PART I – NEW ACADEMIC PROGRAMS AND PROGRAM CHANGES

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

1. Request to establish a Minor in Technology Systems Management in the Department of Biosystems and Agricultural Engineering. The University Committee on Undergraduate Education (UCUE) recommended approval of this request at its October 2, 2014 meeting.

   a. Background Information:

   The Minor in Technology Systems Management will provide students with an understanding of current and emerging technologies that support effective, efficient management decisions for agriculture and natural resources systems. The minor is a crosscutting program offering broader employability opportunities for students primarily in agriculture and natural resources. Students completing the minor gain an understanding on how biological and technology systems interface; how current and emerging technologies related to agriculture, food, natural resource and bioenergy systems; how technology’s role supports timely, efficient and effective management decisions; and how to communication technology nomenclature, function and operation to various and diverse audiences. The minor will fill the niche left by the discontinuation of the technology systems management major.

   b. Academic Programs Catalog Text:

   The Minor in Technology Systems Management, which is administered by the Departments of Biosystems and Agricultural Engineering, serves students interested in technology for management decision support who are pursuing careers in agriculture and natural resources. The minor provides an opportunity to gain a working knowledge of technologies necessary to monitor and manage aspects of food, agriculture, and natural resource systems.

   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 administers 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 for the minor should consult an undergraduate advisor in the Department of Biosystems and Agricultural Engineering to have their program of study approved in advance and in writing.

   Requirements for the Minor in Technology Systems Management

   Students must complete a minimum of 15 credits from the following:

   1. Four of the following courses (12 credits):
      
      TSM 130 Energy Efficiency and Conservation in Agricultural Systems 3
      TSM 222 Fundamentals of Automation and Controls 3
      TSM 226 Renewable Energy Systems Management 3
      TSM 251 Information Technology in Agricultural Systems 3
      TSM 331 Water Management in Agriculture and Food Systems 3
      TSM 343 Principles of Precision Agriculture 3

   2. One of the following courses (3 credits):
      
      ABM 222 Agribusiness and Food Industry Sales (W) 3
      ANS 418 Comprehensive Nutrient Management Planning 3
      CSS 424 Sustainable Agriculture and Food Systems: Integration and Synthesis 3
      CSUS 354 Water Resources Management 3
      FSC 325 Food Processing: Unit Operations 3
      FW 419 Applications of Geographic Information Systems to Natural Resources Management 4
      GEO 221 Introduction to Geographic Information 3
2. Request to establish an Agricultural Technology Certificate in Fruit, Vegetable, and Organic Horticulture Management in the Institute of Agricultural Technology. The University Committee on Undergraduate Education (UCUE) recommended approval of this request at its October 2, 2014 meeting.

a. Background Information:

Michigan’s fruit and vegetable industry contributed $1.4 billion to the Michigan economy in 2012. There is a high demand for experienced individuals who have technical and practical knowledge in the fruit, vegetable, and organic food industries across the state, and the country. More people than ever are focusing on local agriculture, and seeking educational programs that encompass the production of horticultural food crops. The two-year certificate program focused on fruit, vegetable and organic horticulture management can satisfy the needs of both the students and the industries in need of educated, trained professionals.

Michigan State University is home to the oldest Horticulture program in the country, MSU’s horticulture graduates are highly sought after by industry leaders because of the excellent knowledge and hands-on experience. MSU’s programs are locally and internationally renowned. Through the long-standing horticulture research and teaching programs, relationships between industry and faculty have been strengthened. The results of decades of research conducted around the state have been shared with members of industry and have promoted communication, interaction, and loyalty to MSU. Because MSU is a leader in horticulture teaching and research, this program is a perfect fit to continue building strong relationships with Michigan’s horticultural industries.

b. Academic Programs Catalog Text:

The Fruit, Vegetable, and Organic Horticulture Management program provides students an opportunity to gain the necessary skills for a successful career in the multibillion dollar fruit and vegetable industries. The program combines classroom instruction and theory with practical experience gained through field laboratories and a professional internship. Graduates of the program work as owners, managers, buyers, or salespersons in a wide variety of horticultural food crop industries: fruit and vegetable plan production; farmers’ markets; organic farms and community-supported agriculture programs; urban gardening; irrigation design, installation, and management; public and/or private botanical gardens; and more.

Horticulture is a complex and diversified, yet fully integrated discipline that encompasses the biological, molecular, physical, management and marketing sciences and the arts to improve the production of nutritious, high-quality and safe food, advance the development and use of new specialty crops, enhance human health and well-being, and positively impact the natural and built environments.

Students may enroll in online courses, courses that are integrated with outreach and extension programs, and 5- or 10- week courses. They will have opportunities to be extensively involved in professional and social activities beyond the classroom including: working in research laboratories; assisting in field-based projects, assisting with food crop production; and becoming involved with the Student Organic Farm, and the Ecological Food and Farm Stewardship Club.

