO 355 Ecology 3
      - IBIO 355L Ecology Laboratory (W) 1

      Effective Fall 2017.

2. Request to change the requirements in the Graduate Certificate in Forest Carbon Science, Policy and Management in the Department of Forestry. The University Committee on Graduate Studies (UCGS) will consider this request at its March 13, 2017 meeting.

   a. Under the heading Requirements for the Graduate Certificate in Forest Carbon Science, Policy and Management make the following change:

      (1) Change the total credits from '12' to '9' and delete the following course:

      - FOR 831 Forest Biogeochemistry and Global Climate Change 3

      Effective Fall 2017.
COLLEGE OF ENGINEERING

1. Request to change the Graduation Requirements for All Majors in the College of Engineering. The University Committee on Undergraduate Education will consider this request.
   a. Under the heading Graduation Requirements for All Majors make the following changes:
      (1) In item 1. a., delete Zoology 141.
      (2) In item 2. a., delete ‘and Applied Engineering Sciences’.

   Effective Fall 2017.

2. Request to change the requirements for the Bachelor of Science degree in Applied Engineering Sciences in the College of Engineering.
   The concentrations in the Bachelor of Science degree in Applied Engineering Sciences 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 Applied Engineering Sciences make the following changes:
      (1) In item 3. a. make the following changes:
          (a) Change the total credits from ‘46’ to ‘43’.
          (b) Delete the following courses:
              COM 225 Introduction to Interpersonal Communication 3
              MGT 325 Management Skills and Processes 3

              Add the following course:
              ENE 280 Principles of Environmental Engineering and Science 3

      (2) In item 3. b. delete the following courses:
          BE 230 Engineering Analysis of Biological Systems 3
          ENE 280 Principles of Environmental Engineering and Science 3

          Add the following courses:
          COM 225 Introduction to Interpersonal Communication 3
          MGT 325 Management Skills and Processes 3

      (3) In item 3. c. make the following changes:
          (a) In the Computer Science concentration in item 3. add the following courses:
              CSE 476 Mobile Application Development 3
              CSE 477 Web Application Architecture and Development 3
              CSE 480 Database Systems 3
              CSE 482 Big Data Analysis 3

          (b) In the Packaging concentration make the following changes:
              (i) Change the total credits from ‘18’ to ‘17’.
              (ii) Change the credits of ‘PKG 221’ from ‘3’ to ‘2’.
(c) In the Media and Information concentration delete the following courses:

- MI 300 Media Policy and Economics 3
- MI 301 Bringing Media to Market 3
- MI 458 Project Management (W) 3

Add the following courses:

- MI 302 Networks, Markets and Society 3
- MI 305 Media and Information Policy 3
- MI 488 Information and Communication Technology Development Project (W) 3

Effective Fall 2017.

3. 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. a. (1) delete the following course:

- ZOL 141 Introductory Human Genetics 3

Add the following course:

- MMG 141 Introductory Human Genetics 3

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

- CSE 473 Fundamentals of 3D Game Development 3

Add the following courses:

- CSE 402 Biometrics and Pattern Recognition 3
- CSE 415 Introduction to Parallel Programming 3
- CSE 431 Algorithm Engineering 3
- CSE 482 Big Data Analysis 3

(3) In item 3. d. (1) delete ‘EC 210’ and replace with ‘EC 201’.

Effective Fall 2017.
COLLEGE OF HUMAN MEDICINE

1. Request to establish a Doctor of Philosophy degree in Biostatistics in the Department of Epidemiology and Biostatistics. The University Committee on Graduate Studies (UCGS) will consider this request at its January 9, 2017 meeting.

   a. Background Information:

      Biostatistics is an innovative field that focuses on the application of statistics to the design, analysis, and interpretation of data for studies in public health, epidemiology, medicine, and more broadly the life sciences. The advent of modern computation technology has enabled the exploration of vast information collected by the government, business and researchers alike routinely. The future of public health and medicine belongs to the people who can turn data into useful information. Big data is but one example that highlights the promise and challenge the next generation of scientists must face. Special techniques are needed to extract "information" from these massive databases, often assembled without a strict statistical sampling design. Health Informatics, Medical Informatics and Bioinformatics have emerged as interdisciplinary fields that use statistics in their core. The American Medical Informatics Association (AMIA) describes Biomedical Informatics as ‘an interdisciplinary, scientific field that studies and pursues the effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving and decision making, motivated by efforts to improve human health.’ Therefore, the proposal to offer a Ph.D. program in Biostatistics is appropriate and timely. Biostatistics programs are typically offered only at the post-undergraduate level.

