Meeting of the College Academic Council  
College of Liberal Arts & Sciences -- 210 Strong Hall  
January 20, 2015 - 4:00 p.m.  
AGENDA  
(corrected)

I. APPROVAL OF THE DECEMBER 9, 2014 CAC MINUTES

II. REPORT OF THE COMMITTEE ON GRADUATE STUDIES (CGS)  
December 11, 2014 CGS Report  
Submitted by Cindy Lynn; presented by Alesia Woszidlo, 2014-2015 CGS Chair

A. Curricular Changes for Approval  
   NEW COURSES: BINF 703, BINF 704, PSYC 984, PSYC 988

B. Degree Requirements for Approval  
   1. Changes to Existing Degree – PSHX, MS (changes in required and elective hours noted)  
   2. New Track – PSM-EA 4+1 (see Attachment 1)

III. REPORT OF THE COMMITTEE ON UNDERGRADUATE STUDIES AND ADVISING (CUSA)  
December 9, 2014 CUSA Report  
Submitted by Lanis Atwood; presented by Ruth Ann Atchley, 2014-2015 CUSA Chair

A. Curricular Changes for Approval  
   NEW COURSES: COMS 608, GERM 130, HNDI 593, MATH 125, MATH 126, MATH 127, MATH 145, MATH 146, MATH 147  
   CHANGES: ASTR 391, BIOL 545, BIOL 600, HIST 568, LA&S 150, MATH 220, MATH 221, MATH 290, MATH 291, MATH 320, MATH 409, MATH 410, MATH 470, MATH 500, MATH 526, MATH 530, MATH 540, MATH 542, MATH 558, MATH 559, MATH 590, MATH 591, MATH 601, MATH 605, MATH 624, MATH 627, MATH 646, MATH 647, MATH 648, MATH 650, MATH 660, PHSX 201, PHSX 210, PHSX 211, PHSX 212, PHSX 213, PHSX 214, PHSX 521, PHSX 528, PHSX 531, PHSX 536, PHSX 623, SPLH 662/462, SPLH 663/463  
   DELETIONS: BIOL 427

B. Degree Requirements for Approval  
   1. Changes to Existing Major to BA/BGS AND Minor – Speech-Language-Hearing  
   2. Changes to Existing Major to BA Biology  
   3. Changes to Existing Major to BA Human Biology  
   4. Changes to Existing Major to BA Microbiology  
   5. Changes to Existing Major to BS Biology (all subplans)  
   6. Changes to Existing Major to BS Molecular Biosciences  
   7. Changes to Existing BAS Biotechnology  
   8. Changes to Existing Major BA/BGS Linguistics  

   Degree requirement changes #9-19 are specifically related to the change in Calculus course sequence  
   9. Changes to Existing Major to BA Astronomy and BS Astronomy  
   10. Changes to Existing Major to BA Biology  
   11. Changes to Existing Major to BS Biology – EEOB and MCDB and Teaching Biology  
   12. Changes to Existing Major to BA Biochemistry and BS Biochemistry  
   13. Changes to Existing Major to BA Microbiology and BS Microbiology  
   14. Changes to Existing Major to BA Human Biology  
   15. Changes to Existing Major to BS Molecular Biosciences  
   16. Changes to BAS – Biotechnology  
   17. Changes to Existing Major to BA Physics and BS Physics  
   18. Changes to Existing Minor to Astrobiology  
   19. Changes to Minor in Atmospheric Science

Next meeting of the CAC will be Tuesday, February 10, at 4:00 PM in 210 Strong Hall
College of Liberal Arts & Sciences
College Academic Council
Minutes – December 9, 2014

Committee members in attendance: Giselle Anatole, David Brackett, Heather Desaire, Adrian Finucane, Jane Gibson, Dan Katz, Anna Neill, Margaret Pearce

Committee members absent: Mohamed El-Hodiri, Steve Ilardi

Others in attendance: Ruth Ann Atchley, Bob Goldstein, Kristine Latta, Cindy Lynn, Jim Mielke, Reggie Robinson (via speaker phone), Susan Rufledt, Anne Sawyer, Ann Schofield, Alesia Woszidlo

The meeting was called to order by Associate Dean Jim Mielke at 4:02 PM.

Minutes
A motion was made and seconded to approve the November 11, 2014 minutes of the College Academic Council. The motion was approved unanimously.

Report of the Committee on Graduate Studies (CGS)
(Alesia Woszidlo, 2014-2015 CGS Chair, reporting)

- The motion (CGS report by Alesia Woszidlo) was seconded, and the CAC voted unanimously to approve the following course changes:
  NEW COURSES: COMS 811, GEOL 776, SLAV 754
  DELETIONS: GEOL 774

- The motion (CGS report by Alesia Woszidlo) was seconded, and the CAC voted unanimously to approve the following degree requirements:
  Changes to Existing Degree – Psychology, PhD

- The motion (CGS report by Alesia Woszidlo) was seconded, and the CAC voted unanimously to approve the following degree requirements:
  1. New Graduate Certificate: SPAA, City and County Management
  2. New Graduate Certificate: SPAA, Performance Management

Report of the Committee on Undergraduate Studies & Advising (CUSA)
(Ruth Ann Atchley, 2014-2015 CUSA Chair, reporting)

- The motion (CGS report by Ruth Ann Atchley) was seconded, and the CAC voted unanimously to approve the following course changes:
  DELETIONS: BIOL 427, HA 369

- The motion (CGS report by Ruth Ann Atchley) was seconded, and the CAC voted unanimously to approve the following degree requirements:
  Changes to Existing Major to BA/BGS Classical Antiquity and BA/BGS Classical Languages
The motion (CGS report by Ruth Ann Atchley) was seconded, and the CAC voted **unanimously** to approve the following **degree requirements**:

1. Changes to Existing Major to BS Geology – Geophysics option
2. Changes to Existing Major to BS Geology – Earth & Space Science Licensure
3. Changes to Existing Major to BS Geology – General Geology
4. Changes to Existing Major to BS Geology – Environmental Geology
5. Changes to Existing Major to BS Geology – Engineering Geology

The motion (CGS report by Ruth Ann Atchley) was seconded, and the CAC voted **unanimously** to approve the following **degree requirements**:

1. Changes to Existing Major to BA & BGS History of Art
2. Changes to Existing requirements for Departmental Honors in History of Art
3. Changes to Existing Major to BFA History of Art

The motion (CGS report by Ruth Ann Atchley) was seconded, and the CAC voted **unanimously** to approve the following **proposals**:

1. BIOL155 as a lab/field experience course for the BA Degree Specific Requirements
2. ANTH 462 as a lab/field experience course for the BA Degree Specific Requirements

A motion was made and seconded, and the CAC voted **unanimously** to adjourn at 4:50 PM.

*Next regularly scheduled meeting of the CAC will be Tuesday, January 20, 2015, at 4:00 PM in 210 Strong Hall*

*Note: Rather than 2nd week of January, CAC meets on 3rd week (after classes begin) due to winter break.*

II. REPORT OF THE COMMITTEE ON GRADUATE STUDIES (CGS)

A. **Curricular Changes for Approval**

COMPUTATIONAL BIOLOGY
(formerly Bioinformatics)

**CHANGE:**

BINF 703 NEW COURSE
ADVANCED COMPUTATIONAL BIOLOGY I (5)

This is the first semester of an intensive two-semester course in Computational Biology, aimed at second-year graduate students. Topics include graph theory, systems biology, mathematical and computational modeling of complex systems, synthetic biology and protein design. Students will gain a mastery of cutting-edge topics in Computational Biology through lectures, careful reading of current literature, and advanced individual research projects. Prerequisites: BINF 701 and 702, or consent of instructor. LEC

Grading: A-F, W and I

This course is an elective
This course is not an RSRS course
This course is not a degree requirement

Effective Fall 2015 and taught every fall semester

**JUSTIFICATION:**

This course is being created as part of our efforts to modernize and expand our graduate curriculum in the newly renamed Center for Computational Biology (formerly the Center for Bioinformatics). This course will be team-taught by several faculty members in our program, including two recent faculty hires who bring new expertise to the Center. Taken as a sequence, BINF 703 and 704 will provide comprehensive coverage of new areas in Computational Biology, with a focus on systems biology, synthetic biology, and protein design. The course is intended for second-year graduate students in the Computational Biology program; graduate students from other
programs will be allowed to enroll with permission of the instructors. Based on the strong interest among our 
graduate students in this topic, we expect that the majority of them will choose to enroll in this course in their 
second year.

CHANGE: NEW COURSE  
BINF 704  
ADVANCED COMPUTATIONAL BIOLOGY II (5)  
This is the second semester of an intensive two-semester course in Computational Biology, aimed at second-year 
graduate students. Topics include graph theory, systems biology, mathematical and computational modeling of 
complex systems, synthetic biology and protein design. Students will gain a mastery of cutting-edge topics in 
Computational Biology through lectures, careful reading of current literature, and advanced individual research 
projects. Prerequisites: BINF 703. LEC

Grading: A-F, W and I
This course is an elective
This course is not an RSRS course
This course is not a degree requirement
Effective Spring 2016 and taught every Spring semester

JUSTIFICATION:  
This course is being created as part of our efforts to modernize and expand our graduate curriculum in the newly 
renamed Center for Computational Biology (formerly the Center for Bioinformatics). This course will be team-
taught by several faculty members in our program, including two recent faculty hires who bring new expertise to 
the Center. Taken as a sequence, BINF 703 and 704 will provide comprehensive coverage of new areas in 
Computational Biology, with a focus on systems biology, synthetic biology, and protein design. The course is 
tended for second-year graduate students in the Computational Biology program; graduate students from other 
programs will be allowed to enroll with permission of the instructors. Based on the strong interest among our 
graduate students in this topic, we expect that the majority of them will choose to enroll in this course in their 
second year.

PSYCHOLOGY

CHANGE: NEW COURSE  
PSYC 984  
MISSING DATA ANALYSIS  
The primary goal of the course is to promote a solid understanding of the logic and implementation of modern 
missing data techniques. The following topics are included: missing data theory, traditional missing data 
techniques, maximum likelihood estimation, EM algorithm, multiple imputation, planned missing data designs, 
and techniques for missing not at random data. Students will learn how to implement the missing data techniques 
in SAS, Mplus and R. Prerequisite: PSYC 790 and PSYC 896 LEC.

Grading: A-F, W and I
Meets with: PSYC 684
This course is an elective
This course is an RSRS course
This course is not a degree requirement
Effective Spring 2016 and then every other year.

JUSTIFICATION:  
This course has been taught previously as an instance of PSYC 993. Now, we would like it to have a separate 
course number with an undergraduate cross-listing so that it can also satisfy requirements of the undergraduate 
Social and Behavioral Sciences Methodology minor. May not be repeated for graduate credit.

CHANGE: NEW COURSE  
PSYCH 988  
MODELING OF INTRAINDIVIDUAL OBSERVATIONS
Many statistical methods are apt for modeling cross-sectional data or growth processes. These methods are often not ideal for researchers collecting intensive intra-individual observations, such as those from diary studies, ecological momentary assessments, and physiological data, which often exhibit complex, nonlinear changes over time. This class examines methods for extracting information from intensive intra-individual observations. This class will survey methods and concepts from areas such as dynamical systems, chaos theory, time series analysis and differential equation modeling. Some prior experience with R or related language strongly encouraged. Some prior experience with R or related language strongly encouraged. Prerequisites: PSYC 790 or equivalent and a course in Structural Equation Modeling or Multilevel Modeling (Hierarchical Linear modeling, Mixed Models). LEC

Grading: A-F, W and I

Meets with: PSYC 688

This course is an elective
This course is a RSRS course
This course is not a degree requirement

Effective Fall 2016 and then every other year.

JUSTIFICATION:
This course has been taught previously as an instance of PSYC 993. Now we would like it to have a separate course number with an undergraduate cross-listing so that it can serve also as an elective for the undergraduate.

B. **Degree Requirements for Approval**

1. **Changes to Existing Degree – Department, MA/PhD (change in required and elective hours)**

   **(OLD) Current**

   **M.S. Degree in Physics**

   The departmental web page with some additional information, e.g., milestones, can be found at [http://www.physics.ku.edu/~physics/graduate/about.shtml](http://www.physics.ku.edu/~physics/graduate/about.shtml)

   Candidates must complete a minimum of 30 credit hours of advanced lecture courses (numbered 500 or above) in physics and related subjects within a period of 7 years. Program requirements include

   1. An undergraduate knowledge of physics. This must be certified by the department to be at an advanced undergraduate level (600-level KU courses). The certification must be achieved within 12 months (extension possible with recommendation of the graduate admission committee) of entering the program and may require additional coursework. Extension is possible with recommendation of the graduate admission committee. Certification can be achieved in several ways:
      1. A GRE physics score greater than or equal to 650; or
      2. The determination by the graduate director and graduate advisor, based on the diagnostic exam given on entering the program combined with the student’s undergraduate record, that the student understands all major elements of undergraduate physics; or
      3. Successful completion with grade of B or better on all undergraduate courses that the graduate director and/or advisor recommends based on the results of part b. above. The student who has not succeeded in certifying his or her undergraduate physics knowledge in 1 of the above 3 ways could, within 12 months of starting the program, petition the Graduate Committee for an oral exam on undergraduate physics. The oral exam will be administered by a committee of 6 faculty members assigned by the department.
      4. A candidate for a Master's or Ph.D. degree who has not had the equivalent of 6 credit hours of advanced undergraduate laboratory course work (Junior/Senior level) is required to take 1 of the 3 advanced laboratory courses offered in the Department.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 516</td>
<td>Physical Measurements</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 536</td>
<td>Electronic Circuit Measurement and Design</td>
<td>4</td>
</tr>
</tbody>
</table>
2. 3 basic courses:

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<tbody>
<tr>
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<td>Quantum Mechanics I</td>
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<td>Electrodynamics I</td>
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</table>

3. 2 additional courses chosen from:

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<td>PHSX 761</td>
<td>Elementary Particles I</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 781</td>
<td>Solid State Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 793</td>
<td>Physical Cosmology</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 795</td>
<td>Space Plasma Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 815</td>
<td>Computational Methods in Physical Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

4. A minimum of 2 hours in PHSX 899 Master’s Research/Thesis is required, with a maximum of 6 hours that count toward the master’s degree. Ordinarily no more than 2 hours will be allowed unless a thesis or written report is presented.

5. The remaining 9 to 13 hours of advanced electives must be either advanced lecture courses or advanced undergraduate laboratory courses. (This proviso excludes seminars and special problems courses.)