Requirements for Fruit, Vegetable, and Organic Horticulture Management

Students must complete 48 credits from the following:

1. All of the following courses (23 credits):
   - AT 045 Agricultural Communications 2
   - AT 071 Technical Mathematics 2
   - AT 293 Professional Internship in Agricultural Technology 3
   - CSS 110 Computer Applications in Agronomy 2
   - CSS 210 Fundamentals of Soil Science 3
   - ENT 111 Basics of Applied Entomology 2
HRT 109 Introduction to Applied Plant Science   2
HRT 206 Training and Pruning Plants    1
HRT 207 Horticulture Career Development    1
HRT 218 Irrigation Systems for Horticulture  3
PLP 105 Fundamentals of Applied Plant Pathology  2

Students who demonstrate proficiency through placement testing for AT 045 and AT 071 will take elective course work to substitute the credit in those courses.

2. A minimum of 15 credits from the following courses:
   - ABM 100 Decision-making in the Agri-Food System   3
   - ABM 222 Agribusiness and Food Industry Sales (W)   3
   - AT 055 Agricultural Finance     3
   - AT 291 Selected Topics in Agricultural Technology   2
   - HRT 204 Plant Propagation         2
   - HRT 205 Plant Mineral Nutrition     1
   - HRT 221 Greenhouse Structures and Management   3
   - HRT 242 Passive Solar Greenhouses for Protected Cultivation  1
   - HRT 243 Organic Transplant Production  1
   - HRT 251 Organic Farming Principles and Practices  3
   - HRT 253 Compost Production and Use   1

Students who choose AT 291 Selected Topics in Agricultural Technology must enroll in the section titled ‘Spanish – Horticulture Industries’.

3. Completion of 10 additional elective credits in the college as approved by the program coordinator in the Institute of Agricultural Technology.

Effective Summer 2015

3. Request to change the name of the Agricultural Technology Certificate in Landscape and Nursery to the Agricultural Technology Certificate in Landscape and Nursery Management in the Institute of Agricultural Technology.

Students admitted to the certificate prior to Summer 2015 will graduate with an Agricultural Technology Certificate in Landscape and Nursery.

Students admitted to the certificate Summer 2015 and forward will graduate with an Agricultural Technology Certificate in Landscape and Nursery Management.

4. Request to change the requirements for the Agricultural Technology Certificate in Landscape and Nursery Management in the Institute of Agricultural Technology.

a. Under the heading Landscape and Nursery Management replace the entire entry with the following:

The Landscape and Nursery Management program at Michigan State University provides students an opportunity to gain the necessary skills for a successful career in the multibillion dollar green industry. The program combines classroom instruction and theory with practical experience gained through field laboratories and a professional internship. Graduates of the program work as owners, managers, buyers, or salespersons in a wide variety of horticultural industries: landscape design, construction, and management; irrigation design, installation, and management; retail garden center management; herbaceous and woody plant production; urban tree management; and public and/or private botanical gardens.

Horticulture is a complex and diversified, yet fully integrated discipline that encompasses the biological, molecular, physical, management and marketing sciences and the arts to improve the production of nutritious, high-quality and safe food, advances the development and use of new specialty crops, enhances human health and well-being, and positively impacts the natural and built environments.

Students will have opportunities to enroll in online courses integrated with outreach and extension programs, and 5- or 10-week module courses. Students are extensively involved in activities beyond the classroom such as working in research laboratories; assisting in field-based projects,
landscape, greenhouse, garden, and nursery operations; running the Horticulture Club’s annual spring show and plant sale; and participating in academic and field events associated with the Professional Landcare Network (PLANET).

The Landscape and Nursery Management program is offered by the Department of Horticulture in cooperation with the Institute of Agricultural Technology.