      MSU offers a Ph.D. program in Statistics in the College of Natural Science, which, according to the Academic Programs catalog, "is designed for students who plan to pursue careers in university teaching and research or in industrial and government consulting and research." Even though the focus in the proposed Ph.D. program in Biostatistics is substantially different from that in Statistics, students will be required to take two courses in the Department of Statistics and Probability to build a solid foundation for their study.

      MSU has three colleges of medicine – College of Human Medicine, College of Osteopathic Medicine, and College of Veterinary Medicine – however, there is no Ph.D. program in Biostatistics in any college. The recent crisis in Flint prompted demands for and interests in local scientists who are passionate in addressing public health issues. The pervasive and perhaps omnipresent nature of statistical methods, nuanced by the specific applications in the health sciences, makes it an ideal time to offer a Ph.D. program at MSU to begin making investments in training the next generation of Biostatisticians.

      MSU does not have a School of Public Health, which is where most educational programs in Biostatistics around the country are housed. In the United States, several universities have dedicated biostatistics departments, but many other top-tier universities integrate biostatistics into other departments, such as epidemiology. The Department of Epidemiology and Biostatistics in the College of Human Medicine is the ideal place for the program.

   b. Academic Programs Catalog Text:

      The Doctor of Philosophy degree in Biostatistics provides students with the quantitative skills needed for the development, evaluation and application of novel methods for the analysis of modern biomedical data.

      Doctor of Philosophy

      In addition to meeting the requirements of the university, and of the College of Human Medicine, students must meet the requirements specified below.
Admission

For admission to the doctoral degree in biostatistics on regular status, the student must:

1. have a master’s degree in biostatistics, statistics, or related field;
2. submit Graduate Record Examination (GRE) scores, or MCAT scores;
3. provide TOEFL scores if their native language is other than English;
4. provide three letters of recommendation;
5. provide a statement of purpose;
6. provide official transcripts.

Applicants with strong academic records who are in the process of completing a master of science may be admitted on a provisional basis. The first 30 credits applied towards the completion of a master of science may not be counted toward the Ph.D. in Biostatistics. Applicants who are admitted without a master’s degree will be required to complete collateral course work to make up deficiencies. Collateral course work will not count towards the fulfillment of degree requirements. It is strongly recommended that applicants have taken course work in multivariate calculus, advanced undergraduate linear algebra and probability, and numerical computing.

Requirements for the Doctor of Philosophy Degree in Biostatistics

The doctoral degree program in biostatistics is selected in consultation with a faculty advisor and guidance committee. The doctoral degree program will offer three emphasis areas: design and analysis of medical studies; big data and statistical genetics; and biometry, a flexible option for students with diverse interests.

Student’s must:

1. Complete 25 credits in the required courses for the chosen emphasis area, and electives.
2. Pass the comprehensive examination which contains two modules: the first (3/4 of the exam) will be based on the content covered in the required courses common to all emphasis areas; and the second (1/4 of the exam) will be based on the required courses in the chosen emphasis area. A student who fails the comprehensive examination may retake the examination within six months after the first take, usually in January of the following year.

Effective Fall 2017.
1. Request to establish a **Graduate Certificate in Neuroscience and the Law** in the Program in Neuroscience. The University Committee on Graduate Studies (UCGS) will consider this request at its January 9, 2017 meeting.

   a. **Background Information:**

   Neuroscience is playing a greater role in society broadly and also in the legal system in the United States. Neuroscience and the Law is becoming increasingly important as more information becomes available about brain development, sociopathy/psychopathy, predisposition to criminal behavior, and mental illness. Advanced techniques in neuroimaging allow for more precise detection of brain injuries or disorders that could lead to cognitive impairment and influence behavior along with improving the detection of witness veracity. As neuroscience research continues to advance knowledge about the brain and behavior, legal and social work professionals need to understand the promise and limitations of neuroscientific evidence and how best to interpret findings to make informed decisions in and out of the courtroom. From criminal cases to personal injury, trusts and estates, contract law, guardianship and more, moral and ethical considerations need to be made regarding neuroscientific findings. The Graduate Certificate in Neuroscience and the Law will provide individuals working or studying in law or social science fields with the scientific knowledge necessary to effectively, accurately, and ethically use neuroscientific evidence in a professional setting.