Communication Skills

All graduate students, after their first semester, will deliver at least 1 oral presentation per semester. The talk should be at least 20 minutes long. For students not yet associated with a research group, the Graduate Seminar can serve as a venue. For more advanced students the seminar of their research group would be a natural venue. The student does not need to be enrolled in the seminar to present a talk for this purpose. Off-campus venues such as collaboration meetings and physics conferences can also serve this purpose. When giving presentations, students should fill out a form available on the department website and have it signed by 2 witnesses, 1 of which must be a Physics or Astronomy faculty and other a Ph.D. doing research in the department. The completed form must be handed to the office staff. Faculty members who sign off on the talks are expected to provide constructive feedback to the student. The graduate advisor will monitor student compliance with the requirement.

General Examination

Candidates must pass a general oral examination in physics. The examination is given shortly before completion of other work for the degree. A master’s thesis is not required but may be submitted if the candidate and the director of the candidate’s research believe it to be appropriate.

M.S. Subspecialty in Computational Physics and Astronomy

This degree is a subspecialty program for students with a background in physics, astronomy, computer science, mathematics, or engineering who wish to become familiar with computer-based approaches to problems in these fields. Minimum preparation expected includes a year's course in general physics, mathematics through differential equations, and knowledge of FORTRAN, C++, or another programming language.

A total of 30 hours of graduate credit is required. The 33 hours listed below under 2 and 3 may include certain undergraduate-level electrical engineering and computer science courses. (Only courses numbered 500 and above count as graduate credit.) Students entering the program may have satisfied several of these requirements, but a total of 30 hours of graduate credit is still required. No more than the required 6 hours of PHSX 899 Master’s Research/Thesis may be counted toward the degree. Degree requirements include
1. An undergraduate knowledge of physics. This must be certified by the department to be at an advanced undergraduate level (600-level KU courses). The certification must be achieved within 12 months (extension possible with recommendation of the graduate admission committee) of entering the program and may require additional coursework. Extension is possible with recommendation of the graduate admission committee. Certification can be achieved in several ways:
   1. A GRE physics score greater than or equal to 650; or
   2. The determination by the graduate director and graduate advisor, based on the diagnostic exam given on entering the program combined with the student’s undergraduate record, that the student understands all major elements of undergraduate physics; or
   3. Successful completion with grade of B or better on all undergraduate courses that the graduate director and/or advisor recommends based on the results of part b above. The student who has not succeeded in certifying their undergraduate physics knowledge in 1 of the above 3 ways could, within 12 months of starting the program, petition the Graduate Committee for an oral exam on undergraduate physics. The oral exam will be administered by a committee of 6 faculty members assigned by the department.
   4. A candidate for a Master's or Ph.D. degree who has not had the equivalent of 6 credit hours of advanced undergraduate laboratory course work (junior/senior level) is required to take one of the 3 advanced laboratory courses offered in the Department:

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</tr>
<tr>
<td>PHSX 601</td>
<td>Design of Physical and Electronic Systems</td>
<td>4</td>
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2. Required Courses (21 credit hours)

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<tr>
<th>Course Code</th>
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<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX/ASTR 815</td>
<td>Computational Methods in Physical Sciences</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 718</td>
<td>Mathematical Methods in Physical Sciences</td>
<td>3</td>
</tr>
<tr>
<td>MATH/EECS 781</td>
<td>Numerical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>EECS – 1 course at the 300 level or above (in addition to EECS 781)</td>
<td>(Note: courses below the 500 level will not count towards the required 30 hours of graduate credit.)</td>
<td></td>
</tr>
<tr>
<td>1 additional PHSX/ASTR/ATMO lecture course at the level or above</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHSX 899</td>
<td>Master's Research/Thesis</td>
<td>1-10</td>
</tr>
</tbody>
</table>

3. 12 or more credits from the following list of courses:
(Note: Double counting of courses is not allowed, e.g. a course used to fulfill a requirement under part 2. (e.g. EECS 448) may not also be counted under part 3.)

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<tr>
<td>EECS 360</td>
<td>Signal and System Analysis</td>
<td>4</td>
</tr>
<tr>
<td>EECS 368</td>
<td>Programming Language Paradigms</td>
<td>5</td>
</tr>
<tr>
<td>EECS 388</td>
<td>Embedded Systems</td>
<td>4</td>
</tr>
<tr>
<td>EECS 448</td>
<td>Software Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>EECS 560</td>
<td>Data Structures</td>
<td>3</td>
</tr>
<tr>
<td>EECS 672</td>
<td>Introduction to Computer Graphics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 596</td>
<td>Special Topics: _____</td>
<td>1</td>
</tr>
<tr>
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<tr>
<td>MATH 611</td>
<td>Time Series Analysis</td>
<td>3</td>
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<tr>
<td>MATH 627</td>
<td>Probability</td>
<td>8</td>
</tr>
<tr>
<td>MATH 647</td>
<td>Applied Partial Differential Equations</td>
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5. Thesis: An important component of this degree is the completion and documentation of a successful computer project. A thesis must be presented that describes the basic physics involved in the project, the method of implementing the project, and a discussion of the results. An oral defense of the thesis is required before a committee of at least 3 members of the graduate faculty.

Please go to this website to see the University's policy on time limits:
https://documents.ku.edu/policies/Graduate_Studies/maprogramtimeconstraints.htm

(NEW) Proposed
Change in required and elective hours

M.S. Degree in Physics

The departmental web page with some additional information, e.g., milestones, can be found at
http://www.physics.ku.edu/~physics/graduate/about.shtml

Candidates must complete a minimum of 30 credit hours of advanced lecture courses (numbered 500 or above) in physics and related subjects within a period of 7 years. Program requirements include

1. An undergraduate knowledge of physics. This must be certified by the department to be at an advanced undergraduate level (600-level KU courses). The certification must be achieved within 12 months (extension possible with recommendation of the graduate admission committee) of entering the program and may require additional coursework. Extension is possible with recommendation of the graduate admission committee. Certification can be achieved in several ways:
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<td>PHSX 761</td>
<td>Elementary Particles I</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 781</td>
<td>Solid State Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 792</td>
<td>Topics in Advanced Astrophysics</td>
<td>3</td>
</tr>
<tr>
<td>PHSX 793</td>
<td>Physical Cosmology</td>
<td>3</td>
</tr>
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<td>PHSX 795</td>
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</tbody>
</table>

4. A minimum of 2 hours in PHSX 899 Master’s Research/Thesis is required, with a maximum of 6 hours that count toward the master’s degree. Ordinarily no more than 2 hours will be allowed unless a thesis or written report is presented.

5. The remaining 6 to 10 hours of advanced electives must be either advanced lecture courses or advanced undergraduate laboratory courses. (This proviso excludes seminars and special problems courses.)

**Communication Skills**

All graduate students, after their first semester, will deliver at least 1 oral presentation per semester. The talk should be at least 20 minutes long. For students not yet associated with a research group, the Graduate Seminar can serve as a venue. For more advanced students the seminar of their research group would be a natural venue. The student does not need to be enrolled in the seminar to present a talk for this purpose. Off-campus venues such as collaboration meetings and physics conferences can also serve this purpose. When giving presentations, students should fill out a form available on the department web site and have it signed by 2 witnesses, 1 of which must be a Physics or Astronomy faculty and other a Ph.D. doing research in the department. The completed form must be handed to the office staff. Faculty members who sign off on the talks are expected to provide constructive feedback to the student. The graduate advisor will monitor student compliance with the requirement.

**General Examination**

Candidates must pass a general oral examination in physics. The examination is given shortly before completion of other work for the degree. A master’s thesis is not required but may be submitted if the candidate and the director of the candidate’s research believe it to be appropriate.

**M.S. Subspecialty in Computational Physics and Astronomy**

This degree is a subspecialty program for students with a background in physics, astronomy, computer science, mathematics, or engineering who wish to become familiar with computer-based approaches to problems in these fields. Minimum preparation expected includes a year's course in general physics, mathematics through differential equations, and knowledge of FORTRAN, C++, or another programming language.

A total of 30 hours of graduate credit is required. The 33 hours listed below under 2 and 3 may include certain undergraduate-level electrical engineering and computer science courses. (Only courses numbered 500 and above count as graduate credit.) Students entering the program may have satisfied several of these requirements, but a total of 30 hours
of graduate credit is still required. No more than the required 6 hours of **PHSX 899** Master’s Research/Thesis may be counted toward the degree. Degree requirements include

1. An undergraduate knowledge of physics. This must be certified by the department to be at an advanced undergraduate level (600-level KU courses). The certification must be achieved within 12 months (extension possible with recommendation of the graduate admission committee) of entering the program and may require additional coursework. Extension is possible with recommendation of the graduate admission committee. Certification can be achieved in several ways:
   1. A GRE physics score greater than or equal to 650; or
   2. The determination by the graduate director and graduate advisor, based on the diagnostic exam given on entering the program combined with the student's undergraduate record, that the student understands all major elements of undergraduate physics; or
   3. Successful completion with grade of B or better on all undergraduate courses that the graduate director and/or advisor recommends based on the results of part b above. The student who has not succeeded in certifying their undergraduate physics knowledge in 1 of the above 3 ways could, within 12 months of starting the program, petition the Graduate Committee for an oral exam on undergraduate physics. The oral exam will be administered by a committee of 6 faculty members assigned by the department.
   4. A candidate for a Master's or Ph.D. degree who has not had the equivalent of 6 credit hours of advanced undergraduate laboratory course work (junior/senior level) is required to take one of the 3 advanced laboratory courses offered in the Department:

   - **PHSX 516** Physical Measurements
   - **PHSX 536** Electronic Circuit Measurement and Design
   - **PHSX 601** Design of Physical and Electronic Systems

2. Required Courses (21 credit hours)

   - **PHSX/ASTR 815** Computational Methods in Physical Sciences 3
   - **PHSX 718** Mathematical Methods in Physical Sciences 3
   - **MATH/EECS 781** Numerical Analysis I 3
   - EECS – 1 course at the 300 level or above (in addition to EECS 781) (Note: courses below the 500 level will not count towards the required 30 hours of graduate credit.)
   - 1 additional PHSX/ASTR/ATMO lecture course at the level or above
   - **PHSX 899** Master's Research/Thesis 1-10

3. 12 or more credits from the following list of courses:
   (Note: Double counting of courses is not allowed, e.g. a course used to fulfill a requirement under part 2. (e.g. **EECS 448**) may not also be counted under part 3.)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EECS 360</td>
<td>Signal and System Analysis</td>
<td>4</td>
</tr>
<tr>
<td>EECS 368</td>
<td>Programming Language Paradigms</td>
<td>3</td>
</tr>
<tr>
<td>EECS 388</td>
<td>Embedded Systems</td>
<td>4</td>
</tr>
<tr>
<td>EECS 448</td>
<td>Software Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>EECS 560</td>
<td>Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>EECS 672</td>
<td>Introduction to Computer Graphics</td>
<td>3</td>
</tr>
</tbody>
</table>

   Select 1 of the following - Special Topics (Examples of recent topics: Mathematics of Wall Street Computer-aided, Study of Differential Geometry, Chaos and Fractals, Fractional Brownian Motion and Its Applications, Wavelet Analysis, Statistical Theory, Stochastic Differential Equations and Applications)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>MATH 596</td>
<td>Special Topics: _____</td>
<td>4</td>
</tr>
<tr>
<td>MATH 696</td>
<td>Special Topics: _____</td>
<td>4</td>
</tr>
<tr>
<td>MATH 796</td>
<td>Special Topics: _____</td>
<td>4</td>
</tr>
<tr>
<td>MATH 611</td>
<td>Time Series Analysis</td>
<td>8</td>
</tr>
</tbody>
</table>
4. Communication Skills: All graduate students, after their first semester, will deliver at least 1 oral presentation per semester. The talk should be at least 20 minutes long. For students not yet associated with a research group, the Graduate Seminar can serve as a venue. For more advanced students the seminar of their research group would be a natural venue. The student does not need to be enrolled in the seminar to present a talk for this purpose. Off-campus venues such as collaboration meetings and physics conferences can also serve this purpose. When giving presentations, students should fill out a form available on the department web site and have it signed by 2 witnesses, 1 of which must be a Physics or Astronomy faculty and other a Ph.D. doing research in the department. The completed form must be handed to the office staff. Faculty members who sign off on the talks are expected to provide constructive feedback to the student. The graduate advisor will monitor student compliance with the requirement.

5. Thesis: An important component of this degree is the completion and documentation of a successful computer project. A thesis must be presented that describes the basic physics involved in the project, the method of implementing the project, and a discussion of the results. An oral defense of the thesis is required before a committee of at least 3 members of the graduate faculty.

The change(s) to this program will first take effect Fall 2015 and first appear in the 2015-2016 academic catalog.

JUSTIFICATION:
The faculty has taken a vote and determined that PHSX 718 is a core class that is fundamental to a Graduate level education in Physics and Astronomy. Because PHSX 718 is proposed as an additional required course, the number of elective credit hours would need to be reduced from 9-13 down to 6-10. In addition to making PHSX 718 a required course, the faculty has determined that PHSX 731 and PHSX 792 are valuable courses and should be added as additional elective courses to give the students more options for meeting their 6-10 hour requirement.

III. REPORT OF THE COMMITTEE ON UNDERGRADUATE STUDIES & ADVISING (CUSA)

A. Curricular Changes for Approval

ASTRONOMY

CHANGE: PREREQUISITE
ASTR 391 PHYSICAL ASTRONOMY, HONORS N
(OLD) An honors, calculus-based introduction to astronomy and astrophysics, required for astronomy majors. Components of the Universe - from planetary systems, stellar systems, large scale structure and cosmology - are examined to illuminate the physics principles which govern their evolution. Prerequisite: MATH 121, and either permission of instructor, or participation in the University Honors Program. LEC.

ASTR 391 PHYSICAL ASTRONOMY, HONORS
(NEW) An honors, calculus-based introduction to astronomy and astrophysics, required for astronomy majors. Components of the Universe - from planetary systems, stellar systems, large scale structure and cosmology - are examined to illuminate the physics principles which govern their evolution. Prerequisite: MATH 125, and either permission of instructor, or participation in the University Honors Program. LEC.

BIOLOGY

CHANGE: DELETE COURSE
BIOL 427 DEVELOPMENTAL BIOLOGY LABORATORY 2 N
Laboratory exercises examine processes of early development in animal model organisms. Students study the normal development of live embryos and prepared slides of sea anemones, sea urchins, frogs
Study of regeneration and axial patterning through experimental manipulation of invertebrates is also explored. Prerequisite: Concurrent or prior enrollment in BIOL 417. LAB.