**Requirements for the Landscape and Nursery Management**

<table>
<thead>
<tr>
<th>CREDITS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. All of the following courses (30 credits):</td>
<td></td>
</tr>
<tr>
<td>AT 045 Agricultural Communications</td>
<td>2</td>
</tr>
<tr>
<td>AT 291 Selected Topics in Agricultural Technology</td>
<td>2</td>
</tr>
<tr>
<td>AT 293 Professional Internship in Agricultural Technology</td>
<td>3</td>
</tr>
<tr>
<td>CSS 110 Computer Applications in Agronomy</td>
<td>2</td>
</tr>
<tr>
<td>CSS 210 Fundamentals of Soil Science</td>
<td>3</td>
</tr>
<tr>
<td>ENT 111 Basics of Applied Entomology</td>
<td>2</td>
</tr>
<tr>
<td>HRT 109 Introduction to Applied Plant Science</td>
<td>2</td>
</tr>
<tr>
<td>HRT 207 Horticulture Career Development</td>
<td>1</td>
</tr>
<tr>
<td>HRT 211 Landscape Plants I</td>
<td>3</td>
</tr>
<tr>
<td>HRT 212 Landscape Plants II</td>
<td>3</td>
</tr>
<tr>
<td>HRT 213 Landscape Maintenance</td>
<td>2</td>
</tr>
<tr>
<td>HRT 213L Landscape Maintenance Field Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>HRT 214 Landscape and Turfgrass Business Operations</td>
<td>2</td>
</tr>
<tr>
<td>PLP 105 Fundamentals of Applied Plant Pathology</td>
<td>2</td>
</tr>
<tr>
<td>Students should enroll in the Turf and Landscape Calculations section of AT 291.</td>
<td></td>
</tr>
<tr>
<td>2. Complete at least 9 credits from the following courses:</td>
<td></td>
</tr>
<tr>
<td>AE 053 Engine and Equipment Maintenance</td>
<td>2</td>
</tr>
<tr>
<td>AT 291 Selected Topics in Agricultural Technology</td>
<td>2</td>
</tr>
<tr>
<td>CSS 181 Pesticide and Fertilizer Application Technology</td>
<td>3</td>
</tr>
<tr>
<td>CSS 202 World of Turf</td>
<td>2</td>
</tr>
<tr>
<td>CSS 202L World of Turf Lab</td>
<td>1</td>
</tr>
<tr>
<td>HRT 204 Plant Propagation</td>
<td>2</td>
</tr>
<tr>
<td>HRT 218 Irrigation Systems for Horticulture</td>
<td>3</td>
</tr>
<tr>
<td>HRT 219 Landscape Computer Aided Design</td>
<td>2</td>
</tr>
<tr>
<td>HRT 221 Greenhouse Structures and Management</td>
<td>3</td>
</tr>
<tr>
<td>Students should enroll in the Spanish-Horticulture Industries section of AT 291.</td>
<td></td>
</tr>
<tr>
<td>3. Complete a minimum of 9 additional Agricultural Technology courses chosen in consultation with and approved by the program coordinator.</td>
<td></td>
</tr>
</tbody>
</table>

Effective Summer 2015.

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**COLLEGE OF ENGINEERING**

1. Request to change the requirements in the Master of Science degree in Chemical Engineering in the Department of Chemical Engineering and Materials Science. The University Committee on Graduate Studies (UCGS) will consider this request at its November 10, 2014 meeting.

   a. Under the heading Requirements for the Master of Science Degree in Chemical 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. Students in Plan A must complete a minimum of 20 credits at the 800-level or above. Students in Plan B must complete a minimum of 18 credits at the 800-level or above. Courses at the 400-level are acceptable as long as the minimum credit requirement is met at the 800-level. Courses below the 400-level are not acceptable.
Requirements for Both Plan A and Plan B:

<table>
<thead>
<tr>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Core Courses. All of the following courses (15 credits):</td>
</tr>
<tr>
<td>CHE 801 Advanced Chemical Engineering Calculations 3</td>
</tr>
<tr>
<td>CHE 802 Research Methods 3</td>
</tr>
<tr>
<td>CHE 821 Advanced Chemical Engineering Thermodynamics 3</td>
</tr>
<tr>
<td>CHE 822 Advanced Transport Phenomena 3</td>
</tr>
<tr>
<td>CHE 831 Advanced Chemical Reaction Engineering 3</td>
</tr>
<tr>
<td>2. Supporting Courses. Six credits in courses outside the Department of Chemical Engineering and Materials Science approved by the student's academic advisor.</td>
</tr>
</tbody>
</table>

Additional Requirements for Plan A

1. Complete 6 credits of CHE 899 Master's Thesis Research
2. Additional elective credits as approved by the student’s academic advisor.

Additional Requirements for Plan B

1. Complete 6 to 9 credits in a coordinated technical minor as approved by the student’s academic advisor.
2. Pass a final examination, oral or written, given by the student’s academic advisor.

Effective Summer 2015.

2. Request to change the requirements in the Doctor of Philosophy degree in Chemical Engineering in the Department of Chemical Engineering and Materials Science. The University Committee on Graduate Studies (UCGS) will consider this request at its November 10, 2014 meeting.

   a. Under the heading Admission in paragraph two, remove the word ‘International’.
   b. Under the heading Requirements for the Doctor of Philosophy Degree in Chemical Engineering replace the entire entry with the following:

      In addition to meeting the requirements of the university and of the College of Engineering, students must meet the requirements specified by their guidance committee.

      The Doctor of Philosophy degree in Chemical Engineering, as detailed in the graduate handbook for chemical engineering, is comprised of course work, research and selection of an advisor, a qualifying examination, formation of a guidance committee and doctoral degree program, a comprehensive examination, and successful completion of a dissertation and final oral examination in defense of the dissertation.

      Effective Summer 2015.

3. 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 November 10, 2014 meeting.

   a. Under the heading Admission delete paragraph two.
   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. Students must complete a minimum of 18 credits at the 800-level or above.
Requirements for Both Plan A and Plan B:

1. 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 802 Research Methods 3
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. Additional elective credits as approved by the student’s academic advisor.

Additional Requirements for Plan B

1. One course at the 400-level or above in mathematics or statistics as approved by the student’s academic advisor.
2. Additional elective credits as approved by the student’s academic advisor.
3. Pass a final examination, oral or written, given by the student’s academic advisor.