   The growth of this field can be seen as other universities and organizations have begun focusing research and education initiative in Neurolaw. Brain injuries, cognitive impairment and criminal liabilities are key legal issues that have been highlighted in a series Nature Neuroscience reviews ([http://www.nature.com/nrn/series/neurosciencelaw/index.html#close](http://www.nature.com/nrn/series/neurosciencelaw/index.html#close)). The MacArthur Foundation also highlights the growth of neuroscience in the legal profession ([http://www.lawneuro.org/links.php](http://www.lawneuro.org/links.php)).

   Neuroscience and the Law is not represented in the MSU College of Law curriculum. Vanderbilt University offers a one-semester Law and Neuroscience course for currently enrolled students, and they also offer a dual degree JD/PhD program for Law and Neuroscience. Other universities have programs in Neuroscience and Society, which include topics on law-related content, and a number of neuroscience and law programs are hosting seminars and conferences on Neuroscience and Law. This program stands apart, however, as it will focus on providing courses to current legal professionals, not only to currently enrolled undergraduate or graduate/professional students. A review of curriculum at CIC institutions and universities within Michigan found no graduate certificate programs with similar goals and objectives. Three institutions offer a Neuroscience and the Law (or similar) course, two offer law specialties in the psychiatry field, and two offer graduate programs (MS, PhD, PhD/MPA, JD/PhD). However, none offer a fully-online program targeted at practicing legal professionals. Neuroscience and the Law is a fast-growing field, and MSU, with both a highly successful Neuroscience Program and School of Law, is an ideal home for this program.

   The faculty in the Neuroscience Program are nationally recognized experts in the field of neuroscience and have been successfully instructing graduate-level degree programs since 1998. As part of the graduate certificate program, two courses will cover law-based content, and the Neuroscience Program has reached out to the MSU College of Law for assistance in creating and delivering course content. However, since the majority of the courses proposed in the graduate certificate will be neuroscience-based, the Neuroscience Program is the best unit to house the certificate program.

   b. **Academic Programs Catalog Text:**

   The Graduate Certificate in Neuroscience and the Law is designed to provide individuals working in law or social sciences fields with the scientific knowledge necessary to effectively, accurately, and ethically use neuroscientific evidence in a professional setting. The certificate will meet the needs of both working professionals and full-time students. The certificate is available online only.
Admission

To be considered for admission to the Graduate Certificate in Neuroscience and the Law, students must:

1. have a bachelor's degree.
2. have a minimum cumulative undergraduate grade-point average of 2.25.
3. write a reflective essay describing how the certificate will enhance their professional and personal development.

Requirements for the Graduate Certificate in Neuroscience and the Law

Students must complete a minimum of 12 credits from the following courses:

<table>
<thead>
<tr>
<th>CREDITS</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>NEU 840</td>
<td>Social, Cognitive, and Affective Neuroscience</td>
<td>3</td>
</tr>
<tr>
<td>1.</td>
<td>NEU 892</td>
<td>Special Topics in Neuroscience and the Law</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>NEU 848</td>
<td>Foundations of Law and Legal Research</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Students who have completed at least one year of law school are not required to complete this requirement for the certificate.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>NEU 842</td>
<td>Neuroethics</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>NEU 843</td>
<td>Methods for Assessing the Nervous System</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>NEU 844</td>
<td>The Science and Ethics of Brain Interventions</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>NEU 845</td>
<td>Neuroscience of Drug Use and Human Disorders</td>
<td>3</td>
</tr>
</tbody>
</table>

Effective Fall 2018.

2. Request to change the requirements for the Master of Science degree in Biomedical Laboratory Operations in the Biomedical Laboratory Diagnostics Program. The University Committee on Graduate Studies (UCGS) will consider this request at its March 13, 2017 meeting.

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

(1) In item 1. change the total credits from ‘8’ to ‘9’ and add the following course:

<table>
<thead>
<tr>
<th>CREDITS</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>BLD 811</td>
<td>Fundamentals of Scientific</td>
<td>1</td>
</tr>
</tbody>
</table>

(2) Change the credits in item 2. from ‘14’ to ‘13’.