<table>
<thead>
<tr>
<th>CHANGE:</th>
<th>COURSE DESCRIPTION</th>
<th>CREDIT</th>
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<tbody>
<tr>
<td>BIOL 545</td>
<td>EVOLUTION OF DEVELOPMENT</td>
<td>3 N</td>
</tr>
<tr>
<td>(OLD)</td>
<td></td>
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</tr>
<tr>
<td>BIOL 545</td>
<td>EVOLUTION OF DEVELOPMENT</td>
<td>5 N</td>
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<tr>
<td>(NEW)</td>
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An advanced course designed to expose students to evolutionary change in the developmental patterning of plant and animal form. This course integrates multiple biological disciplines including phylogenetics, comparative morphology, molecular evolution and developmental genetics to explore biodiversity at a mechanistic level. Topics range from issues surrounding homology assessment to empirical examples of how changes in gene expression or function may have shaped morphological diversity. Prerequisite: BIOL 350 or equivalent. LEC

BIOL 600

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<tbody>
<tr>
<td>BIOL 600</td>
<td>INTRODUCTORY BIOCHEMISTRY, LECTURES</td>
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<tr>
<td>(OLD)</td>
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</tr>
<tr>
<td>BIOL 600</td>
<td>INTRODUCTORY BIOCHEMISTRY, LECTURES</td>
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<td>(NEW)</td>
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Designed to offer the essentials of the chemistry of the constituents of living organisms and the changes these constituents undergo (during life processes) in the human body and other living forms. Prerequisite: BIOL 150 or BIOL 151 and one semester of organic chemistry.

COMMUNICATION STUDIES

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<tr>
<th>CHANGE:</th>
<th>COURSE DESCRIPTION</th>
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<tbody>
<tr>
<td>COMS 608</td>
<td>COMMUNICATION, MEDIA &amp; TERRORISM</td>
<td>3 S</td>
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<td></td>
<td>The course considers the topics of media and terrorism from a macro public opinion and politics perspective. This course addresses the nature of terrorism, who terrorists are, and what are their grievances with the larger society in which they are embedded. Terrorism has unique links to communication and these will be explored in various ways: consideration of acts of terror, recruiting new terrorists, and issues in choosing effective and ineffective means of fighting terrorism. Additional topics include media portrayals of terrorism in news discourse and mediated communication such as motion pictures and televised dramatic portrayals. Prerequisite: COMS 130</td>
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GERMAN

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<tr>
<th>CHANGE:</th>
<th>COURSE DESCRIPTION</th>
<th>CREDIT</th>
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<tbody>
<tr>
<td>GERM 130</td>
<td>GERMAN-SPEAKING EUROPE AND THE GERMAN-SPEAKING EUROPEANS</td>
<td>3 H</td>
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<td></td>
<td>A survey of contemporary German-speaking Europe that covers topics such as geography, the environment, technology, the arts, music, film, literature, politics, immigration, language, religion, customs. Focus on Germany, Austria, Switzerland, Belgium, Luxembourg, Liechtenstein. Taught in English. Does not count toward the German Studies major or minor.</td>
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HINDI

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<tr>
<th>CHANGE:</th>
<th>COURSE DESCRIPTION</th>
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<tbody>
<tr>
<td>HNDI 593</td>
<td>DIRECTED STUDY IN HINDI CULTURE AND LITERATURE</td>
<td>1-3 H</td>
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<td></td>
<td>This course is designed for students seeking proficiency in Hindi beyond HNDI 320. Instructor will direct the student through readings and materials in Hindi that will add to the students substantive knowledge of India and culture in the Hindi language. May be taken multiple semesters for credit with varying content. Prerequisite: HNDI 320, and consent of instructor.</td>
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</tbody>
</table>
### HISTORY

<table>
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<tr>
<th>CHANGE:</th>
<th>TITLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIST 568 (OLD)</td>
<td>THE RISE AND FALL OF THE SOVIET UNION, 1917 TO THE PRESENT  3  H  W</td>
<td>An exploration of the Soviet Union's creation, evolution, collapse, and legacy in contemporary Russia and Eurasia. Drawing on historical scholarship, literature, music, and film, the course examines the major trends and developments in Soviet politics, ideology, society, economy, and culture. Special attention is paid to how the multiethnic Soviet state's rise and fall reflected broader changes in the world during the &quot;Soviet century&quot;. LEC.</td>
</tr>
<tr>
<td>HIST 568 (NEW)</td>
<td>RISE &amp; FALL OF THE SOVIET UNION  3  H  W</td>
<td>An exploration of the Soviet Union's creation, evolution, collapse, and legacy in contemporary Russia and Eurasia. Drawing on historical scholarship, literature, music, and film, the course examines the major trends and developments in Soviet politics, ideology, society, economy, and culture. Special attention is paid to how the multiethnic Soviet state's rise and fall reflected broader changes in the world during the &quot;Soviet century&quot;. LEC.</td>
</tr>
</tbody>
</table>

### LIBERAL ARTS & SCIENCES

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<tr>
<th>CHANGE:</th>
<th>COURSE DESCRIPTION</th>
<th>PREREQUISITE</th>
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</thead>
<tbody>
<tr>
<td>LA&amp;S 150 (OLD)</td>
<td>ACADEMIC SUCCESS SEMINAR  1  U</td>
<td>This course provides students with the skills and resources necessary to improve their approach to their academic career. Topics covered include: utilization of campus resources; time management; test preparation and anxiety; reading comprehension; procrastination; and memory and concentration. Prerequisite: Eligible students must be on academic probation or consent of instructor.</td>
</tr>
<tr>
<td>LA&amp;S 150 (NEW)</td>
<td>ACADEMIC SUCCESS SEMINAR  1  U</td>
<td>This course provides students with the skills and resources necessary to improve their approach to their academic career. It is designed to help enhance students' time management and study skills as well as facilitate a connection with student success resources. Students and instructors work together in an interactive learning environment to create an academic foundation for success. Additional topics covered include: test preparation and anxiety; reading comprehension; procrastination; and memory and concentration. Recommended for students with less than a 2.5 GPA.</td>
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### MATH

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<thead>
<tr>
<th>CHANGE:</th>
<th>NEW COURSE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 125</td>
<td>CALCULUS I  4  N</td>
<td>Limits, continuity and derivatives of algebraic, trigonometric, exponential and logarithmic functions. Curve sketching, optimization and other applications of the derivative. Antiderivatives, Riemann sums, the definite integral, and the fundamental theorem of calculus. Open for only 1 hour credit to students with credit in MATH 115. Not open for credit to students with credit in MATH 116, 121, 141, or 145. Prerequisite: MATH 103 or MATH 104, with a grade of C- or higher; or 3 years of college preparatory mathematics including trigonometry, with a score of 28 or higher on the ACT Mathematics exam.</td>
</tr>
<tr>
<td>MATH 126</td>
<td>CALCULUS II  4  N</td>
<td>Techniques of integration, including integration by parts. Applications of integration, including volume, arc length, work and average value. Infinite sequences and series and Taylor series. Polar coordinates, vectors and the geometry of space. Open for only 2 hours credit to students with credit in MATH 116. Not open for credit to students with credit in MATH 122, 142 or 146. Prerequisite: MATH 116, 121, 125, 141 or 145, with a grade of C- or higher.</td>
</tr>
<tr>
<td>MATH 127</td>
<td>CALCULUS III  4  N</td>
<td>Multivariable functions, partial derivatives and their applications, multiple integrals and their applications. Vector-valued functions, line and surface integrals, Green, Gauss and Stokes Theorems. Open for only 2 hours credit to students with credit in MATH 122 or 142. Not open for credit to students with credit in MATH 147, 223 or 243. Prerequisite: MATH 126 or 146, with a grade of C- or higher.</td>
</tr>
</tbody>
</table>
CHANGE:  
MATH 145  
NEW COURSE  
CALCULUS I, HONORS  4  N  
Limits, continuity and derivatives of algebraic, trigonometric, exponential and logarithmic functions. Curve sketching, optimization and other applications of the derivative. Antiderivatives, Riemann sums, the definite integral, and the fundamental theorem of calculus. Not open for credit to students with credit in MATH 116, 121, 125 or 141. Prerequisite: An ACT Math score of 34 or higher, or membership in the University Honors Program and an ACT Math score of 32 or higher.

CHANGE:  
MATH 146  
NEW COURSE  
CALCULUS II, HONORS  4  N  
Techniques of integration, including integration by parts. Applications of integration, including volume, arc length, work and average value. Infinite sequences and series and Taylor series. Polar coordinates, vectors and the geometry of space. Open for only 2 hours credit to students with credit in MATH 116. Not open for credit to students with credit in MATH 122, 126 or 142. Prerequisite: MATH 121, 125, 141 or 145, with a grade of C- or higher; and invitation of the Department of Mathematics.

CHANGE:  
MATH 147  
NEW COURSE  
CALCULUS III, HONORS  4  N  
Multivariable functions, partial derivatives and their applications, multiple integrals and their applications. Vector-valued functions, line and surface integrals, Green, Gauss and Stokes Theorems. Open for only 2 hours credit to students with credit in MATH 122 or 142. Not open for credit to students with credit in MATH 127, 223 or 243. Prerequisite: MATH 126 or 146, with a grade of C- or higher; and invitation of the Department of Mathematics.

CHANGE:  
MATH 220  
PREREQUISITE  
APPLIED DIFFERENTIAL EQUATIONS  3  N  
Linear ordinary differential equations, laplace transforms, systems of equations, and applications. Not open to those who have taken MATH 320. Prerequisite: MATH 122 or MATH 142 or equivalent. LEC.

MATH 220  
APPLIED DIFFERENTIAL EQUATIONS  3  N  
Linear ordinary differential equations, Laplace transforms, systems of equations, and applications. Not open to those who have taken MATH 320. Prerequisite: MATH 122 or MATH 142, or MATH 126 or MATH 146 with grade of C- or higher; previous or concurrent enrollment in MATH 290 or MATH 291 recommended. LEC.

CHANGE:  
MATH 221  
PREREQUISITE  
APPLIED DIFFERENTIAL EQUATIONS, HONORS  3  N  (OLD)  
Linear Ordinary Differential Equations, Laplace Transforms, Systems of Equations, Enrichment Applications. Prerequisite: Math 122 or Math 142 or equivalent, and invitation from the Department of Mathematics. Not open to students with credit in Math 320. LEC.

MATH 221  
APPLIED DIFFERENTIAL EQUATIONS, HONORS  3  N  (NEW)  
Linear Ordinary Differential Equations, Laplace Transforms, Systems of Equations, Enrichment Applications. Prerequisite: Math 122 or Math 142, or MATH 126 or MATH 146 with grade of C- or higher, and invitation from the Department of Mathematics; previous or concurrent enrollment in MATH 290 or 291 recommended. Not open to students with credit in Math 320. LEC.

CHANGE:  
MATH 290  
PREREQUISITE  
ELEMENTARY LINEAR ALGEBRA  2  N  (OLD)  
Systems of linear equations, matrices, vector spaces, linear transformations, and applications. Not open to those who have taken MATH 590. Prerequisite: MATH 122 or MATH 142 or equivalent. LEC.

MATH 290  
ELEMENTARY LINEAR ALGEBRA  2  N  (NEW)  
Systems of linear equations, matrices, vector spaces, linear transformations, and applications. Not open to those who have taken MATH 590. Prerequisite: MATH 122 or MATH 142, or MATH 126 or MATH 146 with grade of C- or higher. LEC.
MATH 291 ELEMENTARY LINEAR ALGEBRA, HONORS 2 N
(OLD) Systems of Linear Equations, Matrices, Vector Spaces, Linear Transformations, Enrichment Applications. Prerequisite: Math 122 or Math 142 or equivalent, and invitation from the Department of Mathematics. Not open to students who have taken MATH 590. LEC.

MATH 291 ELEMENTARY LINEAR ALGEBRA, HONORS 2 N
(NEW) Systems of Linear Equations, Matrices, Vector Spaces, Linear Transformations, Enrichment Applications. Prerequisite: Math 122 or Math 142, or MATH 126 or MATH 146 with a grade of C- or higher, and invitation from the Department of Mathematics. Not open to students who have taken MATH 590. LEC.

CHANGE: PREREQUISITE
MATH 320 ELEMENTARY DIFFERENTIAL EQUATIONS 3 N
(OLD) Linear ordinary differential equations, series solutions. Laplace transforms. Systems of equations. Not open to those who have taken MATH 220. Prerequisite: MATH 223 and MATH 290, or MATH 143. LEC.

MATH 320 ELEMENTARY DIFFERENTIAL EQUATIONS 3 N
(NEW) Linear ordinary differential equations, series solutions. Laplace transforms. Systems of equations. Not open to those who have taken MATH 220. Prerequisite: MATH 223 or MATH 243, or MATH 127 or MATH 147 with a grade of C- or higher, and MATH 290 or MATH 291. LEC.

CHANGE: PREREQUISITE
MATH 409 TOPICS IN GEOMETRY FOR SECONDARY AND MIDDLE SCHOOL TEACHERS 2 N
(OLD) Study of selected topics from Euclidean, non-Euclidean, and transformation geometry chosen to give breadth to the mathematical background of secondary and middle school teachers. May not be counted for junior-senior credit towards a major in mathematics. Prerequisite: MATH 122. Students enrolled in MATH 409 must concurrently enroll in MATH 410. LEC.

MATH 409 TOPICS IN GEOMETRY FOR SECONDARY AND MIDDLE SCHOOL TEACHERS 2 N
(NEW) Study of selected topics from Euclidean, non-Euclidean, and transformation geometry chosen to give breadth to the mathematical background of secondary and middle school teachers. May not be counted for junior-senior credit towards a major in mathematics. Prerequisite: MATH 122 or MATH 126 or MATH 142 or MATH 146. Students enrolled in MATH 409 must concurrently enroll in MATH 410. LEC.

CHANGE: PREREQUISITE
MATH 410 TOPICS IN HISTORY OF MATHEMATICS FOR SECONDARY AND MIDDLE SCHOOL TEACHERS 1 N
(OLD) Study of selected topics from mathematical history chosen to provide students with knowledge of major historical developments in mathematics including individual contributions and contributions from different cultures. These topics will include a historical development of Euclidean and non-Euclidean geometry. May not be counted for junior-senior credit towards a major in mathematics. Prerequisite: MATH 122. Students enrolled in MATH 410 must concurrently enroll in MATH 409. LEC.

MATH 410 TOPICS IN HISTORY OF MATHEMATICS FOR SECONDARY AND MIDDLE SCHOOL TEACHERS 1 N
(NEW) Study of selected topics from mathematical history chosen to provide students with knowledge of major historical developments in mathematics including individual contributions and contributions from different cultures. These topics will include a historical development of Euclidean and non-Euclidean geometry. May not be counted for junior-senior credit towards a major in mathematics. Prerequisite: MATH 122 or MATH 126 or MATH 142 or MATH 146. Students enrolled in MATH 410 must concurrently enroll in MATH 409. LEC.

CHANGE: PREREQUISITE
MATH 470 PROBLEM SOLVING 3 N
(OLD) An introduction to the general methods of solving mathematical problems. Particular techniques such as specialization, generalization, contradiction, and induction will be presented. Topics presented may vary from semester to semester. Prerequisite: MATH 122 or equivalent or concurrent enrollment in MATH 122. LEC.