Effective Summer 2015.

4. Request to change the requirements in the Doctor of Philosophy 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 November 10, 2014 meeting.
   a. Under the heading Admission replace the paragraph with the following:

   An applicant for admission to the Ph.D. degree program in materials science and engineering must hold a bachelor's or master's degree in materials science and engineering or a related field and must have a grade-point average that would indicate success in graduate study. Applicants must submit their scores on the Graduate Record Examination General Test.

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

   In addition to meeting the requirements of the university and of the College of Engineering, students must meet the requirements specified by their guidance committee.

   The Doctor of Philosophy degree in Materials Science and Engineering, as detailed in the graduate handbook for materials science and engineering, is comprised of course work, research and selection of an advisor, a qualifying examination, formation of a guidance committee and doctoral degree program, a comprehensive examination, and successful completion of a dissertation and final oral examination in defense of the dissertation.

   Effective Summer 2015.
1. Request to change the requirements for the Bachelor of Science degree in Biochemistry and Molecular Biology in the Department of Biochemistry and Molecular Biology.

   a. Under the heading Requirements for the Bachelor of Science Degree in Biochemistry and Molecular Biology make the following changes:

   (1) In item 3. a. (4) change the total credits from ‘2 or 4’ to ‘2’.

   (2) In item 3. a. (4) (b) delete the following course:

   CEM 186H Honors Chemistry Laboratory II 2

   Add the following course:

   CEM 185H Honors Chemistry Laboratory I 2

   (3) In item 3. a. (4) add the following note:

   Students who select CEM 185H may use that course alone to fulfill this requirement.

   Effective Summer 2015.

2. Request to change the requirements for the Bachelor of Science degree in Biochemistry and Molecular Biology/Biotechnology in the Department of Biochemistry and Molecular Biology.

   a. Under the heading Requirements for the Bachelor of Science Degree in Biochemistry and Molecular Biology/Biotechnology make the following changes:

   (1) In item 3. a. (4) change the total credits from ‘2 or 4’ to ‘2’.

   (2) In item 3. a. (4) (b) delete the following course:

   CEM 186H Honors Chemistry Laboratory II 2

   Add the following course:

   CEM 185H Honors Chemistry Laboratory I 2

   (3) In item 3. a. (4) add the following note:

   Students who select CEM 185H may use that course alone to fulfill this requirement.

   Effective Summer 2015.
3. 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 November 3, 2014 meeting.

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

1. In item 1., replace paragraph two with the following:

The University’s Tier II writing requirement for the Chemistry major is met by completing Chemistry 333 and 425. Those courses are referenced in item 3. b. (5) below.

2. In item 3. a. make the following changes:

(a) Change the total credits from ‘18 to 23’ to ‘22 to 27’.

(b) Add the following item (5):

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB 401</td>
<td>4</td>
</tr>
<tr>
<td>Comprehensive Biochemistry</td>
<td></td>
</tr>
</tbody>
</table>

3. In item 3. b. make the following changes:

(a) Change the total credits from ‘32 to 34’ to ‘36 or 37’.

(b) In item (2) change the total credits from ‘4 or 5’ to ‘5’.

(c) In item (2) (b) delete the following course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEM 186H</td>
<td>2</td>
</tr>
<tr>
<td>Honors Chemistry Laboratory II</td>
<td></td>
</tr>
</tbody>
</table>

Add the following course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEM 262</td>
<td>3</td>
</tr>
<tr>
<td>Quantitative Analysis</td>
<td></td>
</tr>
</tbody>
</table>

(d) In item (5) change the total credits from ‘10’ to ‘13’ and add the following course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEM 425</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry Communication and Professional Development (W)</td>
<td></td>
</tr>
</tbody>
</table>

Effective Summer 2015.
4. 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 November 3, 2014 meeting.

   a. **Requirements for the Bachelor of Science Degree in Chemistry**

   (1) In item b, change the total credits from '44 to 46' to '45 or 46'.

   (2) In item (2) (b) delete the following course:
   
   **CEM 186H Honors Chemistry Laboratory II**  
   2

   Add the following course:
   
   **CEM 262 Quantitative Analysis**  
   3

   Effective Summer 2015.

5. Request to change the requirements for the **Bachelor of Science** degree in **Chemical Physics** in the Department of Chemistry.

   a. **Requirements for the Bachelor of Science Degree in Chemical Physics**

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

   (a) Change the total credits from '27 to 30' to '28 to 30'.

   (b) In item (2) change the total credits from '4 or 5' to '5'.

   (c) In item (2) (b) delete the following course:
   
   **CEM 186H Honors Chemistry Laboratory II**  
   2

   Add the following course:
   
   **CEM 262 Quantitative Analysis**  
   3

   Effective Summer 2015.

6. Request to change the award type of the **Specialization in Actuarial Science** to **Minor in Actuarial Science** in the Department of Mathematics.