Effective Fall 2017.
3. Request to establish a Minor in Computational Mathematics, Science, and Engineering in the Department of Computational Mathematics, Science, and Engineering. The University Committee on Undergraduate Education (UCUE) will consider this request.

a. Background Information:

Computational science is the use of computational methods to solve scientific problems. It is a rapidly growing and evolving field. Modern research problems are often complex and require extensive computation, either to manipulate and explore vast quantities of data or to create sophisticated theoretical models or both. At present, training in the methods of computational science is ad hoc and varies widely at Michigan State University, and many faculty members, particularly in disciplines where computational techniques are not traditionally used, do not have the expertise to educate their students in necessary topics. Faculty discussion of this critical need at both the undergraduate and graduate levels – and the lack of a curriculum to address this need – precipitated extensive faculty discussion and the creation of this proposed undergraduate minor.

MSU is in the midst of a Provost-led initiative focusing on computational and data science, which involves the creation of a new Department of Computational Mathematics, Science, and Engineering, hiring faculty to staff this department and lead interdisciplinary initiatives in computation-enabled science, and the creation of both undergraduate and graduate curricula that support the need to educate MSU students across the university in computational techniques and give them a skillset that can be immediately applied to their course work and/or research, and which will make them more desirable to employers and graduate schools.

The minor will complement undergraduate students’ choice of majors with a set of courses that achieve several outcomes. Students that have achieved the goals of this minor will be able to:
- demonstrate a basic understanding of functional and object-oriented computer programming as applied to a range of problems in computational and data science;
- analyze problems in terms of the algorithms and pre-existing computational tools required to solve a range of problems in computational and data science, and write a program to efficiently solve the problem;
- construct and implement models and simulations of physical, biological, engineering, and social situations, and use these models/simulations to understand experimental or observational data; and
- apply some subset of discipline-focused or methodology-focused topics in computational and data science to solve problems in the student’s major discipline.

b. Academic Programs Catalog Text:

The Minor in Computational Mathematics, Science, and Engineering complements a students’ major by providing a strong background in computational modeling of a variety of systems using a broad range of computational techniques, functional and object-oriented computer programming, practice in computational thinking, as well as in-depth exposure to some subset of discipline-focused or methodology-focused topics in computational and or data science.

The minor is available as an elective to students who are enrolled in bachelor’s degree programs at Michigan State University. With the approval of the department and college that administer the student’s degree program, the courses that are used to satisfy the minor may also be used to satisfy the requirements for the bachelor’s degree.

Students who plan to complete the requirements of the minor should consult the undergraduate adviser in the Department of Computational Mathematics, Science, and Engineering.

Requirements for the Minor in Computational Mathematics, Science, and Engineering

Complete 17 credits from the following:

<table>
<thead>
<tr>
<th>C R E D I T S</th>
<th>C O U R S E</th>
<th>T I T L E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Both of the following courses (8 credits):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMSE 201</td>
<td>Introduction to Computational Modeling</td>
<td>4</td>
</tr>
<tr>
<td>CMSE 202</td>
<td>Computational Modeling Tools and Techniques</td>
<td>4</td>
</tr>
<tr>
<td>2. Complete a minimum of 9 credits from the following courses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEM 481</td>
<td>Seminar in Computational Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CMSE 401</td>
<td>Methods for Parallel Computing</td>
<td>4</td>
</tr>
<tr>
<td>CMSE 402</td>
<td>Visualization of Scientific Datasets</td>
<td>3</td>
</tr>
<tr>
<td>CSE 232</td>
<td>Introduction to Programming II</td>
<td>4</td>
</tr>
<tr>
<td>MTH 451</td>
<td>Numerical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MTH 452</td>
<td>Numerical Analysis II</td>
<td>3</td>
</tr>
</tbody>
</table>
PHY 480  Computational Physics  3
PLB 400  Introduction to Bioinformatics  3
STT 301  Computational Methods for Data Science  3
STT 461  Computations in Probability and Statistics  3
STT 465  Bayesian Statistical Methods  3

Additional courses may be used with approval the program advisor. Any CMSE 300-400 level courses including special topics and independent study courses will receive automatic approval. Courses outside of CMSE with a strong focus on the applications of computational methods or on discipline-related computational techniques will be considered.

