CBM003 ADD/CHANGE FORM

☒ Undergraduate Council	or	☐ Graduate/Professional Studies Council
☐ New Course ☒ Course Change		☐ New Course ☐ Course Change
Core Category: WI-ID Effective Fall 2009		Effective Fall __

1. Department: Biology and Biochemistry College: NSM RECEIVED OCT 23 2008
2. Faculty Contact Person: Larry Rapp Telephone: x3-8398 Email: lrapp@uh.edu
3. Course Information on New/Revised course: APPROVED DEC 10 2008
   - Instructional Area / Course Number / Long Course Title: BCHS / 4311 / Biochemistry Lab II
   - Instructional Area / Course Number / Short Course Title (30 characters max.) BCHS / 4311 / BIOCHEMISTRY LAB II
   - SCH: 3.00 Level: SR CIP Code: 2602020002 Lect Hrs: 1 Lab Hrs: 6
4. Justification for adding/changing course: **To meet core curriculum requirements**
5. Was the proposed/revised course previously offered as a special topics course? ☐ Yes ☒ No
   If Yes, please complete:
   - Instructional Area / Course Number / Long Course Title: _____ / _____ / _____
   - Course ID: _____ Effective Date (currently active row): _____
6. Authorized Degree Program(s): BA, BS Biochemical and Biophysical Sciences
   - Does this course affect major/minor requirements in the College/Department? ☒ Yes ☐ No
   - Does this course affect major/minor requirements in other Colleges/Departments? ☐ Yes ☒ No
   - Can the course be repeated for credit? ☐ Yes ☒ No (if yes, include in course description)
7. Grade Option: Letter (A, B, C ...) Instruction Type: lecture laboratory (Note: Lect/Lab info. must match item 3, above.)
8. If this form involves a change to an existing course, please obtain the following information from the course inventory: Instructional Area / Course Number / Long Course Title
   BCHS / 4311 / Biochemistry II Laboratory
   - Course ID: 12742 Effective Date (currently active row): 1998
9. Proposed Catalog Description: (If there are no prerequisites, type in "none".)
   Cr: 3. (1-6). Prerequisites: BCHS 3201. Description (30 words max.): Experimental study of current techniques in biochemistry and molecular biology with an emphasis on scientific writing.
10. Dean's Signature: [redacted] Date: 21 Oct '08
    Print/Type Name: IAN EVANS

U N I V E R S I T Y *of* H O U S T O N

CORE CURRICULUM COURSE REQUEST

Originating Department/College: Biology and Biochemistry/NSM

Person making request: Donna Pattison Telephone: x3-2642

E-mail: dpattison@uh.edu

Dean's signature: _____ Date: _____

I. General Information:

Course number and title: BCHS4311: Biochemistry Laboratory II

Catalog description must be included on completed CBM 003 form and attached to this document.

Category of Core for which course is being proposed (mark only one):

_____ Communication
_____ Mathematics
_____ Mathematics/Reasoning (IDO)
_____ American History
_____ Government
_____ Humanities
_____ Visual/Performing Arts Critical
_____ Visual/Performing Arts Experiential
_____ Natural Sciences
_____ Social/Behavioral Sciences
__x__ Writing in the Disciplines (IDO)

II. Objectives and Evaluation (respond on one or more separate sheets):

Call ext. 3-0919 for a copy of "Guidelines for Requesting and Evaluating Core Courses" or visit the website at www.uh.edu/academics/corecurriculum

A. How does the proposed course meet the appropriate Exemplary Educational Objectives (see Guidelines). Attach a syllabus and supporting materials for the objectives the syllabus does not make clear.

The proposed course, BCHS4311 Biochemistry Laboratory II, was developed by modifying the existing BCHS4311 Biochemistry II Laboratory course to place a greater emphasis on writing skills. BCHS4311 already has an extensive writing component. Currently, students write two papers in the style of a scientific journal article based on their work in the lab course. The papers are each 2500-3000 words in length. The teaching assistants for the course present a mini-workshop on writing scientific papers during the lab sessions. Students also receive a "Guide to Scientific Writing" provided by the course instructor and a rubric to guide their writing. Students receive feedback

on their first paper from their teaching assistants before attempting to write the second paper. In the "Writing for the Disciplines" version of the course, students will write two papers but the second paper will be based on the student's contribution to an ongoing research project under the direction of the laboratory instructor. Students will have the opportunity to conduct meaningful research with future applications in bioremediation and will be charged with the responsibility of communicating their efforts effectively so that they will be of value to the scientific community at large. Students will receive instruction on scientific writing from the course instructor during the lecture portion of the course rather than from the teaching assistants during the lab. Instruction on how to read and critically analyze scientific journal articles will be added to the course. In addition, students will use LabWrite, an online writing program designed at North Carolina State University, to guide their writing activities. The program helps students analyze their own reasoning and logic in developing their hypothesis and provides step-by-step guidance and tips on writing each segment of their laboratory report papers. The use of this program is expected to improve the quality of student writing by providing guidance throughout the writing process.