   *Per the May 30, 2013 memo to Deans, Directors, and Chairpersons from Linda O. Stanford, Associate Provost for Academic Services, all units offering undergraduate specializations will need to convert the award to a minor.*

   Students currently enrolled in the Specialization will continue to follow the requirements for the specialization that were in effect the term they were admitted to the specialization.

   Students who do not complete the requirements for the specialization prior to Fall 2015 will be administratively moved to the minor.

   Students admitted to the Minor in Actuarial Science Fall 2015 and forward will follow the requirements for the minor in accordance with the minor policy.

   Effective Fall 2015.
PART II - NEW COURSES AND CHANGES

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

AT 202  Agricultural Regulation, Compliance and Safety
Fall of every year. Traverse City 3(3-0) R: Open to agricultural technology students in the College of Agriculture and Natural Resources.
NEW
Regulation, laws, compliance and safety as it relates to Michigan’s agricultural sector. Michigan Occupational Safety and Health Administration safety standards, food safety, water protection, pesticide and fertilizer application and voluntary programs for agricultural producers. Students will have the option to pay for the pesticide core exam.
Effective Spring 2015

TSM 122  Alternating and Direct Current Machines
Spring of every year. 3(3-3) P: (TSM 121 or concurrently) or MTH 103 or approval of department
Types and characteristics of electric motors. Connecting, reversing and servicing of AC and DC motors and drives. Stepper motors. Variable frequency drives for induction motors. Offered first ten weeks of semester.
SA: AE 084
DELETE COURSE
Effective Fall 2015

TSM 130  Energy Efficiency and Conservation in Agricultural Systems
Spring of every year. Summer of every year. 3(3-0)
NEW
Introduction and basic concepts of energy efficiency and conservation in agricultural and food production systems.
Effective Fall 2015

TSM 222  Fundamentals of Automation and Controls
Fall of every year. 3(2-2) P: (TSM 121 or concurrently) or MTH 103 or approval of department
NEW
On-off controllers for electric actuators. Installation according to code. Ladder-logic. Programmable logic controllers (PLC). Installation and programming. Interfacing to a computer.
SA: AE 083, TSM 223
Effective Fall 2015

TSM 223  Fundamentals of Automation and Controls
Fall of every year. 4(3-2) P: (TSM 121 or concurrently) or MTH 103 or approval of department
NEW
On-off controllers for electric actuators. Installation according to code. Ladder-logic. Programmable logic controllers. Installation and programming. Interfacing to a computer.
SA: AE 083
DELETE COURSE
Effective Summer 2015

TSM 224  Fundamentals of Digital Systems
Spring of every year. 3(3-0) P: (TSM 121 or concurrently) or MTH 103 or approval of department
Not open to students with credit in ECE 230.
DELETE COURSE
Effective Fall 2015

TSM 226  Renewable Energy Systems Management
Fall of every year. Summer of every year. 3(3-0) P: (TSM 121 or concurrently) or TSM 130 or MTH 103 or approval of department
NEW
An introduction to renewable energy systems. Benefits and limitations (political, social, and environmental) of renewable energy power systems including biomass, solar photovoltaic, wind, geothermal, hydroelectric, and fuel cells.
Effective Fall 2015
TSM 331  Water Management in Agriculture and Food Systems
Spring of every year. 3(3-0) P: MTH 103 R: Open to undergraduate students in the College of Agriculture and Natural Resources.
NEW  Principles of water management, use efficiency and conservation in agricultural production, natural resources and food processing facilities. Best agricultural water management practices, water rights, irrigation scheduling, irrigation systems selection, evaluation and management and drainage principles. Large scale water use, management and conservation in food processing.
SA: TSM 431
Effective Fall 2015

TSM 341  Power and Machinery Systems
Fall of every year. 3(2-2) P: MTH 103 or approval of department
Principles, performance, operation, and management of agricultural machine systems and tractors.
DELETE COURSE
Effective Fall 2015

TSM 431  Irrigation, Drainage and Erosion Control
Fall of every year. 3(2-2) P: MTH 103 and CSS 210 or approval of department R: Not open to freshmen or sophomores.
Soil and water conservation engineering, including land and soil surveying, basic hydraulics, hydrology, soil moisture, and soil and water conservation practices.
Applications to irrigation, drainage, and erosion control systems.
DELETE COURSE
Effective Summer 2015

COLLEGE OF HUMAN MEDICINE

ANTR 585  Directed Study in Human Prosection
Fall of every year. Spring of every year. Summer of every year. 1 to 5 credits. A student may earn a maximum of 15 credits in all enrollments for this course. P: ANTR 551 P: ANTR 551 or ANTR 510 R: Open only to graduate-professional students in the College of Human Medicine or College of Osteopathic Medicine and approval of department. R: Open to human medicine students or osteopathic medicine students. Approval of department.
Prosection of selected regions and isolated structures of preserved human cadavers. Oral presentation.
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 2002 Effective Spring 2015