Effective Fall 2017.
PART II - NEW COURSES AND CHANGES

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

FOR 898  Master's Professional Project
Fall of every year. Spring of every year. Summer of every year. 1 to 6 credits. A student may earn a maximum of 10 credits in all enrollments for this course. R: Open to master's students in the College of Agriculture and Natural Resources or in the Department of Forestry or in the Forestry Major. Approval of department.
NEW  Master's project, non-thesis research, practicum or other professional development capstone experiences.
Request the use of the Pass-No Grade (P-N) system.
Effective Fall 2017

COLLEGE OF ENGINEERING

CSE 232  Introduction to Programming II
Fall of every year. Spring of every year. 4(3-2) P: CSE 231 and (LB 118 or MTH 124 or MTH 132 or MTH 152H) P: (CSE 231 or CMSE 202) and (LB 118 or MTH 124 or MTH 132 or MTH 152H)
Continuation of object-centered design and implementation in C++. Building programs from modules. Data abstraction and classes to implement abstract data types. Static and dynamic memory allocation. Data structure implementation and algorithm efficiency. Lists, tables, stacks, and queues. Templates and generic programming.
SA: CSE 330
Effective Spring 2014  Effective Fall 2017

CSE 402  Biometrics and Pattern Recognition
Fall of every year. 3(3-0) P: CSE 331 and STT 351 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.
NEW  Biometrics is the science of recognizing individuals based on their physical (e.g., gait, signature) traits. This course will present the automated techniques used for feature extraction and pattern matching. The focus will be on face, fingerprint and iris recognition. Topics related to multimodal biometrics and biometric security/privacy will also be presented. The programming projects will be geared toward implementing basic feature extraction and pattern matching algorithms.
Effective Fall 2017

CSE 410  Operating Systems
Fall of every year. Spring of every year. 3(3-0) P: (CSE 232 and CSE 260) and (CSE 320 or ECE 331) R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor. 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 Computer Science Disciplinary Teaching Minor.
SA: CPS 410
Effective Fall 2015  Effective Fall 2017

CSE 415  Introduction to Parallel Computing
Spring of every year. 3(3-0) P: CSE 320 and CSE 331 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.
Effective Fall 2017
CSE 420  Computer Architecture
Fall of every year. Spring of every year. 3(3-0) P: (CSE 232 and CSE 260) and (CSE 320 or ECE 331) R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor. 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 Computer Science Disciplinary Teaching Minor.
SA: CPS 420
Effective Fall 2015 Effective Fall 2017

CSE 422  Computer Networks
Fall of every year. Spring of every year. 3(3-0) P: (STT 351 or ECE 280) and (CSE 410 or concurrently) R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor. 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. Computer network architectures and models. Physical media and signaling. Data link protocols. Medium access control. Routing and IP. Transport services including TCP/UDP. Network applications. Local-area and wide-area networks.
SA: CPS 422
Effective Fall 2015 Effective Fall 2017

CSE 425  Introduction to Computer Security
Spring of every year. 3(3-0) P: CSE 422 or concurrently R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor. 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.
Effective Fall 2015 Effective Fall 2017

CSE 429  Interdisciplinary Topics in CyberSecurity
Fall of every year. Spring of every year. 3(3-0) Interdepartmental with Criminal Justice. P: CSE 101 or CSE 131 or CSE 231 R: Open to juniors or seniors or graduate students. Technical, legal, criminal, medical business, and communication aspects of CyberSecurity.
Effective Spring 2014 Effective Fall 2017

CSE 431  Algorithm Engineering
Fall of every year. Spring of every year. 3(3-0) P: CSE 331 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.
NEW This course will review algorithm analysis, design, implementation, and optimization for a broad range of problem categories. Students will develop an intuition for how to approach new or unfamiliar computational problems, including techniques to recognize and cope with intractable problems.
Effective Fall 2017
CSE 435  Software Engineering  
Fall of every year, 3(3-0)  
P: (CSE 331 and CSE 335) and completion of Tier I writing requirement  
R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor.  
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.  
Software lifecycle including specification, design, coding, testing, and verification of a software product. Stepwise refinement and traceability. Software maintenance and documentation.  
SA: CSE 470  
Effective Fall 2015 Effective Fall 2017