MATH 470 PROBLEM SOLVING 3 N
(NEW) An introduction to the general methods of solving mathematical problems. Particular techniques such as specialization, generalization, contradiction, and induction will be presented. Topics presented may vary from semester to semester. Prerequisite: MATH 122 or equivalent or concurrent enrollment in MATH 122 or MATH 127 or MATH 142 or MATH 147 or concurrent enrollment in MATH 127 or MATH 147. LEC.
**CHANGE:**

**MATH 500**

**PREREQUISITE**

**INTERMEDIATE ANALYSIS 3 N**

A careful formulation of convergence and limits of sequences and functions; continuity and properties of continuous functions; differentiation; the Riemann integral; mean-value theorems and the fundamental theorem of calculus. Not open to students with credit in MATH 765. Prerequisite: MATH 223 and MATH 290, or MATH 143. LEC. 

**MATH 500**

**INTERMEDIATE ANALYSIS 3 N**

A careful formulation of convergence and limits of sequences and functions; continuity and properties of continuous functions; differentiation; the Riemann integral; mean-value theorems and the fundamental theorem of calculus. Not open to students with credit in MATH 765. Prerequisite: MATH 127 or MATH 147 or MATH 223 or MATH 243, and MATH 290 or MATH 291. LEC.

**CHANGE:**

**MATH 526**

**PREREQUISITE**

**APPLIED MATHEMATICAL STATISTICS I 3 N**

A first course in statistics for students with the techniques of calculus at their disposal. The following topics are studied with illustrations and problems drawn from various fields of applications: basic notions of probability and probability distributions; classical estimation and testing procedures for one and two sample problems; chi-square test. Not open to those with credit in MATH 628 or DSCI 301. Prerequisite: MATH 122 or MATH 116. LEC.

**MATH 526**

**APPLIED MATHEMATICAL STATISTICS I 3 N**

A first course in statistics for students with the techniques of calculus at their disposal. The following topics are studied with illustrations and problems drawn from various fields of applications: basic notions of probability and probability distributions; classical estimation and testing procedures for one and two sample problems; chi-square test. Not open to those with credit in MATH 628 or DSCI 301. Prerequisite: MATH 122 or MATH 127 or MATH 142 or MATH 147 or MATH 116 (MATH 127 or MATH 147 recommended). LEC.

**CHANGE:**

**MATH 530**

**PREREQUISITE**

**MATHEMATICAL MODELS 3 N**

An introduction to mathematical models useful in a large variety of scientific and technical endeavors. Topics include: model construction, Markov chain models, models for linear optimization, graphs as models, and game theory. Prerequisite: MATH 223 and MATH 290, or MATH 143. LEC. An introduction to mathematical models useful in a large variety of scientific and technical endeavors. Topics include: model construction, Markov chain models, models for linear optimization, graphs as models, and game theory. Prerequisite: MATH 223 and MATH 290, or MATH 143. LEC.

**MATH 530**

**MATHEMATICAL MODELS 3 N**

An introduction to mathematical models useful in a large variety of scientific and technical endeavors. Topics include: model construction, Markov chain models, models for linear optimization, graphs as models, and game theory. Prerequisite: MATH 127 or MATH 147 or MATH 223 or MATH 243, and MATH 290 or MATH 291. LEC.

**CHANGE:**

**MATH 540**

**PREREQUISITE**

**ELEMENTARY NUMBER THEORY 3 N**

Divisibility, primes and their distribution, the Euclidean algorithm, perfect numbers, Fermat's theorem, Diophantine equations, applications to cryptography. Prerequisite: MATH 122 or consent of instructor. LEC.

**MATH 540**

**ELEMENTARY NUMBER THEORY 3 N**

Divisibility, primes and their distribution, the Euclidean algorithm, perfect numbers, Fermat's theorem, Diophantine equations, applications to cryptography. Prerequisite: MATH 122 or MATH 127 or MATH 142 or MATH 147. LEC.

**CHANGE:**

**MATH 542**

**PREREQUISITE**

**VECTOR ANALYSIS 2 N**

Vector algebra; vector and scalar fields; line and surface integrals; theorems of Gauss, Green, and Stokes. Curvilinear coordinates. Applications. Introduction to tensor analysis. Not open to those with credit in MATH 143. Prerequisite: MATH 223 and MATH 290. LEC.

**MATH 542**

**VECTOR ANALYSIS 2 N**

Vector algebra; vector and scalar fields; line and surface integrals; theorems of Gauss, Green, and Stokes. Curvilinear coordinates. Applications. Introduction to tensor analysis. Not open to those with credit in MATH 143. Prerequisite: MATH 127 or MATH 147 or MATH 223 or MATH 243, and MATH 290 or MATH 291. LEC.
MATH 558 INTRODUCTORY MODERN ALGEBRA 3 N
Development of the number systems. Polynomials. Introduction to abstract number systems such as
groups and fields. Not open to students with credit in MATH 791. Prerequisite: MATH 290. LEC.

MATH 558 INTRODUCTORY MODERN ALGEBRA 3 N
Development of the number systems. Polynomials. Introduction to abstract number systems such as
groups and fields. Not open to students with credit in MATH 791. Prerequisite: MATH 290 or MATH
291. LEC.

MATH 559 MODERN GEOMETRIES 3 N
Selected topics in Euclidean geometry. Synthetic and analytic projective geometry; duality, Desargues'
theorem, perspectives, conics. Non-Euclidean and metric projective geometries. Prerequisite: MATH
122. LEC.

MATH 559 MODERN GEOMETRIES 3 N
Selected topics in Euclidean geometry. Synthetic and analytic projective geometry; duality, Desargues'
theorem, perspectives, conics. Non-Euclidean and metric projective geometries. Prerequisite: MATH
122 or MATH 127 or MATH 142 or MATH 147. LEC.

MATH 590 LINEAR ALGEBRA 3 N
Vector spaces, linear transformations, and matrices. Canonical forms, Determinants. Hermitian, unitary
and normal transformations. Not open to students with credit in MATH 792. Prerequisite: MATH 223
and MATH 290 or equivalent, or MATH 143. LEC.

MATH 590 LINEAR ALGEBRA 3 N
Vector spaces, linear transformations, and matrices. Canonical forms, Determinants. Hermitian, unitary
and normal transformations. Not open to students with credit in MATH 792. Prerequisite: MATH 127
or MATH 147 or MATH 223 or MATH 243, and MATH 290 or MATH 291. LEC.

MATH 591 APPLIED NUMERICAL LINEAR ALGEBRA 3 N
An introduction to numerical linear algebra. Possible topics include: applied canonical forms, matrix
factorizations, perturbation theory, systems of linear equations, linear least squares, singular value
decomposition, algebraic eigenvalue problems, matrix functions, and the use of computational software.
Not open to students with credit in MATH 780 or MATH 782. Prerequisite: MATH 290.
Recommended: EECS 138 or equivalent experience. LEC.

MATH 591 APPLIED NUMERICAL LINEAR ALGEBRA 3 N
An introduction to numerical linear algebra. Possible topics include: applied canonical forms, matrix
factorizations, perturbation theory, systems of linear equations, linear least squares, singular value
decomposition, algebraic eigenvalue problems, matrix functions, and the use of computational software.
Not open to students with credit in MATH 780 or MATH 782. Prerequisite: MATH 290 or MATH 291.
EECS 138 or equivalent recommended. LEC.

MATH 601 ALGEBRAIC CODING THEORY 3 N
An introduction to error correcting codes. Included are: linear codes, cyclic codes, BCH codes, and
convolutional codes. Prerequisite: MATH 290. LEC.

MATH 601 ALGEBRAIC CODING THEORY 3 N
An introduction to error correcting codes. Included are: linear codes, cyclic codes, BCH codes, and
convolutional codes. Prerequisite: MATH 290 or MATH 291. LEC.

MATH 605 APPLIED REGRESSION ANALYSIS 3 N
The matrix approach to regression. Weighted least squares, transformations, examination of residuals,
model selection, and analysis of variance. Prerequisite: One calculus-based statistics course. LEC.

MATH 605 APPLIED REGRESSION ANALYSIS 3 N
The matrix approach to regression. Weighted least squares, transformations, examination of residuals,
model selection, and analysis of variance. Prerequisite: MATH 290 or MATH 291, and MATH 526 or
MATH 628. LEC.
CHANGE: PREREQUISITE
MATH 624 DISCRETE PROBABILITY 3 N
(OLD) Theory and applications of discrete probability models. Elementary combinatory analysis, random walks, urn models, occupancy problems, and the binomial and Poisson distributions. Prerequisite: MATH 223 and MATH 290, or MATH 143. LEC.

MATH 624 DISCRETE PROBABILITY 3 N
(NEW) Theory and applications of discrete probability models. Elementary combinatory analysis, random walks, urn models, occupancy problems, and the binomial and Poisson distributions. Prerequisite: MATH 127 or MATH 147 or MATH 223 or MATH 243, and MATH 290 or MATH 291. LEC.

CHANGE: PREREQUISITE
MATH 627 PROBABILITY 3 N
(OLD) Introduction to mathematical probability; combinatorial analysis; the binomial, Poisson, and normal distributions; limit theorems; laws of large numbers. Prerequisite: MATH 223 and MATH 290 or equivalent, or MATH 143. LEC.

MATH 627 PROBABILITY 3 N
(NEW) Introduction to mathematical probability; combinatorial analysis; the binomial, Poisson, and normal distributions; limit theorems; laws of large numbers. Prerequisite: MATH 127 or MATH 147 or MATH 223 or MATH 243, and MATH 290 or MATH 291. LEC.

CHANGE: PREREQUISITE
MATH 646 COMPLEX VARIABLE AND APPLICATIONS 3 N
(OLD) Analytic functions of a complex variable, infinite series in the complex plane, theory of residues, conformal mapping and applications. Prerequisite: MATH 223. LEC.

MATH 646 COMPLEX VARIABLE AND APPLICATIONS 3 N
(NEW) Analytic functions of a complex variable, infinite series in the complex plane, theory of residues, conformal mapping and applications. Prerequisite: MATH 127 or MATH 147 or MATH 223 or MATH 243. LEC.

CHANGE: PREREQUISITE
MATH 647 APPLIED PARTIAL DIFFERENTIAL EQUATIONS 3 N
(OLD) Boundary value problems; topics on partial differentiation; theory of characteristic curves; partial differential equations of mathematical physics. Prerequisite: MATH 220, MATH 223 and MATH 290; or MATH 320. LEC.

MATH 647 APPLIED PARTIAL DIFFERENTIAL EQUATIONS 3 N
(NEW) Boundary value problems; topics on partial differentiation; theory of characteristic curves; partial differential equations of mathematical physics. Prerequisite: MATH 127 or MATH 147 or MATH 223 or MATH 243, and MATH 220 or MATH 221 or MATH 320. LEC.

CHANGE: PREREQUISITE
MATH 648 CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS 3 N
(OLD) Topics in the calculus of variations, integral equations, and applications. Prerequisite: MATH 220, MATH 223 and MATH 290; or MATH 320. LEC. Prerequisite:

MATH 648 CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS 3 N
(NEW) Topics in the calculus of variations, integral equations, and applications. Prerequisite: MATH 127 or MATH 147 or MATH 223 or MATH 243, and MATH 220 or MATH 221 or MATH 320. LEC.

CHANGE: PREREQUISITE
MATH 650 NONLINEAR DYNAMICAL SYSTEMS 3 N
(OLD) This course provides an introduction to nonlinear ordinary differential equations and dynamical systems theory with an emphasis on applications. Topics covered include the existence and uniqueness of solutions to initial value problems, as well as the qualitative behavior of solutions, including existence of equilibria, periodic and connecting orbits and their stability. Additional topics include an introduction to bifurcation theory and chaos. Prerequisites: MATH 220 and MATH 290, or MATH 320, or equivalent. LEC.

MATH 650 NONLINEAR DYNAMICAL SYSTEMS 3 N
(NEW) This course provides an introduction to nonlinear ordinary differential equations and dynamical systems theory with an emphasis on applications. Topics covered include the existence and uniqueness of solutions to initial value problems, as well as the qualitative behavior of solutions, including existence of equilibria, periodic and connecting orbits and their stability. Additional topics include an introduction
to bifurcation theory and chaos. Prerequisites: MATH 122 or MATH 127 or MATH 142 or MATH 147, and MATH 220 or MATH 221 or MATH 320, and MATH 290 or MATH 291. LEC.

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<tr>
<td>MATH 660 GEOMETRY I 3 N</td>
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<tr>
<td>(OLD)</td>
<td>An introduction to modern geometry. Differential geometry of curves and surfaces, the topological classification of closed surfaces, dynamical systems, and knots and their polynomials. Other topics as time permits. Prerequisite: MATH 223 and MATH 290, or equivalent, or MATH 143. LEC.</td>
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<tr>
<td>MATH 660 GEOMETRY I 3 N</td>
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<tr>
<td>(NEW)</td>
<td>An introduction to modern geometry. Differential geometry of curves and surfaces, the topological classification of closed surfaces, dynamical systems, and knots and their polynomials. Other topics as time permits. Prerequisite: MATH 127 or MATH 147 or MATH 223 or MATH 243, and MATH 290 or MATH 291. LEC.</td>
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**PHYSICS & ASTRONOMY**

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<tr>
<td>PHSX 201 Transition to General Physics</td>
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<tr>
<td>(OLD)</td>
<td>Classical mechanics and thermodynamics with calculus for students who have had a prior algebra-based course. Prerequisite: PHSX 114, either MATH 116 or 121, and permission of the department. LEC.</td>
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<tr>
<td>PHSX 201 Transition to General Physics</td>
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<tr>
<td>(NEW)</td>
<td>Classical mechanics and thermodynamics with calculus for students who have had a prior algebra-based course. Prerequisite: PHSX 114, either MATH 116 or 125; co-requisite MATH 126; and permission of the department. LEC.</td>
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<tr>
<td>PHSX 210 General Physics I for Engineers GE11 N</td>
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<tr>
<td>(OLD)</td>
<td>Introduction to classical mechanics and thermodynamics designed for students in the School of Engineering. Students not admitted to the School of Engineering must receive permission from instructor. PHSX 210 and PHSX 211 cannot both be taken for credit. Students with credit in PHSX 114 can obtain only one hour of credit. Prerequisite: MATH 121 with a grade of C or better; courses in high school physics and/or chemistry recommended. LEC.</td>
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<tr>
<td>PHSX 210 General Physics I for Engineers GE11 N</td>
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<tr>
<td>(NEW)</td>
<td>Introduction to classical mechanics and thermodynamics designed for students in the School of Engineering who have completed MATH 125 with a grade of C or better. Students not admitted to the School of Engineering must receive permission from instructor. PHSX 210 and PHSX 211 cannot both be taken for credit. Students with credit in PHSX 114 can obtain only one hour of credit. Prerequisite: MATH 125 with a grade of C or better; co-requisite MATH 126; courses in high school physics and/or chemistry recommended. LEC.</td>
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<tr>
<td>PHSX 211 General Physics I NP</td>
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<tr>
<td>(OLD)</td>
<td>Introduction to classical mechanics and thermodynamics. Designed for students in engineering and physical science majors. In special circumstances, permission to enroll for fewer than four hours credit may be obtained from the department. Students with credit in PHSX 114 can obtain only one hour of credit. Prerequisite: MATH 116 or MATH 121; courses in high school physics and/or chemistry are recommended. LEC.</td>
</tr>
<tr>
<td>PHSX 211 General Physics I NP</td>
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<tr>
<td>(NEW)</td>
<td>Introduction to classical mechanics and thermodynamics. Designed for students in engineering and physical science majors. In special circumstances, permission to enroll for fewer than four hours credit may be obtained from the department. Students with credit in PHSX 114 can obtain only one hour of credit. Prerequisite: MATH 116 or MATH 125; co-requisite MATH 126; courses in high school physics and/or chemistry are recommended. LEC.</td>
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<tr>
<td>PHSX 212 General Physics II G3N N</td>
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<tr>
<td>(OLD)</td>
<td>Study of electricity and magnetism, waves and sound. In special circumstances, permission to enroll for fewer than three hours credit may be obtained from the department. Students with credit in PHSX 115 can obtain only one hour of credit. Prerequisite: PHSX 211, PHSX 210 or PHSX 213. Co-requisite: MATH 122. LEC.</td>
</tr>
<tr>
<td>PHSX 212 General Physics II G3N N</td>
<td></td>
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</tbody>
</table>
Study of electricity and magnetism, waves and sound. In special circumstances, permission to enroll for fewer than three hours credit may be obtained from the department. Students with credit in PHSX 115 can obtain only one hour of credit. Prerequisite: PHSX 211, PHSX 210 or PHSX 213. MATH 116 or MATH 125; Co-requisite: MATH 126. LEC.