COLLEGE OF NATURAL SCIENCE

BLD 214L  Biomedical Laboratory Research Techniques
Summer of every year. 2(1-3) P: MTH 103 or approval of department
NEW  Basic techniques, skills and safety in biomedical research. Ethical conduct of research and regulatory principles such as Good Laboratory Practice (GLP). Maintaining a research notebook for legal and intellectual property purposes. Offered second half of semester.
Effective Summer 2015

CEM 186H  Honors Chemistry Laboratory II
Spring of every year. 2(0-6) P: CEM 182H or concurrently R: Approval of department.
Laboratory research.
DELETE COURSE
Effective Spring 2015
CEM 262  Quantitative Analysis
Fall of every year. Spring of every year. Summer of every year. 3(3-3) P: (CEM 142 or CEM 152 or CEM 182H or LB 172) and (CEM 162 or CEM 185H or LB 172L) Not open to students with credit in CEM 186H.
Introduction to analytical chemistry and quantitative methods; aqueous solution equilibria and statistics related to quantitative chemical analysis; titrimetric, gravimetric, and spectrophotometric measurements.
Effective Fall 2013 Effective Summer 2015

CEM 333  Instrumental Methods and Applications
Spring of every year. 3(2-3) P: ((CEM 262 or CEM 186H) or (CEM 162 and BLD 213 and BLD 417)) and ((CEM 143 or CEM 251 or CEM 262) and completion of Tier I writing requirement) P: (CEM 262 or (CEM 162 and BLD 213 and BLD 417)) and ((CEM 143 or CEM 251 or CEM 351) and completion of Tier I writing requirement)
Principles and applications of instrumental analysis of separation techniques.
Effective Spring 2013 Effective Spring 2015

CEM 355  Organic Laboratory I
Spring of every year. 2(0-6) P: (CEM 162 or CEM 186H or LB 172L) and (((CEM 352 or concurrently) or (CEM 252 or concurrently)) and completion of Tier I writing requirement) P: (CEM 162 or CEM 185H or LB 172L) and (((CEM 352 or concurrently) or (CEM 252 or concurrently)) and completion of Tier I writing requirement)
Effective Spring 2013 Effective Spring 2015

CEM 395  Analytical/Physical Laboratory
Spring of every year. 2(1-4) P: ((CEM 483) and completion of Tier I writing requirement) and (CEM 262 or CEM 186H) P: (CEM 483 and (CEM 484 or concurrently) and CEM 262) and completion of Tier I writing requirement C: CEM 484 concurrently.
Chemical kinetics, thermodynamics, and computer-based data analysis methods.
SA: CEM 372, CEM 472
Effective Spring 2013 Effective Spring 2015

CEM 425  Chemistry Communication and Professional Development (W)
Fall of every year. 3(3-0) P: (CEM 262) and completion of Tier I writing requirement) and (CEM 255 or CEM 355) P: Open to students in the Chemistry Major or approval of department.
NEW
Written and oral communication for chemistry careers
Effective Spring 2015

MMG 103  Frontiers of Microbiology and Molecular Genetics
Spring of every year. 1(2-0) R: Open to freshmen or sophomores.
PCR
Current microbiology research. Significance to modern biological science and impact on society.
Request the use of the Pass-No Grade (P-N) system.
Effective Spring 2009 Effective Spring 2015

MMG 201  Fundamentals of Microbiology
Spring of every year. 3(3-0) RB: (CEM 141 or ISP 201 or ISP 207 or ISP 209 or ISP 247) RB: (CEM 141 or ISP 207 or ISP 209 or ISP 217 or LB 171) and (BS 161 or BS 181H or LB 145)
PCR
Microbial structure, function, growth, control, and diversity. Role of microbes in health, industry, and the environment.
SA: MMG 105, MMG 205
Effective Spring 2005 Effective Spring 2014

MMG 301  Introductory Microbiology
Fall of every year. Spring of every year. 3(3-0) P: (BS 161 or LB 145 or BS 181H and (CEM 251 or concurrently) or (CEM 351 or concurrently) or (CEM 143 or concurrently))
PCR
Fundamentals of microbiology, including microbial structure and function, nutrition and growth, death and control. Importance and applications of major microbial groups.
SA: MIC 301
Effective Fall 2011 Effective Spring 2014
MMG 302  Introductory Laboratory for General and Allied Health Microbiology  
Spring of every year. 1(0-3) P: (MMG 201 or concurrently) or (MMG 301 or concurrently)  
PCR  
Methodology of microbiology. Microscopy, staining, aseptic technique, media, quantification, diagnostics, and laboratory safety.  
SA: MIC 302  
Effective Spring 2009 Effective Spring 2014

MMG 404  Human Genetics  
Fall of every year, Spring of every year. 3(3-0) P: (ZOL 341) and (BMB 401 or concurrently or BMB 461 or concurrently) and completion of Tier I writing requirement. P: ZOL 341  
PCR  
SA: ZOL 344, ZOL 404  
Effective Summer 2010 Effective Spring 2014