CSE 440  Introduction to Artificial Intelligence  
Fall of every year, 3(3-0)  
P: CSE 331  
R: Open to students in the Computer Engineering Major or in the Computer Science Major 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 Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major.  
SA: CPS 440  
Effective Fall 2015 Effective Fall 2017

CSE 450  Translation of Programming Languages  
Fall of every year, Spring of every year, 3(3-0)  
P: CSE 331 and (CSE 320 or ECE 331)  
R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor.  
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.  
SA: CPS 450  
Effective Fall 2015 Effective Fall 2017

CSE 460  Computability and Formal Language Theory  
Fall of every year, Spring of every year, 3(3-0)  
P: CSE 331  
R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor.  
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 Computer Science Disciplinary Teaching Minor.  
Formal models of computation such as finite state automata, pushdown automata and Turing machines. Formal definitions of languages, problems, and language classes including recursive, recursively enumerable, regular, and context free languages. The relationships among various models of computation, language classes, and problems. Church’s thesis and the limits of computability. Proofs of program properties including correctness.  
SA: CSE 360  
Effective Fall 2015 Effective Fall 2017
CSE 471  Media Processing and Multimedia Computing  
Fall of every year. Spring of every year. 3(3-0) P: CSE 320 or CSE 331 or CSE 335  R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor. R: Open to juniors or seniors in the College of Engineering or in the Computer Science Minor or in the Lyman Briggs Computer Science Major or in the Lyman Briggs Computer Science Disciplinary Teaching Minor. R: Open to juniors or seniors in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major.  
- Basic operations for processing images, video, and audio. Devices for input and output.  
**Effective Fall 2015**  
**Effective Fall 2017**

CSE 472  Computer Graphics  
Spring of every year. 3(3-0) P: CSE 331 or CSE 335  R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor. 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.  
- Graphics systems. Two- and three-dimensional imaging geometry and transformations.  
- Curve and surface design. Rendering, shading, color, and animation. Graphics programming.  
SA: CPS 472  
**Effective Fall 2015**  
**Effective Fall 2017**

CSE 476  Mobile Application Development  
Spring of every year. 3(3-0) P: CSE 320 or CSE 331 or CSE 335  R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor. 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.  
- Software development techniques for mobile devices such as smart phones and tablet computers.  
**Effective Fall 2015**  
**Effective Fall 2017**

CSE 477  Web Application Architecture and Development  
Spring of every year. 3(3-0) P: CSE 331 P: CSE 320 or CSE 331 or CSE 335  R: Open to students in the Computer Engineering Major or in the Computer Science Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Disciplinary Teaching Minor. 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.  
- Fundamentals of World Wide Web (WWW) programming, including protocols, client-server interaction, markup languages, client- and server-side programming, databases, and remote procedure calls. Development of a WWW server and WWW sites with browser-based interfaces to remote databases. Students will incorporate scaling, throughput, and latency considerations in the development of widely-distributed systems.  
**Effective Fall 2015**  
**Effective Fall 2017**
CSE 480  Database Systems
Spring of every year. 3(3-0) P: CSE 331 P: CSE 331 or CSE 335 P: Open to students in the Computer Engineering Major or in the Lyman Briggs Computer Science Coordinate Major or in the Lyman Briggs Computer Science Major or in the Computer Science Major or in the Computer Science Disciplinary Teaching Minor. 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.
Storage of and access to physical databases including indexing, hashing, and range accesses. Relational data models, database design principles, query languages, query optimization, transaction processing and recovery techniques. Object-oriented and distributed databases.
SA: CPS 480
Effective Fall 2015 Effective Fall 2017

ME 812  Conductive Heat Transfer
Fall of every year. 3(3-0) RB: ME 391 and ME 411 RB: ME 391 and ME 410
Effective Fall 1995 Effective Fall 2017

ME 891  Selected Topics in Mechanical Engineering
Fall of every year. Spring of every year. 1 to 4 credits. A student may earn a maximum of 6 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.
Special topics in mechanical engineering of current importance.
Effective Fall 2004 Effective Fall 2017