CHANGE: PREREQUISITE
PHSX 213 General Physics I, Honors NP
(OLD) An honors section of PHSX 211 and PHSX 216. Credit for fewer than five hours requires permission of the department. Recommended for students with a strong math background who are either in the University Honors Program or intending to major in a physical science. Courses in high school physics and chemistry are strongly recommended. Prerequisite: MATH 121 and permission of instructor. LEC.

PHSX 213 General Physics I, Honors NP
(NEW) An honors section of PHSX 211 and PHSX 216. Credit for fewer than five hours requires permission of the department. Recommended for students with a strong math background who are either in the University Honors Program or intending to major in a physical science. Courses in high school physics and chemistry are strongly recommended. Prerequisite: MATH 125; co-requisite MATH 126; and permission of instructor. LEC.

CHANGE: PREREQUISITE
PHSX 214 General Physics II, Honors N
(OLD) An honors section of PHSX 212 and PHSX 236. Credit for fewer than four hours requires permission of the department. Recommended for students with a strong math background who are either in the University Honors Program or intending to major in a physical science. Prerequisite: PHSX 216 together with either PHSX 211 or PHSX 210; or PHSX 213, and permission of instructor. Co-requisite: MATH 122. LEC.

PHSX 214 General Physics II, Honors N
(NEW) An honors section of PHSX 212 and PHSX 236. Credit for fewer than four hours requires permission of the department. Recommended for students with a strong math background who are either in the University Honors Program or intending to major in a physical science. Prerequisite: PHSX 216 together with either PHSX 211 or PHSX 210; or PHSX 213, and permission of instructor. Co-requisite: MATH 127. LEC.

CHANGE: PREREQUISITE
PHSX 521 Mechanics
(OLD) Newton's laws of motion. Motions of a particle in one, two, and three dimensions. Motion of a system of particles. Moving coordinate systems. (Same as EPHX 521.) Prerequisite: PHSX 211 and PHSX 216, or PHSX 213; MATH 223; MATH 290; and MATH 220 or MATH 320. LEC.

PHSX 521 Mechanics
(NEW) Newton's laws of motion. Motions of a particle in one, two, and three dimensions. Motion of a system of particles. Moving coordinate systems. (Same as EPHX 521.) Prerequisite: PHSX 211 and PHSX 216, or PHSX 213; MATH 127; MATH 290; and MATH 220 or MATH 320. LEC.

CHANGE: PREREQUISITE
PHSX 528 Geodynamics and Plate Tectonics N
(OLD) Study of physical processes in the solid Earth and of geophysical approaches to studying Earth systems at regional and global scales. Topics include global potential fields, thermal regime, rheology and Earth deformation, earthquakes and seismic structure, plate motions and global tectonics. (Same as GEOL 573) Prerequisite: An introductory course in geology; MATH 116 or MATH 122; and PHSX 115, PHSX 214, or PHSX 212 and PHSX 236. LEC.

PHSX 528 Geodynamics and Plate Tectonics
(NEW) Study of physical processes in the solid Earth and of geophysical approaches to studying Earth systems at regional and global scales. Topics include global potential fields, thermal regime, rheology and Earth deformation, earthquakes and seismic structure, plate motions and global tectonics. (Same as GEOL 573) Prerequisite: An introductory course in geology; MATH 116 or MATH 126; and PHSX 115, PHSX 214, or PHSX 212 and PHSX 236. LEC.

CHANGE: PREREQUISITE
PHSX 531 Electricity and Magnetism N
(OLD) The properties of electric and magnetic fields, including electrostatics, Gauss' Law, boundary value methods, electric fields in matter, electromagnetic induction, magnetic fields in matter, the properties of
electric and magnetic dipoles, and of dielectric and magnetic materials. (Same as EPHX 531.)

PHSX 531 Electricity and Magnetism N
(NEW) The properties of electric and magnetic fields, including electrostatics, Gauss’ Law, boundary value methods, electric fields in matter, electromagnetic induction, magnetic fields in matter, the properties of electric and magnetic dipoles, and of dielectric and magnetic materials. (Same as EPHX 531.)

Prerequisite: PHSX 214, or PHSX 212 and PHSX 236; PHSX 521 or special permission; MATH 223; MATH 290; and MATH 220 or MATH 320. LEC.

CHANGE: PREREQUISITE
PHSX 536 Electronic Measurement and Design N
(OLD) A laboratory course that explores the theory and experimental techniques of analog and digital electronic circuit design and measurements. Topics include transient response, transmission lines, transistors, operational amplifiers, and digital logic. (Same as EPHX 536.) Prerequisite: PHSX 214 or PHSX 212 and PHSX 236; MATH 223; and MATH 290. PHSX 313 and 316 recommended. LAB.

PHSX 536 Electronic Measurement and Design N
(NEW) A laboratory course that explores the theory and experimental techniques of analog and digital electronic circuit design and measurements. Topics include transient response, transmission lines, transistors, operational amplifiers, and digital logic. (Same as EPHX 536.) Prerequisite: PHSX 214 or PHSX 212 and PHSX 236; MATH 127; and MATH 290. PHSX 313 and 316 recommended. LAB.

CHANGE: PREREQUISITE
PHSX 623 Physics of Fluids N
(OLD) An introduction to basic fluid mechanics in which fundamental concepts and equations are covered. Topics include hydrostatics, hydrodynamics, wave propagation in fluids, and applications in the areas such as astrophysics, atmospheric physics, and geophysics. (Same as EPHX 623.) Prerequisite: MATH 223; MATH 290; PHSX 212 and PHSX 236 (or PHSX 214 can replace PHSX 212 and PHSX 236.) LEC.

PHSX 623 Physics of Fluids N
(NEW) An introduction to basic fluid mechanics in which fundamental concepts and equations are covered. Topics include hydrostatics, hydrodynamics, wave propagation in fluids, and applications in the areas such as astrophysics, atmospheric physics, and geophysics. (Same as EPHX 623.) Prerequisite: MATH 127 (corrected); MATH 290; PHSX 212 and PHSX 236 (or PHSX 214 can replace PHSX 212 and PHSX 236.) LEC.

SPEECH, LANGUAGE, HEARING

CHANGE: COURSE DESCRIPTION PREREQUISITE NUMBER
SPLH 662 PRINCIPLES OF SPEECH SCIENCE 3 N
(OLD) Survey of the physiology of speech production, and the physics of sound. Emphasis upon methodologies in the laboratory study of normal speech. Prerequisite: SPLH 120 and SPLH 320, or concurrent enrollment in SPLH 120 and SPLH 320, or consent of instructor.

SPLH 462 PRINCIPLES OF SPEECH SCIENCE 3 N
(NEW) Survey of the physiology of speech production, and the physics of sound. Emphasis upon methodologies in the laboratory study of normal speech. Prerequisite: SPLH 120, or concurrent enrollment in SPLH 120 or consent of instructor.

CHANGE: COURSE DESCRIPTION PREREQUISITE NUMBER
SPLH 663 PRINCIPLES OF HEARING SCIENCE 3 N
(OLD) Concepts and principles relevant to the normal hearing processes: gross anatomy, psychophysical methods, and basic subjective correlates of the auditory system. Prerequisites: SPLH 120 and SPLH 320, or concurrent enrollment in SPLH 120 and SPLH 320, or consent of instructor.

SPLH 463 PRINCIPLES OF HEARING SCIENCE 3 N
(NEW) This class discusses the concepts and principles relevant to normal hearing processing: anatomy, psychophysical methods, and basic subjective correlates of the auditory system. Prerequisites: SPLH 120, or concurrent enrollment in SPLH 120, or consent of instructor.
B. **Degree Requirements for Approval**

1. **Changes to Existing Major to BA/BGS AND Minor – Speech-Language-Hearing**

   **PROPOSAL**
   We have submitted a request to change SPLH 662 to SPLH 462 and to change the prerequisites from SPLH 120 and 320 to just SPLH 120

   **JUSTIFICATION**
   We are requesting a change in numbering and prerequisites for SPLH 662 and 663. The requested numbers are SPLH 462 and 463 and the requested change in prerequisites is from SPLH 120 & 320 to only SPLH 120.

   The change in numbering necessitates a change to **the major and minor also**. Renumbering SPLH 662 to SPLH 462 and SPLH 663 to 463 will acknowledge a new suggested course sequence for SPLH students in which they are encouraged to complete the SPLH “sciences” courses (Speech Science, Language Science and Hearing Science) prior to advanced courses at the 500 and 600 level.

   **EFFECTIVE DATE**
   F 2015

**First- and Second-Year Preparation**

Both the B.A. and the B.G.S. aspirant should fulfill the College general education requirements. Students also should complete **SPLH 120, SPLH 261, SPLH 320, SPLH 465, SPLH 466, SPLH 663, SPLH 463**, and elective courses in human physiology, psychology, and linguistics during their first 2 years. Faculty members can help students select appropriate course work.

**Requirements for the B.A. or B.G.S. Major**

Speech-Language-Hearing Prerequisite or Co-Requisite Requirements (0)

Majors must complete this requirement, however, these hours do not contribute to the minimum number of hours required for the major.

Mathematics. Satisfied by one of the following:

- **MATH 101** College Algebra
- **MATH 104** Pre-calculus Mathematics

Or upper-level placement

Statistics. An introductory statistics course (**PSYC 210, MATH 365**) is recommended.

Speech-Language-Hearing Introductory Knowledge (17)

Majors must complete a course in the following areas (recommended within first and second year):

The Physics of Speech. Satisfied by:

- **SPLH 120** The Physics of Speech 4

Survey Communication Disorders. Satisfied by:

- **SPLH 261** Survey of Communication Disorders 3

The Communicating Brain: The Ultimate Personal Computer. Satisfied by:

- **SPLH 320** The Communicating Brain: The Ultimate Personal Computer 3

Language Science. Satisfied by:

- **SPLH 466** Language Science 3

Fundamentals of Clinical Phonetics. Satisfied by:

- **SPLH 465** Fundamentals of Clinical Phonetics 1

Principles of Hearing Science. Satisfied by:

- **SPLH 663-SPLH 463** Principles of Hearing Science 3

Speech-Language-Hearing Core Knowledge and Skills (18)

Majors must complete a course in the following areas:

Language Sample Analysis Laboratory. Satisfied by:

- **SPLH 565** Language Sample Analysis Lab 1

Language Development. Satisfied by:
SPLH 566 Language Development
Research Methods in Speech-Language-Hearing. Satisfied by:
SPLH 660 Research Methods in Speech-Language-Hearing
Principles of Speech Science. Satisfied by:
SPLH 662-SPLH 462 Principles of Speech Science
Introduction to Audiological Assessment & Rehabilitation. Satisfied by:
SPLH 668 Introduction to Audiological Assessment and Rehabilitation
Introduction to Speech-Language Pathology. Satisfied by:
SPLH 671 Introduction to Speech-Language Pathology
Further Speech-Language-Hearing Study (0)
After completing the requirements, students with grade-point averages of 3.0 or higher may enroll in any one of the following:
SPLH 670 Beginning Clinical Practice in Audiology
SPLH 672 Clinical Practice in Speech-Language Pathology

Major Hours & Major GPA

While completing all required courses, majors must also meet each of the following hour and grade-point average minimum standards:

Major Hours
Satisfied by 35 hours of major courses.

Major Hours in Residence
Satisfied by a minimum of 15 hours of KU resident credit in the major.

Major Junior/Senior Hours
Satisfied by a minimum of 28 hours from junior/senior courses (300+) in the major.

Major Junior/Senior Graduation GPA
Satisfied by a minimum of a 2.0 KU GPA in junior/senior courses (300+) in the major. GPA calculations include all junior/senior courses in the field of study including F’s and repeated courses. See the Semester/Cumulative GPA Calculator.

Requirements for the Minor

Speech-Language-Hearing Minor Course Requirements (15)
Students selecting this minor must complete the following:
Survey Communication Disorders. Satisfied by:
SPLH 261 Survey of Communication Disorders 3
Speech-Language-Hearing Required Electives. Satisfied by at least 4 SPLH courses (12 hours) from the following: 12
SPLH 120 The Physics of Speech
SPLH 320 The Communicating Brain: The Ultimate Personal Computer
SPLH 464 Undergraduate Seminar in: ______
SPLH 465 Fundamentals of Clinical Phonetics
SPLH 466 Language Science
SPLH 499 Directed Study in Speech-Language-Hearing
SPLH 565 Language Sample Analysis Lab
SPLH 566 Language Development
SPLH 660 Research Methods in Speech-Language-Hearing
SPLH 662-SPLH 462 Principles of Speech Science
SPLH 663-SPLH 463 Principles of Hearing Science

Courses with clinical content can be taken as directed study with the permission and support of a faculty mentor.