The proposed course meets all of the Exemplary Educational Objectives as defined by the Texas Higher Education Coordinating Board. This laboratory portion of the course provides students with an opportunity to apply the scientific method to an actual research project while learning to use current biotechnology techniques and equipment. The writing portion of the course will help students develop skills in communicating their findings in the style and format appropriate for the biological sciences. The reading and analysis of scientific journal articles will help students develop their critical thinking skills. The lecture portion of the class includes discussions on the development of research technologies and the ensuing ethical and public policy issues arising from the introduction of these technologies. Also covered in the course are some of the creative ways artists have incorporated some of the technologies used in the lab into their work as well as the impact of some of these technologies on society (for example, the use of PCR and gel electrophoresis in forensics and the impact these techniques have had on our criminal justice system).

B. **Specify the processes and procedures for evaluating course effectiveness in regard to its goals.**

Currently, students submit two papers in the style of scientific journal articles. During the Spring 2009 semester, both the first and second papers submitted by the students will be assessed to gain a baseline measure for the course before implementation of the course as a "Writing in the Disciplines" course. The writing instruction for this course will be taught as it has in past semesters for the Spring 2009 semester. During the Spring 2010 semester, the writing instruction will be conducted in the lecture part of the course by the course instructor rather than in the lab section by the teaching assistants. In addition, a lesson on how to read and critically analyze scientific journal articles will be included. The same evaluation will be conducted in Spring 2010 to assess the benefit of the changes to the course. As in the past, papers will be submitted to turnitin.com. This will facilitate the sorting and grouping of papers for assessment purposes. Beginning Spring 2010, the first paper will be used to identify students that have poor writing skills. These students will meet in small groups with a writing instructor to discuss common problems in writing and how to improve. The effectiveness of the writing studios will be assessed by comparing improvement in performance on the second paper in comparison to improvement made by students identified as being poor writers during the Spring 2009 semester. A rubric for

evaluating the papers is already in place for this course and will be used as a guideline for evaluating student writing in both the Spring 2009 and Spring 2010 semesters. Students will complete surveys to measure their perception of their technical writing skills at the beginning of the course, after the first paper, and after the second paper. The surveys after the first paper and the second paper will contain additional questions to gauge student perception as to the value of the class activities aimed at teaching the fundamentals of writing and any other interventions provided. The campus Writing Center will be utilized to evaluate student writing samples and conduct the writing studios.

C. **Delineate how these evaluation results will be used to improve the course.**

The evaluations and surveys will be used to determine the effectiveness of the instruction in writing provided. Examination of the rubric-based evaluations should illuminate areas where further writing instruction may be necessary. The surveys will provide insight into areas the students themselves would like to see expanded coverage. Lecture content, writing studios, and teaching methodology will be adjusted to address the areas in need of improvement.

MEMORANDUM

Date: October 8, 2008

To: Dr. Ian Evans, Associate Dean
College of Natural Science and Math

From: Dr. Donna Pattison, Instructional Assistant Professor
Department of Biology and Biochemistry

RE: Designation of BCHS4311 Biochemistry II Laboratory as a "Writing in the Disciplines" course

We are requesting the BCHS4311 Biochemistry II 3-credit laboratory course be designated as a "Writing in the Disciplines" course for the B.A./B.S. Biology degree program. The course already provides several technical writing opportunities. The mini-workshop on scientific writing currently held during the lab time will be expanded and moved to the lecture portion of the class. Course content will be expanded to include direct instruction and practice in searching the scientific literature as well as critical reading of journal articles. The expansion of our currently existing curriculum qualifies this course for credit towards "Writing in the Disciplines".

Current Course: BCHS4311 is comprised of both a laboratory and a lecture component. Students meet for two 3-hour sessions and a one hour lecture. During the lab portion of the course, students gain first-hand experience using some of the most common and useful tools employed by biochemists and molecular biologists today. During the lecture session of the course, the "why" behind the steps in a protocol are discussed. The types of research and applications in which the techniques learned in lab are actually used are also discussed. Students write two papers (2,500 -3,000 words each) in the style of a scientific journal article during this course. Two lab activities are chosen each semester to serve as the basis for these papers. Before the first paper is written, students are given a short lecture at the beginning of a lab session about how to write a scientific journal article. Students learn how to search the scientific literature during the BCHS3201 laboratory course (a pre-requisite for BCHS4311). The topic is reviewed briefly in this course and students are expected to appropriately utilize and cite relevant material in the literature in their papers. Students receive a "Guide to Scientific Writing" (written by the course instructor) and a rubric that summarizes the expectations and specifies the criteria on which each lab will be evaluated. Extensive feedback is provided on the first paper. The second paper is worth a higher percentage of the total course grade than the first one. Feedback is also provided on the second paper. The second paper covers a lab activity that takes several weeks to complete and involves multiple techniques to arrive at the "endpoint". This provides students an opportunity to write a fairly complex paper more analogous to a true research article.