COLLEGE OF NATURAL SCIENCE

CEM 151  General and Descriptive Chemistry
Fall of every year. 4(4-0) P: ((MTH 116 or concurrently) or (MTH 124 or concurrently) or (MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 118 or concurrently)) or designated score on Mathematics Placement test. Not open to students with credit in CEM 141 or CEM 181H or LB 171. Not open to students with credit in CEM 181H or LB 171.
Stoichiometry; solutions; reactions and thermochemistry; quantum mechanics and atomic structure; periodic properties; chemical bonding; molecular structure; coordination chemistry; organic molecules and functional groups.
Effective Fall 2013 Effective Fall 2017

CEM 152  Principles of Chemistry
Spring of every year. 3(4-0) P: CEM 151 or CEM 181H or LB 171 Not open to students with credit in CEM 142 or CEM 182H or LB 172. Not open to students with credit in CEM 182H or LB 172.
Gases, liquids, and solids; thermodynamics; changes of state; solutions and colligative properties; chemical equilibria; acids, bases, and aqueous equilibria; kinetics; redox reactions and electrochemistry; nuclear chemistry.
Effective Fall 2013 Effective Fall 2017

CMSE 401  Methods for Parallel Computing
Spring of odd years. 4(4-0) A student may earn a maximum of 4 credits in all enrollments for this course. P: (CMSE 202 and CSE 232) and (MTH 235 or MTH 340 or MTH 347H)
NEW
Effective Fall 2017
CMSE 402  Visualization of Scientific Datasets
Spring of even years. 3(3-0) A student may earn a maximum of 3 credits in all enrollments for this course. P: (CMSE 202) and (MTH 234 or MTH 254H or LB 220)
NEW Core principles, methods, and techniques of effective data visualization. Visualization toolkits. Vector and scalar data. Multivariate visualization. Relationship between data analysis and visualization. Effective Fall 2017

GLG 873  Introduction to Numerical Tools for Earth and Environmental Scientists
Fall of odd years. 3(3-0) RB: B.S. in the Earth Sciences or related field
NEW Computation is increasingly becoming more important in every aspect of the Earth and Environmental Sciences. Introductory course in the following topics: learning to use the Linux operating system, coding in the C programming language, and learning basic numerical methods that repeatedly arise in the Geological Sciences such as integration, curve-fitting, and solving relatively simple but commonly used differential equations. Prior coursework in computational methods and differential equations is not required. Effective Fall 2017

IBIO 402
NEU 300 Neurobiology
Fall of every year. Spring of every year. 3(3-0) Interdepartmental with Integrative Biology. P: (BS 162 or LB 144 or BS 182H) and (BS 161 or LB 145 or BS 181H) R: Not open to freshmen or sophomores and not open to students in the Program in Neuroscience and not open to students in the Lyman Briggs Neuroscience Major.
Structure and function of nerve cells and nervous systems.
SA: ZOL 402
Effective Fall 2016 Effective Summer 2017

NEU 301 Introduction to Neuroscience I
Fall of every year. 3(3-0) P: (BS 161 or BS 181H or LB 145) and (BS 162 or BS 191H or LB 144) P: (BS 161 or BS 181H or LB 145) and (BS 162 or BS 182H or LB 144) RB: PSY 101 R: Open to undergraduate students in the Program in Neuroscience. R: Open to undergraduate students in the Lyman Briggs College or in the College of Natural Science or in the Program in Neuroscience.
Survey of the field of neuroscience, including molecular, cellular, and autonomic, sensory and motor systems.
Effective Fall 2016 Effective Spring 2017

NEU 840 Social, Cognitive, and Affective Neuroscience
Fall of every year. 3(3-0) Not open to students with credit in NEU 839 or NEU 841.
NEW Introduction to nervous system structure and function aimed at students and professionals with limited biological science background. Effective Fall 2016

NEU 845 Neuroscience of Drug Use and Human Disorders
Spring of every year. 3(3-0) RB: NEU 840 or concurrently
NEW Introduction to the neurochemical basis of human disorders and how drugs are used to treat these disorders. Effective Spring 2017

NEU 848 Foundations of Law and Legal Research
Fall of every year. Spring of every year. Summer of every year. 2(2-0) R: Open to graduate students in the Program in Neuroscience. Approval of department. Not open to students with credit in LAW 807A.
NEW Introduction to the American legal system with focus on legal research and communication needs of non-lawyers Effective Fall 2016