Minor Hours & Minor GPA

23
While completing all required courses, minors must also meet each of the following hour and grade-point average minimum standards:

**Minor Hours**
Satisfied by 18 hours of minor courses.

**Minor Hours in Residence**
Satisfied by a minimum of 9 junior/senior (300+) hours of KU resident credit in the minor.

**Minor Junior/Senior Hours**
Satisfied by a minimum of 12 hours from junior/senior courses (300+) in the minor.

2. **Changes to Existing Major to BA Biology**

**PROPOSAL**
The current B.A. Biology major requires, in part

**GENERAL BIOLOGY REQUIREMENTS (26-27 h) (in part)**
Two of the following five courses (6-7 h):
- BIOL 400/401 Fund Microbiology (3)  BIOL 17 Biology of Development (3)
- BIOL 408 Physiology of Organisms (3)  BIOL 600 Introductory Biochemistry, Lectures (4)
- BIOL 416/536 Cell Structure and Function (3)

We are changing the number of credit hours for BIOL 600 Introductory Biochemistry, Lectures from 4 credit hours to 3 credit hours.

The new requirements would read, in part:

**GENERAL BIOLOGY REQUIREMENTS (26-27 h) (26 h)**
Two of the following five courses (6-7 h) (6 h):
- BIOL 400/401 Fund Microbiology (3)  BIOL 17 Biology of Development (3)
- BIOL 408 Physiology of Organisms (3)  BIOL 600 Introductory Biochemistry, Lectures (4) (3)
- BIOL 416/536 Cell Structure and Function (3)

**JUSTIFICATION**
The number of credit hours for BIOL 600 Introductory Biochemistry, Lectures will be decreasing from 4 credit hours to 3 credit hours because of the elimination of course material that we have determined is redundant with material that is presented in other required courses.

**EFFECTIVE**
Fall 2015

3. **Changes to Existing Major to BA Human Biology**

**PROPOSAL**
Human Biology requirements in part:

**ANTHROPOLOGY CONCENTRATION/Human Anatomy & Physiology Category (12 h)**
BIOL 417 Biology of Development (3) AND
9 h selected from the following: ANTH 542 Biology of Human Nutrition (4); ANTH 648 Human Osteology (4); ANTH 650 Human Reproduction: Biology & Behavior (3); BIOL 426 Lab in Cell Biology (3); BIOL 440 Advanced Human Anatomy (lect & lab) (6); BIOL 600 Intro Biochemistry, Lectures (4); BIOL 637 Intro Biochemistry Lab (2); BIOL 646 Mammalian Physiology (4); BIOL 647 Mammalian Physiology Lab (2)

**BIOLOGY CONCENTRATION/Anatomy and Physiology Category (10 h)**
BIOL 646 Mammalian Physiology (4) AND
6 h selected from the following: ANTH 542 Biology Human Nutrition (4); ANTH 648 Human Osteology (4); BIOL 435 Intro Neurobiology (3); BIOL 440 Advanced Human Anatomy (lect & lab) (6); BIOL 600 Introd Biochemistry (4); BIOL 637 Introd Biochemistry Lab (2); BIOL 647 Mammalian Physiology Lab (2); HSES 672 Exercise Physiology (3); PSYC 370 Behavioral Neuroscience (3); PSYC 380 Clinical Neuroscience (3); PSYC 475 Cognitive Neuroscience (3)
We are changing the number of credit hours for BIOL 600 Introductory Biochemistry, Lectures from 4 credit hours to 3 credit hours.

The new requirements would read:
ANTHROPOLOGY CONCENTRATION/Human Anatomy & Physiology Category (12 h)
BIOL 417 Biology of Development (3) AND
9 h selected from the following: ANTH 542 Biology of Human Nutrition (4); ANTH 648 Human Osteology (4); ANTH 650 Human Reproduction: Biology & Behavior (3); BIOL 426 Lab in Cell Biology (3); BIOL 440 Advanced Human Anatomy (lect & lab) (6); BIOL 600 Intro Biochemistry, Lectures (4) (3); BIOL 637 Intro Biochemistry Lab (2); BIOL 646 Mammalian Physiology (4); BIOL 647 Mammalian Physiology Lab (2)

BIOLOGY CONCENTRATION/Anatomy and Physiology Category (10 h)
BIOL 646 Mammalian Physiology (4) AND
6 h selected from the following: ANTH 542 Biology Human Nutrition (4); ANTH 648 Human Osteology (4); BIOL 435 Intro Neurobiology (3); BIOL 440 Advanced Human Anatomy (lect & lab) (6); BIOL 600 Intro Biochemistry (4) (3); BIOL 637 Intro Biochemistry Lab (2); BIOL 647 Mammalian Physiology Lab (2); HSES 672 Exercise Physiology (3); PSYC 370 Behavioral Neuroscience (3); PSYC 380 Clinical Neuroscience (3); PSYC 475 Cognitive Neuroscience (3)

JUSTIFICATION
The number of credit hours for BIOL 600 Introductory Biochemistry, Lectures will be decreasing from 4 credit hours to 3 credit hours because of the elimination of course material that we have determined is redundant with material that is presented in other required courses.

EFFECTIVE
Fall 2015

4. Changes to Existing Major to BA Microbiology

PROPOSAL
The current B.A. Microbiology degree requires, in part, that students complete:

MICROBIOLOGY CORE REQUIREMENTS (9–10 h)
BIOL 400/401 Fundamentals Microbiology (3)
BIOL 599 Senior Seminar: Current Progress in Microbiology (1)
BIOL 402 Fund Microbiology Lab (2) (must be taken Sr yr)
One of the following two courses (3–4 h):
BIOL 516 Microbial Physiology (3)
BIOL 600 Introductory Biochemistry, Lectures (4)

We are changing the number of credit hours for BIOL 600 Introductory Biochemistry, Lectures from 4 credit hours to 3 credit hours.

The new requirements would read:
MICROBIOLOGY CORE REQUIREMENTS (9–10 h) (9 h)
BIOL 400/401 Fundamentals Microbiology (3)
BIOL 599 Senior Seminar: Current Progress in Microbiology (1)
BIOL 402 Fund Microbiology Lab (2) (must be taken Sr yr)
One of the following two courses (3–4 h) (3 h):
BIOL 516 Microbial Physiology (3)
BIOL 600 Introductory Biochemistry, Lectures (4) (3)

JUSTIFICATION
The number of credit hours for BIOL 600 Introductory Biochemistry, Lectures will be decreasing from 4 credit hours to 3 credit hours because of the elimination of course material that we have determined is redundant with material that is presented in other required courses.

EFFECTIVE
Fall 2015
5. Changes to Existing Major to BS Biology (all subplans)

PROPOSAL
The EEOB subplan for B.S. Biology requires in part:

GENERAL SCIENCE REQUIREMENTS (31–33 h)
BIOL 105 Biology Orientation Seminar (1)  \textbf{BIOL 600}
Introductory Biochemistry, Lectures (4)
CHEM 130 Foundations of Chemistry I (5)  \textbf{MATH 121}
Calculus I (5) OR MATH 115 & 116 Calculus I & II (6)
CHEM 135 Foundations of Chemistry II (5)  \textbf{PHSX 114 & 115}
115 College Physics I & II (8) OR
CHEM 310 Fund Organic Chemistry (3) OR
PHSX 211+216 & 212+236 Gen. Physics I & II (9)
CHEM 330 Organic Chemistry I (3)

We are changing the number of credit hours for BIOL 600 Introductory Biochemistry, Lectures from 4 credit hours to 3 credit hours.

The new requirements would read:
GENERAL SCIENCE REQUIREMENTS (31–33 h) (30-32 h)
BIOL 105 Biology Orientation Seminar (1)  \textbf{BIOL 600}
Introductory Biochemistry, Lectures (4) (3)
CHEM 130 Foundations of Chemistry I (5)  \textbf{MATH 121}
Calculus I (5) OR MATH 115 & 116 Calculus I & II (6)
CHEM 135 Foundations of Chemistry II (5)  \textbf{PHSX 114 & 115}
115 College Physics I & II (8) OR
CHEM 310 Fund Organic Chemistry (3) OR
PHSX 211+216 & 212+236 Gen. Physics I & II (9)
CHEM 330 Organic Chemistry I (3)

The MCDB subplan for B.S. Biology requires in part:

MOLECULAR, CELLULAR, AND DEVELOPMENTAL BIOLOGY REQUIREMENTS (34–35 h)
BIOL 150/151 Prin Molecular & Cell Biol (4)  \textbf{BIOL 416/536 Cell Structure and Function (3)}
BIOL 152/153 Prin Organismal Biology (4)  \textbf{BIOL 417 Biology of Development (3)}
BIOL 350/360 Principles of Genetics (4)  \textbf{BIOL 435 Introduction to Neurobiology (3)}
BIOL 412 Evolutionary Biology (4)  \textbf{BIOL 600 Introductory Biochemistry, Lectures (4)}
BIOL 405 Laboratory in Genetics (2) OR
Gene Expression  \textbf{BIOL 650 Advanced Neurobiology (3) OR BIOL 672}
BIOL 426 Laboratory in Cell Biology (3) OR
\textbf{BIOL 427 Developmental Biology Lab (2)}  \textbf{(3) OR BIOL 688 Molecular Biology of Cancer (3)}
\textbf{BIOL 599 Senior Seminar: MCDB (1) (must be taken Sr yr)}

We are changing the number of credit hours for BIOL 600 Introductory Biochemistry, Lectures from 4 credit hours to 3 credit hours and BIOL 427 is being deleted from the Catalog.

The new requirements would read:
MOLECULAR, CELLULAR, AND DEVELOPMENTAL BIOLOGY REQUIREMENTS (35–36 h) (34-35 h)
BIOL 150/151 Prin Molecular & Cell Biol (4)  \textbf{BIOL 416/536 Cell Structure and Function (3)}
BIOL 152/153 Prin Organismal Biology (4)  \textbf{BIOL 417 Biology of Development (3)}
BIOL 350/360 Principles of Genetics (4)  \textbf{BIOL 435 Introduction to Neurobiology (3)}
BIOL 412 Evolutionary Biology (4)  \textbf{BIOL 600 Introductory Biochemistry, Lectures (4) (3)}
BIOL 405 Laboratory in Genetics (2) OR BIOL 650 Advanced Neurobiology (3) OR BIOL 672 Gene Expression
BIOL 426 Laboratory in Cell Biology (3) OR BIOL 427 Developmental Biology Lab (2)
BIOL 599 Senior Seminar: MCDB (1) (must be taken Sr yr)

The Teaching Biology subplan for B.S. Biology requires in part:

GENERAL BIOLOGY REQUIREMENTS (32–33 h)
BIOL 150/151 Prin Molecular & Cell Biol (4)
BIOL 414 Principles of Ecology (3)
BIOL 152/153 Prin Organismal Biology (4)
BIOL 416/536 Cell Structure and Function (3)
BIOL 350/360 Principles of Genetics (4)
BIOL 598 Research Methods (3)
BIOL 412 Evolutionary Biology (4)
BIOL 599 Senior Seminar in Biology (1) (must be taken Sr yr)
One of the following two courses (3 h):
   BIOL 413 History and Diversity of Organisms (3)
   BIOL 428 Introduction to Systematics (3)
One of the following three courses (3-4 h):
   BIOL 400/401 Fundamentals of Microbiology (3)
   BIOL 408 Physiology of Organisms (3)
   BIOL 600 Introductory Biochemistry, Lectures (4)

We are changing the number of credit hours for BIOL 600 Introductory Biochemistry, Lectures from 4 credit hours to 3 credit hours.

The new requirements would read:
GENERAL BIOLOGY REQUIREMENTS (32–33 h) (32 h)
BIOL 150/151 Prin Molecular & Cell Biol (4)
BIOL 414 Principles of Ecology (3)
BIOL 152/153 Prin Organismal Biology (4)
BIOL 416/536 Cell Structure and Function (3)
BIOL 350/360 Principles of Genetics (4)
BIOL 598 Research Methods (3)
BIOL 412 Evolutionary Biology (4)
BIOL 599 Senior Seminar in Biology (1) (must be taken Sr yr)
One of the following two courses (3 h):
   BIOL 413 History and Diversity of Organisms (3)
   BIOL 428 Introduction to Systematics (3)
One of the following three courses (3-4 h) (3 h):
   BIOL 400/401 Fundamentals of Microbiology (3)
   BIOL 408 Physiology of Organisms (3)
   BIOL 600 Introductory Biochemistry, Lectures (4)

JUSTIFICATION
The number of credit hours for BIOL 600 Introductory Biochemistry, Lectures will be decreasing from 4 credit hours to 3 credit hours because of the elimination of course material that we have determined is redundant with material that is presented in other required courses. BIOL 427 Developmental Biology Laboratory is being incorporated into another course (request previously submitted to CUSA) and will, therefore, be removed from the KU Catalog.

EFFECTIVE DATE.
Fall 2015

6. Changes to Existing Major to BS Molecular Sciences

PROPOSAL

The current B.S. Molecular Biosciences degree requires in part:
GENERAL SCIENCE REQUIREMENTS (31–33 h)
CHEM 130 Foundation of Chemistry I (5)
CHEM 335 Organic Chemistry II (3)
CHEM 135 Foundation of Chemistry II (5)
MATH 115 & 116 Calculus I & II (6) OR MATH 121 (5)
CHEM 330 Organic Chemistry I (3) PHSX 114 & 115 College Physics I & II (8) OR
CHEM 331 Organic Chemistry I Lab (2)
PHSX 211+216 & 212+236 Gen Physics I & II (9)

MOLECULAR BIOSCIENCES REQUIREMENTS (35 h)
BIOL 150 Prin Molecular & Cell Biol (4)
BIOL 430 Molecular Biology Laboratory (3)
BIOL 152 Prin Organismal Biology (4)
BIOL 570 Intro to Biostatistics (3)
BIOL 350 Principles of Genetics (4)
BIOL 599 Senior Seminar: Molecular Biosciences (1) (must be taken
BIOL 400 Fundamentals Microbiology (3) Sr yr; offered only at Edwards campus)
BIOL 402 Fund Microbiology Lab (2)
BIOL 600 Introductory Biochemistry, Lectures (4)
BIOL 405 Laboratory in Genetics (2)
BIOL 601 Prin Biochemistry Laboratory (2)
BIOL 416 Cell Structure & Function (3)

We are moving BIOL 570 from the Molecular Biosciences requirements to the General Science requirements and adding MATH 365 and PSYC 210 as statistics course choices and we are changing the number of credit hours for BIOL 600 Introductory Biochemistry, Lectures from 4 credit hours to 3 credit hours.