MMG 408  Advanced Microbiology Laboratory (W)  
Fall of every year. 3(1-6) P: (MMG 302 and MMG 431 or concurrently) and completion of Tier I writing requirement. P: (MMG 302 and (MMG 431 or concurrently)) and completion of Tier I writing requirement R: Open only to students in the Department of Microbiology and Molecular Genetics or LBS Environmental Biology/Microbiology or Microbiology coordinate major. R: Open to students in the Department of Microbiology and Molecular Genetics or in the Genetics Major or in the Environmental Biology/Microbiology Major or in the Microbiology Major.  
PCR  
Microbiological techniques and procedures to study physiology and genetics of bacteria and bacteriophages. Collection and critical assessment of quantitative data and written communication of results.  
SA: MPH 408  
Effective Fall 2001 Effective Spring 2014

MMG 409  Eukaryotic Cell Biology  
Spring of every year. 3(3-0) P: (BS 161 or LB 145 or BS 181H) and ((BMB 401 or concurrently) or (BMB 462 or concurrently))  
PCR  
Structure and function of nucleated cells. Emphasis on the molecular mechanisms that underlie cell processes.  
SA: MIC 403, MPH 403  
Effective Fall 2011 Effective Spring 2014

MMG 413  Virology  
Spring of every year. 3(3-0) P: (BMB 462 or concurrently) or BMB 401  
PCR  
Effective Spring 2009 Effective Spring 2014

MMG 421  Prokaryotic Cell Physiology  
Fall of every year. 3(3-0) P: (MMG 301 and (BMB 461 or concurrently)) or (MMG 301 and (BMB 401 or concurrently))  
PCR  
Prokaryotic cell structure and function. Growth and replication. Macromolecular synthesis and control.  
SA: MIC 401, MPH 401  
Effective Fall 2010 Effective Spring 2014

MMG 425  Microbial Ecology  
Spring of every year. 3(3-0) Interdepartmental with Crop and Soil Sciences. RB: MMG 301  
PCR  
Microbial population and community interactions. Microbial activities in natural systems, including associations with plants or animals.  
SA: MPH 425  
Effective Fall 2001 Effective Spring 2014
MMG 431 Microbial Genetics  
Fall of every year. 3(3-0) P: (BMB 461 or concurrently) or (BMB 401 or concurrently) RB: MMG 301 or ZOL 341  
PCR Genetics of bacteria, their viruses, plasmids, and transposons. Emphasis on genetic principles.  
SA: MIC 401, MPH 401  
Effective Fall 2010 Effective Spring 2014

MMG 433 Microbial Genomics  
Spring of every year. 3(2-3) P: (MMG 431) RB: (MMG 421 or BMB 461) and CSE 101  
Effective Fall 2005 Effective Spring 2014

MMG 434 Laboratory in Genomics and Molecular Genetics (W)  
Spring of every year. 3(1-6) 4(1-8) P: ((MMG 301) and completion of Tier I writing requirement) and (MMG 431 or MMG 433) P: (MMG 301 and (MMG 433 or concurrently)) and completion of Tier I writing requirement R: Open to students in the Genomics and Molecular Genetics.  
R: Open to students in the Genomics and Molecular Genetics Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major.  
PCR Genomics and molecular genetic techniques using microbes. Collection and critical assessment of quantitative data and written communication of results.  
Effective Fall 2011 Effective Spring 2014

MMG 445 Microbial Biotechnology (W)  
Fall of every year. Summer of every year. 3(3-0) P: (MMG 301 or BMB 461 or BMB 401) and completion of Tier I writing requirement  
PCR Applications of microbial products and processes in areas such as biopharmaceuticals, bioremediation, biocatalysis and other green chemistries.  
SA: MIC 445  
Effective Summer 2010 Effective Spring 2014

MMG 451 Immunology  
Fall of every year. 3(3-0) P: (BS 161 or LB 145 or BS 181H) and ((BMB 401 or concurrently) or (BMB 461 or concurrently)) Not open to students with credit in BLD 434.  
SA: MPH 451  
Effective Summer 2014 Effective Spring 2014

MMG 461 Molecular Pathogenesis  
Spring of even years. 3(3-0) P: (MMG 301) RB: MMG 431  
PCR Molecular basis of microbial virulence. Nature of determinants and their role in overcoming host defense mechanisms.  
SA: MPH 461  
Effective Fall 2011 Effective Spring 2014
MMG 463  Medical Microbiology
Fall of every year. 3(3-0) Interdepartmental with Biomedical Laboratory Diagnostics. P: MMG 301 or (MMG 201 and BS 161) or (MMG 201 and LB 145) or (MMG 201 and BS 181H) RB: MMG 451 or BLD 434 R: Open to juniors or seniors in the Biomedical Laboratory Diagnostics Program or in the Department of Microbiology and Molecular Genetics or in the Biomedical Laboratory Science Major or in the Lyman Briggs Biomedical Laboratory Science Coordinate Major or in the Lyman Briggs Environmental/Biology/Microbiology Coordinate Major or in the Environmental Biology/Microbiology Major or in the Genomics and Molecular Genetics Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major or in the Lyman Briggs Human Biology Coordinate Major or in the Human Biology Major or in the Microbiology Major or in the Lyman Briggs Microbiology Coordinate Major.
PCR Properties of pathogenic bacteria and viruses and their mechanisms of pathogenicity and clinical diagnoses.
SA: MIC 463
Effective Fall 2013 Effective Spring 2015