NEU 892 Special Topics in Neuroscience and the Law
Fall of every year. 1 to 3 credits. A student may earn a maximum of 4 credits in all enrollments for this course. RB: NEU 840 or concurrently
NEW Topics in which the field of neuroscience and the legal system intersect Effective Fall 2016
PSL 499  Physiology Senior Research Thesis
Fall of every year. Spring of every year. Summer of every year. 2 to 8 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open to seniors in the Physiology Major or in the Lyman Briggs Physiology Coordinate Major. Approval of department; application required. A student may earn a maximum of 12 credits PSL 480, PSL 490, PSL 499

NEW
Independent Research Culminating in a Thesis
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.
Effective Spring 2017

PLB 400  Introduction to Bioinformatics
Fall of even years, Spring of odd years. 3(2-2) Interdepartmental with Biochemistry and Molecular Biology and Microbiology and Molecular Genetics, P: (STT 200 or STT 201 or STT 231 or STT 421) and (PLB 203 or MMG 201 or BMB 200) P: (STT 200 or STT 201 or STT 231 or STT 421) and (PLB 203 or MMG 201 or BMB 200 or BS 161) RB: An introductory biology course covering basic genetics, macromolecules, evolution, energy metabolism, genetic materials, and signal transduction is recommended for non-biology majors. A statistics course covering random variable, distributions, and basic probability theory is recommended for biology majors. RB: An introductory biology course covering basic genetics, macromolecules, evolution, energy metabolism, genetic materials, and signal transduction is recommended for non-biology majors. A statistics course covering random variable, distributions, and basic probability theory is recommended for biology majors.
Bioinformatic theory and practice. How to manage and analyze sequences, structures, gene expression, and other types of biological data. Managing and analyzing biological data with bioinformatic tools, basic programming, and statistics.
Effective Fall 2014 Effective Fall 2016

PLB 810  Theories and Practices in Bioinformatics
Fall of even years, Spring of odd years. 3(2-2) Interdepartmental with Biochemistry and Molecular Biology and Microbiology and Molecular Genetics. RB: Basic genetics, macromolecules, evolution, energy metabolism, genetic materials, and signal transduction is recommended for non-biology majors. A statistics course covering random variable, distributions, and basic probability theory is recommended for biology majors. RB: Basic genetics, macromolecules, evolution, energy metabolism, genetic materials, and signal transduction is recommended for non-biology majors. A statistics course covering random variable, distributions, and basic probability theory is recommended for biology majors.
Theories and algorithms behind bioinformatics tools. Basic tool development by writing scripts in the Python programming language for data analysis.
Effective Spring 2013 Effective Fall 2016

NUR 454  Honors Research Internship
Fall of every year, Spring of every year. Summer of every year. On Demand. 2 to 3 credits. P: NUR 220 RB: Students must provide a copy of Human Subjects and HIPAA approval to supervising faculty member. R: Open to students in the Nursing Major or in the Prenursing Major.
Immersion in the research process in the College of Nursing working directly with a nurse researcher in the context of a funded/non-funded research team.
Request the use of the Pass-No Grade (P-N) system.
Effective Spring 2013 Effective Summer 2017
NUR 490  Independent Study in Nursing
Fall of every year. Spring of every year. Summer of every year. On Demand. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Approval of college. Individualized area of study in Nursing. 
Effective Summer 2014 Effective Summer 2017

NUR 930  Methods In Clinical Research
Fall of every year. Summer of every year. 3(3-0) R: Open to doctoral students in the College of Nursing or approval of college.
Advanced research designs, measurement and data collection strategies. Draws on a broad range of behavioral and health disciplines relevant to nursing. Logic of statistical models used in the evaluation of research designs and measures. 
Effective Summer 2014 Effective Fall 2017

NUR 989  Doctor of Nursing Practice Synthesis Project
Fall of every year, Spring of every year. Summer of every year. 1 to 4 credits. A student may earn a maximum of 16 credits in all enrollments for this course. R: Open to doctoral students in the College of Nursing.
Demonstrate synthesis of didactic coursework and application to practice by learning a practice change innovation to address a health care problem and improve health outcomes.
Request the use of the Pass-No Grade (P-N) system. 
Effective Summer 2016 Effective Summer 2017