The new requirements would read:
GENERAL SCIENCE REQUIREMENTS (31-33 h) (34-36 h)
CHEM 130 Foundation of Chemistry I (5)
CHEM 335 Organic Chemistry II (3)
CHEM 135 Foundation of Chemistry II (5)
MATH 115 & 116 Calculus I & II (6) OR MATH 121 (5)
CHEM 330 Organic Chemistry I (3)
PHSX 114 & 115 College Physics I & II (8) OR
CHEM 331 Organic Chemistry I Lab (2)
PHSX 211+216 & 212+236 Gen Physics I & II (9)
BIOL 570, MATH 365, OR PSYC 210 Statistics (3)

MOLECULAR BIOSCIENCES REQUIREMENTS (35 h) (31 h)
BIOL 150 Prin Molecular & Cell Biol (4)
BIOL 416 Cell Structure & Function (3)
BIOL 152 Prin Organismal Biology (4)
BIOL 430 Molecular Biology Laboratory (3)
BIOL 350 Principles of Genetics (4)
BIOL 599 Senior Seminar: Molecular Biosciences (1) (must be taken Sr yr; offered only at Edwards campus)
BIOL 400 Fundamentals Microbiology (3)
BIOL 402 Fund Microbiology Lab (2)
BIOL 600 Introductory Biochemistry, Lectures (4) (3)
BIOL 405 Laboratory in Genetics (2)
BIOL 601 Prin Biochemistry Laboratory (2)

JUSTIFICATION
The number of credit hours for BIOL 600 Introductory Biochemistry, Lectures will be decreasing from 4 credit hours to 3 credit hours because of the elimination of course material that we have determined is redundant with material that is presented in other required courses. Adding MATH 365 and PSYC 210 as statistics options increases choices for students completing this degree at the KU Edwards Campus and placing the statistics requirement with the General Science requirements better defines both the General Science and Molecular Biosciences groups of courses.
EFFECTIVE DATE. Unless otherwise requested by the department and approved by CUSA and College Assembly, the new requirements will apply to students whose KU initial term is the one immediately following final approval of the requirements. The Math change is in response to changes proposed by the Math Department.

Fall 2015

7. Changes to Existing BAS Biotechnology

PROPOSAL
The Bachelor of Applied Science degree in Biotechnology requires in part:

GENERAL SCIENCE REQUIREMENTS (44-46 h)
CHEM 130 and CHEM 135 Foundations of Chemistry I and II ......................... 10
CHEM 330 Organic Chemistry I or 310 Fund. Organic Chemistry .................. 3
CHEM 331 Organic Chemistry I Laboratory .............................................. 2
PHSX 114 College Physics I .......................................................................... 4
MATH 115 Calculus I (3) or MATH 121 Calculus I (5) ............................... 3-5
BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology . 4
BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology ........... 4
BIOL 350 Principles of Genetics ................................................................. 4
BIOL 400 Fundamentals of Microbiology .................................................... 3
BIOL 416 Cell Structure and Function ...................................................... 3
BIOL 600 Introductory Biochemistry, Lectures ......................................... 4

We are changing the number of credit hours for BIOL 600 Introductory Biochemistry, Lectures from 4 credit hours to 3 credit hours.

GENERAL SCIENCE REQUIREMENTS (44-46 h) (43-45 h)
CHEM 130 and CHEM 135 Foundations of Chemistry I and II ......................... 10
CHEM 330 Organic Chemistry I or 310 Fund. Organic Chemistry .................. 3
CHEM 331 Organic Chemistry I Laboratory .............................................. 2
PHSX 114 College Physics I .......................................................................... 4
MATH 115 Calculus I (3) or MATH 121 Calculus I (5) ............................... 3-5
BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology . 4
BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology ........... 4
BIOL 350 Principles of Genetics ................................................................. 4
BIOL 400 Fundamentals of Microbiology .................................................... 3
BIOL 416 Cell Structure and Function ...................................................... 3
BIOL 600 Introductory Biochemistry, Lectures ......................................... 3

JUSTIFICATION
The number of credit hours for BIOL 600 Introductory Biochemistry, Lectures will be decreasing from 4 credit hours to 3 credit hours because of the elimination of course material that we have determined is redundant with material that is presented in other required courses.

EFFECTIVE
Fall 2015

8. Changes to Existing Major BA/BGS Linguistics

PROPOSAL
In the current set-up for the Linguistics major, a student is required to take one course from the “Structure and Description” group and another course from the “Form and Meaning” group of classes. (See highlighted sections in the “Current BA Major Requirements” below). We propose to combine the “Structure and Description” and “Form and Meaning” groups in a new “Analysis and Description” group. A student will have to take one course from this new group. (See “Proposed BA Major Requirements” below).

JUSTIFICATION
There are two reasons for the proposed change. First, in its current form, the major only allows for one elective and we would like students to have more flexibility to pursue their interests. With the proposed change, students will have two electives instead of one for the major. Second, with the combined group, scheduling of courses will be easier for the Linguistics Department because there will be fewer groups of required classes that have to be accommodated each semester.
Required Course Work for Linguistics (30 Hours)

**Admission Requirements** (all courses listed)
LING 106 or 107  Introductory Linguistics  
LING 110 or 111  Language and Mind

**Core Requirements** (all courses listed)
LING 305  Phonetics I  
LING 312  Phonology  
LING 325  Syntax I

**Acquisition & Processing** (one of the following courses)
LING 415, 425, 435, 438

**Structure & Description** (one of the following courses)
LING 370, 441, 447, 570, 572, 575 Field Methods / Structure of ___

**Form & Meaning** (one of the following courses)
LING 308, 327, 331  Linguistics Analysis /  
Morphology / Semantics

**Capstone** (one of the following courses)
LING 420  Research in Linguistic Science  
LING 421  Typology – Unity & Diversity of Human Lang.

**Elective Course Work** (3 Hours – must be junior/senior level – Linguistics courses)

**Major Hours & Major GPA**
While completing all required courses, majors must also meet each of the following hour and GPA minimum standards:

**Major Hours**
Satisfied by 30 hours of major courses, or 33 hours required if completing departmental honors course LING 496.

**Major Hours in Residence**
Satisfied by a minimum of 24 junior/senior (300+) hours of KU resident credit in the major.

**Major Junior/Senior Hours**
Satisfied by a minimum of 24 hours from junior/senior courses (300+) in the major.

**Major Junior/Senior (300+) Graduation GPA**
Satisfied by a minimum of a 2.0 KU GPA in junior/senior courses (300+) in the major. GPA calculations include all junior/senior courses in the field of study including F’s and repeated courses. See the Semester/Cumulative GPA Calculator.

University of Kansas  
Department of Linguistics  
**Proposed BA Major Requirements**

Required Course Work for Linguistics (30 Hours)
Admission Requirements (all courses listed)
LING 106 or 107  Introductory Linguistics
LING 110 or 111  Language and Mind

Core Requirements (all courses listed)
LING 305  Phonetics I
LING 312  Phonology
LING 325  Syntax I

Acquisition & Processing (one of the following courses)
LING 415,425,435,438

Analysis & Description (one of the following courses)
LING 308, 327, 331, 370, 441,447, 570, 572, 575

Capstone (one of the following courses)
LING 420  Research in Linguistic Science
LING 421  Typology – Unity & Diversity of Human Lang.

Elective Course Work (6 Hours – must be junior/senior level – Linguistics courses)

Major Hours & Major GPA
While completing all required courses, majors must also meet each of the following hour and GPA minimum standards:

Major Hours
Satisfied by 30 hours of major courses, or 33 hours required if completing departmental honors course LING 496.

Major Hours in Residence
Satisfied by a minimum of 24 junior/senior (300+) hours of KU resident credit in the major.

Major Junior/Senior Hours
Satisfied by a minimum of 24 hours from junior/senior courses (300+) in the major.

Major Junior/Senior (300+) Graduation GPA
Satisfied by a minimum of a 2.0 KU GPA in junior/senior courses (300+) in the major. GPA calculations include all junior/senior courses in the field of study including F’s and repeated courses. See the Semester/Cumulative GPA Calculator.

MATH 121 and MATH 122 CALCULUS SEQUENCE RELATED MAJOR/MINOR CHANGES

PROPOSAL and JUSTIFICATION:
The Math department is transitioning from a two course, 10 hour calculus sequence to a three course, 12 hour calculus sequence. As a part of this transition, affected departments were asked to make changes to both course prerequisites and major or minor requirements as needed.

In an effort to move the changes through more quickly, the proposals below (approved by the departments) are being submitted as a group to begin the transition.

To date we have received approval from Biology and from Physics and Astronomy. Their changes are listed below. (as soon as approval is obtained from Chemistry, Economics, Environmental Studies, Geography, Geology, and Psychology these will be submitted as well)

Non-Math Courses requiring a change to prerequisites:
ASTR 391 – current prerequisite = MATH 121, and either permission of instructor, or participation in the University Honors Program.

PHSX 201-current prerequisite=PHSX 114, either MATH 116 or 121, and permission of the department
PHSX 210-current prerequisite=MATH 121 with a grade of C or better; courses in high school physics and/or chemistry recommended.

PHSX 211-current prerequisite=MATH 116 or MATH 121; courses in high school physics and/or chemistry are recommended

PHSX 212-current prerequisite=PHSX 211, PHSX 210 or PHSX 213. Co-requisite: MATH 122

PHSX 213-current prerequisite=MATH 121 and permission of instructor

PHSX 214-current prerequisite=PHSX 216 together with either PHSX 211 or PHSX 210; or PHSX 213, and permission of instructor. Co-requisite: MATH 122

PHSX 521-current prerequisite=PHSX 211 and PHSX 216, or PHSX 213; MATH 223; MATH 290; and MATH 220 or MATH 320

PHSX 528-current prerequisite=MATH 116 or MATH 122; and PHSX 115, PHSX 214, or PHSX 212 and PHSX 236

PHSX 531-current prerequisite=PHSX 214, or PHSX 212 and PHSX 236; PHSX 521 or special permission; MATH 223; MATH 290; and MATH 220 or MATH 320

PHSX 536-current prerequisite=PHSX 214 or PHSX 212 and PHSX 236; MATH 223; and MATH 290. PHSX 313 and 316 recommended

PHSX 623-current prerequisite=MATH 223; MATH 290; PHSX 212 and PHSX 236 (or PHSX 214 can replace PHSX 212 and PHSX 236.)

9. Changes to Existing Major to BA Astronomy and BS Astronomy

BA ASTRONOMY

Additional general science requirements:
Majors must complete courses as specified in each of the following areas. Majors are advised to take honors courses when eligible. These hours do not contribute to the minimum number of hours required for the major.

Calculus I. Satisfied by one of the following:

**MATH 121** MATH 125
MATH 141 MATH 145

Or equivalent

Calculus I: Honors

Calculus II. Satisfied by one of the following:

**MATH 122** MATH 126
MATH 142 MATH 146

Or equivalent

BS ASTRONOMY

Requirements for the B.S. Degree in Astronomy

All students pursuing the Bachelor of Science in Astronomy must complete the KU Core requirements in addition to the degree and major requirements. For details regarding the KU Core requirements, please see the KU Core section of the catalog.

General science requirements:
Majors must complete courses as specified in each of the following areas. Majors are advised to take honors courses when eligible. These hours do not contribute to the minimum number of hours required for the major.

Computing and Programming. Satisfied by one of the following:

**EECS 138**
EECS 168

Programming I

Calculus I. Satisfied by one of the following:

**MATH 121** MATH 125

**MATH 141** MATH 145

Or equivalent

Calculus II. Satisfied by one of the following:

**MATH 122** MATH 126

**MATH 142** MATH 146

Or equivalent

10. Changes to Existing Major to BA Biology

**BA BIOLOGY**

**Major Course Requirements**

General Science Requirements (29-31)

Biology Orientation Seminar. Satisfied by:

**BIOL 105** Biology Orientation Seminar 1

Chemistry I. Satisfied by one of the following:

**CHEM 130** General Chemistry I

**CHEM 195** Foundations of Chemistry II, Honors

Chemistry II. Satisfied by one of the following:

**CHEM 135** General Chemistry II

**CHEM 195** Foundations of Chemistry II, Honors

Organic Chemistry I. Satisfied by one of the following:

**CHEM 310** Fundamentals of Organic Chemistry

**CHEM 330** Organic Chemistry I

Organic Chemistry I Laboratory. Satisfied by:

**CHEM 331** Organic Chemistry I Laboratory 2

Calculus. Satisfied by one of the following: 5-6

**MATH 115** & **MATH 116** Calculus I and Calculus II

OR

**MATH 121** MATH 125 Calculus I

**MATH 141** MATH 145 Calculus I: Honors

Physics I. Satisfied by one of the following:

**PHSX 114** College Physics I

**PHSX 211** General Physics I

& **PHSX 216** and General Physics I Laboratory

Physics II. Satisfied by one of the following:

**PHSX 115** College Physics II

**PHSX 212** General Physics II

& **PHSX 236** and General Physics II Laboratory

11. Changes to Existing Major to BS Biology – EEOB and MCDB and Teaching Biology

**BS BIOLOGY – EEOB**

Ecology, Evolution, and Organismal Biology

General Science Requirements (34-33) (29-32)
Majors must complete the following general science requirements that serve as foundational courses for this major.

**Biology Orientation Seminar. Satisfied by:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 105</td>
<td>Biology Orientation Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

**Chemistry I. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 130</td>
<td>General Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 190</td>
<td>Foundations of Chemistry I, Honors</td>
<td></td>
</tr>
</tbody>
</table>

**Chemistry II. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 135</td>
<td>General Chemistry II</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 195</td>
<td>Foundations of Chemistry II, Honors</td>
<td></td>
</tr>
</tbody>
</table>

**Organic Chemistry I. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 310</td>
<td>Fundamentals of Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 330</td>
<td>Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHEM 380</td>
<td>Organic Chemistry I, Honors</td>
<td></td>
</tr>
</tbody>
</table>

**Introductory Biochemistry. Satisfied by:**

<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>BIOL 600</td>
<td>Introductory Biochemistry, Lectures</td>
<td>4</td>
</tr>
</tbody>
</table>

**Calculus. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 115 &amp; MATH 116</td>
<td>Calculus I and Calculus II</td>
<td>4-6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 121-MATH 125</td>
<td>Calculus I</td>
<td></td>
</tr>
<tr>
<td>MATH 141-MATH 145</td>
<td>Calculus I: Honors</td>
<td></td>
</tr>
</tbody>
</table>

**BS BIOLOGY – MCDB**

Molecular, Cellular, and Developmental Biology

**General Science Requirements (32-34)(34-37)**

Majors must complete the following general science requirements that serve as foundational courses for this major.