MMG 464  Diagnostic Microbiology Laboratory
Fall of every year. 2(0-4) Interdepartmental with Biomedical Laboratory Diagnostics. P: MMG 463 or concurrently R: Open to juniors or seniors in the Biomedical Laboratory Diagnostics Program or in the Clinical Laboratory Sciences major. R: Open to juniors or seniors in the Biomedical Laboratory Diagnostics Program or in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Biomedical Laboratory Science Coordinate Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major or in the Lyman Briggs Microbiology Coordinate Major.
PCR Clinical laboratory diagnostic procedures for the identification of pathogenic microbes.
SA: MIC 464
Effective Fall 2008 Effective Fall 2013

MMG 490  Special Problems in Microbiology
Fall of every year. Spring of every year. Summer of every year. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.
PCR Library research or tutorial instruction in advanced laboratory techniques.
SA: MPH 490
Effective Fall 2001 Effective Spring 2014

MMG 491  Current Topics in Microbiology and Molecular Genetics
Spring of every year. 3(4-0) R: Open to seniors in the Lyman Briggs College or in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major.
PCR Capstone experience for microbiology majors. Presentation and discussion of journal articles. Writing of position papers. Topics such as microbial physiology, ecology, genetics, molecular biology, virology, immunology, or pathogenesis.
SA: MIC 491
Effective Spring 2009 Effective Spring 2014

MMG 492  Undergraduate Research Seminar
Spring of every year. 1(2-0) P: MMG 499 or MMG 499H R: Open to students in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major.
PCR Presentation and group discussion of undergraduate research results.
SA: MIC 492
Effective Spring 2009 Effective Spring 2014
MMG 499  Undergraduate Research  
Fall of every year. Spring of every year. Summer of every year. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.  
R: Open to students in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major.  
R: Open to students in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Environmental/Biology/Microbiology Coordinate Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major or in the Lyman Briggs Microbiology Coordinate Major.  
PCR  
Participation in a laboratory research project.  
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.  
SA: MIC 499  
Effective Fall 2008 Effective Spring 2014

MMG 499H  Honors Research  
Fall of every year. Spring of every year. Summer of every year. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.  
R: Open to students in the Department of Microbiology and Molecular Genetics and open to students in the Lyman Briggs College.  
R: Open to students in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Environmental/Biology/Microbiology Coordinate Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major or in the Lyman Briggs Microbiology Coordinate Major.  
PCR  
Research project with thesis and oral report. A portion of Microbiology or Genomics and Molecular Genetics capstone experience.  
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.  
SA: MIC 499H  
Effective Fall 2014

PHY 491  Atomic, Molecular, and Condensed Matter Physics  
Introduction to Condensed Matter Physics  
Fall of every year. 3(3-0) P: (PHY 471 and PHY 410) and completion of Tier I writing requirement  
Not open to students with credit in PHY 801.  
Effective Fall 2013 Effective Fall 2015

PHY 492  Nuclear and Elementary Particle Physics  
Introduction to Nuclear Physics  
Spring of every year. 3(3-0) P: (PHY 471) and completion of Tier I writing requirement RB: PHY 472 Not open to students with credit in PHY 802.  
Effective Fall 2013 Effective Fall 2015

STT 464  Statistics for Biologists  
Fall of every year. 3(3-0) Interdepartmental with Animal Science and Crop and Soil Sciences. P: STT 424 P: MTH 103 or MTH 110 or MTH 116 RB: STT 421  
Biological random variables. Estimation of population parameters. Testing hypotheses. Linear correlation and regression. Analyses of counted and measured data to compare several biological groups including contingency tables and analysis of variance.  
Effective Fall 2014
COLLEGE OF VETERINARY MEDICINE

VM 826 Creating a Food Safety Culture
Summer of odd years. 3(3-0) RB: Professional or graduate status with knowledge of food safety. R:
Open to graduate students in the Food Safety Major. Approval of college.
NEW CFSC explores proven, evidence-based ways to change or strengthen the food safety
culture of an organization and influence employee behavior.
Request the use of ET-Extension to postpone grading.
The work for the course must be completed and the final grade reported within 2
semesters after the end of the semester of enrollment.
Effective Summer 2015

VM 827 Food Safety Modernization Act and Hazard Analysis and Critical Control Point Systems
Spring of every year. 3(3-0) RB: Professional or graduate status with knowledge of food safety. R:
Open to graduate students in the Food Safety Major. Approval of college.
NEW Food safety requirements for food establishments subject to the Food Safety
Modernization Act. Food safety management systems, with a focus on the Hazard
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 2015