**Biology Orientation Seminar. Satisfied by:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 105</td>
<td>Biology Orientation Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

**Chemistry I. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 130</td>
<td>General Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 190</td>
<td>Foundations of Chemistry I, Honors</td>
<td></td>
</tr>
</tbody>
</table>

**Chemistry II. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 135</td>
<td>General Chemistry II</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 195</td>
<td>Foundations of Chemistry II, Honors</td>
<td></td>
</tr>
</tbody>
</table>

**Organic Chemistry I. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 330</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 380</td>
<td>Organic Chemistry I, Honors</td>
<td></td>
</tr>
</tbody>
</table>

**Organic Chemistry I Laboratory. Satisfied by:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>CHEM 331</td>
<td>Organic Chemistry I Laboratory</td>
<td>2</td>
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</tbody>
</table>

**Organic Chemistry II. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 335</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 385</td>
<td>Organic Chemistry II, Honors</td>
<td></td>
</tr>
</tbody>
</table>

**Calculus. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 121-MATH 125</td>
<td>Calculus I</td>
<td></td>
</tr>
<tr>
<td>MATH 141-MATH 145</td>
<td>Calculus I: Honors</td>
<td></td>
</tr>
<tr>
<td>MATH 115 &amp; MATH 116</td>
<td>Calculus I and Calculus II</td>
<td></td>
</tr>
</tbody>
</table>
12. Changes to Existing Major to BA Biochemistry and BS Biochemistry

BA BIOCHEMISTRY

Requirements for the B.A. Major in Biochemistry

Major Course Requirements

General Science Requirements (33-36)

Majors must complete the following general science requirements that serve as foundational courses for this major.

Biology Orientation Seminar. Satisfied by:

**BIOL 105** Biology Orientation Seminar

Chemistry I. Satisfied by one of the following:

- **CHEM 170** Chemistry for the Chemical Sciences I
- **CHEM 130** General Chemistry I
- **CHEM 190** Foundations of Chemistry I, Honors

Chemistry II. Satisfied by one of the following:

- **CHEM 175** Chemistry for the Chemical Sciences II
- **CHEM 135** General Chemistry II
- **CHEM 195** Foundations of Chemistry II, Honors

Organic Chemistry I. Satisfied by one of the following:

- **CHEM 330** Organic Chemistry I
- **CHEM 380** Organic Chemistry I, Honors

Organic Chemistry I Laboratory. Satisfied by:

**CHEM 331** Organic Chemistry I Laboratory

Organic Chemistry II. Satisfied by:

**CHEM 335** Organic Chemistry II

Calculus I and II. Satisfied by one of the following:

- **MATH 121** and **MATH 125** Calculus I
- **MATH 122** and **MATH 126** and Calculus II (or equivalent)
- **MATH 115** and **MATH 116** Calculus I
- **MATH 115** and **MATH 116** Calculus II

BS BIOCHEMISTRY

Requirements for the B.S. Degree in Biochemistry

General Education Requirements

In addition to degree and major requirements, all students must complete the KU Core.

General Science Requirements (30-40) (37-38)

Majors must complete the following general science requirements that serve as foundational courses for this major.

Biology Orientation Seminar. Satisfied by:

**BIOL 105** Biology Orientation Seminar

Chemistry I. Satisfied by one of the following:

- **CHEM 170** Chemistry for the Chemical Sciences I
- **CHEM 130** General Chemistry I
- **CHEM 190** Foundations of Chemistry I, Honors

Chemistry II. Satisfied by one of the following:

- **CHEM 175** Chemistry for the Chemical Sciences II
- **CHEM 135** General Chemistry II
- **CHEM 195** Foundations of Chemistry II, Honors

Organic Chemistry I. Satisfied by one of the following:
13. Changes to Existing Major to BA Microbiology and BS Microbiology

BA MICROBIOLOGY

Requirements for the B.A. Major in Microbiology

Course work allows students to study microbiology as part of their general education and provides a background for teachers. It also prepares students for work in medical, public health, research, and industrial laboratories; for graduate, medical, or dental school; or for the clinical laboratory sciences program.

For general requirements for the B.A. degree, see CLAS General Education Degree Requirements on the College of Liberal Arts and Sciences Degree Requirements page.

General Science Requirements

Microbiology General Science Requirements (≈36-39)

Biology Orientation Seminar. Satisfied by:

BIOL 105 Biology Orientation Seminar 1

Principles of Molecular & Cellular Biology. Satisfied by one of the following:

BIOL 150 Principles of Molecular and Cellular Biology 4

BIOL 151 Principles of Molecular and Cellular Biology, Honors

Principles of Genetics. Satisfied by one of the following:

BIOL 350 Principles of Genetics 4

BIOL 360 Principles of Genetics, Honors

Chemistry I. Satisfied by one of the following:

CHEM 130 General Chemistry I 5

CHEM 190 Foundations of Chemistry I, Honors

Chemistry II. Satisfied by one of the following:

CHEM 135 General Chemistry II 5

CHEM 195 Foundations of Chemistry II, Honors

Organic Chemistry I. Satisfied by one of the following:

CHEM 310 Fundamentals of Organic Chemistry 3

CHEM 330 Organic Chemistry I

Organic Chemistry I Laboratory. Satisfied by:

CHEM 331 Organic Chemistry I Laboratory 2

Calculus. Satisfied by one of the following:

MATH 115 Calculus I 4

MATH 121 MATH 125 and Calculus II

MATH 116
BS MICROBIOLOGY

Requirements for the B.S. Degree in Microbiology

General Education Requirements
In addition to degree and major requirements, all students must complete the KU Core.

Microbiology Course Requirements
General Science Requirements (54-50-53)
Majors must complete 50-53 hours of the following general science requirements that serve as foundational courses for this major.

Calculus. Satisfied by one of the following:
- MATH 115 & MATH 116
- MATH 121 & MATH 125

Statistics. Satisfied by one of the following:
- BIOL 570
- MATH 365
- PSYC 210

Biochemistry I. Satisfied by:
- BIOL 636

Biochemistry II. Satisfied by:
- BIOL 638

14. Changes to Existing Major to BA Human Biology

BA HUMAN BIOLOGY
General Science Requirements (34-33)
Majors must complete the following 33-hour minimum of general science requirements that serve as foundational courses for this major.

Fundamentals of Physical Anthropology. Satisfied by:
- ANTH 304

Biology Orientation Seminar. Satisfied by:
- BIOL 105

Principles of Molecular & Cellular Biology. Satisfied by one of the following:
- BIOL 150
- BIOL 151

Principles of Organismal Biology. Satisfied by one of the following:
- BIOL 152
- BIOL 153

Calculus. Satisfied by one of the following:
- MATH 115 & MATH 116
- MATH 121 & MATH 125
15. Changes to Existing Major to BS Molecular Biosciences

BS MOLECULAR BIOSCIENCES

General Science Requirements (34-37)

Majors must complete the following 34-hour minimum of general science requirements that serve as foundational courses for this major.

Fundamentals of Physical Anthropology. Satisfied by:
- ANTH 304  

Biology Orientation Seminar. Satisfied by:
- BIOL 105  

Principles of Molecular & Cellular Biology. Satisfied by one of the following:
- BIOL 150  
- BIOL 151

Principles of Organismal Biology. Satisfied by one of the following:
- BIOL 152  
- BIOL 153

Calculus. Satisfied by one of the following:
- MATH 115 & MATH 116  
- MATH 125  
- MATH 141 & MATH 145

16. Changes to BAS – Biotechnology

BAS – BIOTECHNOLOGY

The Bachelor of Applied Science degree in Biotechnology requires in part:

GENERAL SCIENCE REQUIREMENTS (44-45 h)

CHEM 130 and CHEM 135 Foundations of Chemistry I and II .......................... 10
CHEM 330 Organic Chemistry I or 310 Fund. Organic Chemistry ................. 3
CHEM 331 Organic Chemistry I Laboratory .............................................. 2
PHSX 114 College Physics I ................................................................. 4
MATH 115 Calculus I (3) or MATH 125 Calculus I (4) ............................... 3-4
BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology 4
BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology ............. 4
BIOL 350 Principles of Genetics ............................................................ 4
BIOL 400 Fundamentals of Microbiology ................................................. 3
BIOL 416 Cell Structure and Function ..................................................... 3
BIOL 600 Introductory Biochemistry, Lectures ....................................... 4

17. Changes to Existing Major to BA Physics and BS Physics

BA PHYSICS

Bachelor of Arts in Physics Major Course Requirements

Foundational Physics and Mathematics (14-5 18.5)

Majors must complete courses as specified in each of the following areas. Majors are advised to take honors courses when eligible. All honors equivalents are also acceptable to fulfill PHSX major requirements. These hours do not contribute to the minimum number of hours required for the major.

Seminar in Physics, Astronomy, & Engineering Physics. Satisfied by:
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 150</td>
<td>Seminar in Physics, Astronomy and Engineering Physics</td>
<td>0.5</td>
</tr>
<tr>
<td>PHSX 211 &amp; PHSX 216</td>
<td>General Physics I and General Physics I Laboratory</td>
<td>5</td>
</tr>
<tr>
<td>PHSX 213</td>
<td>General Physics I Honors</td>
<td></td>
</tr>
<tr>
<td>PHSX 212 &amp; PHSX 236</td>
<td>General Physics II and General Physics II Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 214</td>
<td>General Physics II Honors</td>
<td></td>
</tr>
</tbody>
</table>

**General Physics I. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 211</td>
<td>General Physics I</td>
<td>5</td>
</tr>
<tr>
<td>PHSX 216</td>
<td>General Physics I Laboratory</td>
<td></td>
</tr>
<tr>
<td>PHSX 213</td>
<td>General Physics I Honors</td>
<td></td>
</tr>
</tbody>
</table>

**General Physics II. Satisfied by one of the following:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 212</td>
<td>General Physics II</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 236</td>
<td>General Physics II Laboratory</td>
<td></td>
</tr>
<tr>
<td>PHSX 214</td>
<td>General Physics II Honors</td>
<td></td>
</tr>
</tbody>
</table>

Calculus I. Satisfied by:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 121 - MATH 125</td>
<td>Calculus I (or equivalent)</td>
<td>4</td>
</tr>
</tbody>
</table>

Calculus II. Satisfied by:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 122 - MATH 126</td>
<td>Calculus II (or equivalent)</td>
<td>4</td>
</tr>
</tbody>
</table>

Advanced Math Requirement (5, 6)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 223 - MATH 127</td>
<td>Vector Calculus, Calculus III</td>
<td>4</td>
</tr>
</tbody>
</table>

Elementary Linear Algebra. Satisfied by:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 290</td>
<td>Elementary Linear Algebra</td>
<td>2</td>
</tr>
</tbody>
</table>

Differential Equations. Satisfied by one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 220</td>
<td>Applied Differential Equations</td>
<td></td>
</tr>
<tr>
<td>MATH 320</td>
<td>Elementary Differential Equations (recommended)</td>
<td></td>
</tr>
</tbody>
</table>

**BS PHYSICS**

Foundational Physics and Mathematics (8.5)

Majors must complete courses as specified in each of the following areas. Majors are advised to take honors courses when eligible. All honors equivalents are also acceptable to fulfill PHSX major requirements. These hours do not contribute to the minimum number of hours required for the major.

Calculus I. Satisfied by:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 121 - MATH 125</td>
<td>Calculus I (or equivalent)</td>
<td>4</td>
</tr>
</tbody>
</table>

Calculus II. Satisfied by:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 122 - MATH 126</td>
<td>Calculus II (or equivalent)</td>
<td>4</td>
</tr>
</tbody>
</table>

Seminar in Physics, Astronomy, & Engineering Physics. Satisfied by:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 150</td>
<td>Seminar in Physics, Astronomy and Engineering Physics</td>
<td>0.5</td>
</tr>
</tbody>
</table>

General Physics I. Satisfied by one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 211</td>
<td>General Physics I</td>
<td>5</td>
</tr>
<tr>
<td>PHSX 216</td>
<td>General Physics I Laboratory</td>
<td></td>
</tr>
<tr>
<td>PHSX 213</td>
<td>General Physics I Honors</td>
<td></td>
</tr>
</tbody>
</table>

General Physics II. Satisfied by one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 212</td>
<td>General Physics II</td>
<td>4</td>
</tr>
<tr>
<td>PHSX 236</td>
<td>General Physics II Laboratory</td>
<td></td>
</tr>
<tr>
<td>PHSX 214</td>
<td>General Physics II Honors</td>
<td></td>
</tr>
</tbody>
</table>

General Science Requirements (8)

Foundations of Chemistry I. Satisfied by:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 130</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Computing and Programming. Satisfied by:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EECS 138</td>
<td>Introduction to Computing: excluding Fortran or C++</td>
<td>3</td>
</tr>
<tr>
<td>or EECS 168</td>
<td>Programming I</td>
<td></td>
</tr>
</tbody>
</table>
Advanced Mathematics (8)
Vector Calculus. Satisfied by:

MATH 223 - MATH 127
Elementary Linear Algebra. Satisfied by:
MATH 290

Applied Differential Equations. Satisfied by:
MATH 320

Math Elective. Satisfied by one of the following: (0)
PHSX 518
PHSX 718
MATH 526
MATH 530
MATH 558
MATH 581
MATH 590
MATH 628
MATH 646
MATH 647
MATH 648
MATH 660
MATH 661

any 700-level MATH lecture course except MATH 701 and MATH 715

Elementary Differential Equations 3

Elementary Linear Algebra 2

Vector Calculus
Calculus III 4

Mathematical Physics
Mathematical Methods in Physical Sciences
Applied Mathematical Statistics I
Mathematical Models I
Introductory Modern Algebra
Numerical Methods
Linear Algebra
Mathematical Theory of Statistics
Complex Variable and Applications
Applied Partial Differential Equations
Calculus of Variations and Integral Equations
Geometry I
Geometry II

18. Changes to Existing Minor to Astrobiology

ASTROBIOLOGY MINOR
Preparatory Coursework
Calculus (3-4)
Satisfied by one of the following:
MATH 121 - MATH 125
or MATH 115
Foundations of Chemistry (5)
Satisfied by the following:
CHEM 130

General Chemistry I

Minor Requirements
Principles of Molecular and Cellular Biology (4)
Satisfied by the following:
BIOL 150

Principles of Molecular and Cellular Biology

Geology (3)
Satisfied by one of the following:
19. **Changes to Minor in Atmospheric Science**

**ATMOSPHERIC SCIENCE MINOR**

Requirements for the Minor in Atmospheric Science

Atmospheric Science Prerequisite or Co-requisite Knowledge

Calculus I. Satisfied by the following:

- **MATH 121–MATH 125**  
  Calculus I

- **MATH 141 MATH 145**  
  Calculus I: Honors

Calculus II. Satisfied by the following:

- **MATH 122–MATH 126**  
  Calculus II

- **MATH 142 MATH 146**  
  Calculus II: Honors

General Physics I. Satisfied by the following:

- **PHSX 211**  
  General Physics I

- **& PHSX 216**  
  and General Physics I Laboratory

- **PHSX 213**  
  General Physics I Honors