Changes to Qualify the Course for Writing in the Disciplines:

1) Instruction on scientific writing will be moved from the laboratory session to the lecture session so that a more thorough discussion can be held.

2) LabWrite, an online writing program (http://www.ncsu.edu/labwrite/) designed by North Carolina State University (sponsored by the National Science Foundation DUE-9950405 and DUE-0231086; Development Team: Michale Carter, Eric Wiebe, and Miriam Ferzli), will be implemented to guide students through every step of the writing process. The program helps students develop meaningful hypothesis and to reflect on their own reasoning and deductive processes in arriving at their hypothesis. The LabWrite Pre-Lab will be used to help students write a a meaningful hypothesis for every activity in the lab. The full LabWrite program will be used to guide students through the paper writing process. In addition to the Pre-Lab, the program provides an InLab section to guide students in data organization, presentation, and analysis. A PostLab section which teaches students how to tackle writing the full paper (title, abstract, introduction, methods, results, discussion, conclusion, references). The program also provides tutorials to aid students with matters of grammer and proper citations as well as in how to use Excel, design tables, determine what type of graph is appropriate for the type of data collected, and how to represent experimental uncertainty using error bars. Students will receive an introduction to the program in lecture. The use of this program is expected to improve the quality of student writing by providing guidance throughout the writing process.

3) Lecture will include a lesson on how to read and critically analyze journal articles from the current literature. This lesson will be presented before the completion of the first paper. Students will be required to select two scientific papers that they plan to cite in their introduction section of the first paper and write a three sentence explanation as to why the article they have selected is relevant and appropriate as background information for their paper.

4) The second paper will be written on the student's work on an ongoing research project under the direction of the laboratory instructor. Students will have the opportunity to conduct meaningful research with future applications in bioremediation. The actual experiments conducted from semester to semester will change with the needs of the research project. The importance of precise and clear scientific writing should become more meaningful to students as they begin to fully understand the value of communicating their efforts in solving real-life environmental problems to the next round of students who will continue their work and to the scientific research community at large.

Attachments:
CBM003 Form to Change BCHS4311
Core Curriculum Request Form
Syllabus for lecture and laboratory components of BCHS4311
Writing rubric for papers

Cc: Dr. Stuart Dryer
Dr. Larry Rapp

BIOCHEMISTRY LABORATORY II
BCHS 4311 Lecture Syllabus
Spring 2010

Lab Coordinator: Dr. Donna Pattison
Office: Room 124B, Old Science Building
Phone Number: 713-743-2642
e-mail: dpattison@uh.edu

Text: Laboratory DNA Science; Blooom, Freyer, and Micklos (1996) [ISBN: 0-8053-3040-2]

Lecture Time/Location: Thursdays, 4-5 pm; SEC204

Course Overview and Objectives: Students will gain first-hand experience using some of the most common and useful tools employed by biochemists and molecular biologists today. By the end of the course students will understand and be able to set up a polymerase chain reaction, clone a gene into a vector, transform a cloning vector into a cell line, and purify expressed protein. Students will be able to explain when and why scientists would use these particular methods in the laboratory. Students will be able to communicate their findings in the form of a scientific journal article in the style appropriate for the biological sciences.

Lecture Focus: In lecture we will discuss the "why" behind the steps in a protocol. Molecular biology protocols are not just recipes to be followed. Understanding the reason the steps are written will help you design your own experiments and protocols in the future and help you understand the discipline of molecular biology itself. We will also discuss the types of research and applications in which the techniques you will be learning are used. We will also discuss how to read and critically analyze the scientific literature as well as cover the fundamentals of writing for the sciences.

Thursday	Topic
January 17	Restrictions Enzymes/Methylation/Electrophoresis
January 24	E.coli/Plasmids/Transformation (Chapter 4, p.116-131) The Wonders of Green Fluorescent Protein (Trends in Genetics August 1995 Vol. 11 No. 8 p.320-323)
January 31	Protein Purification Methods/Intro to β-lactamase
February 7	How to Read a Scientific Journal Article

February 14	Writing a Scientific Journal Article
February 21	Introduction to the Research Project
February 28	Polymerase Chain Reaction and Sequencing Technologies
March 6	DNA Fingerprinting
March 13	Southern, Northern, Western Blots
March 20	No lecture (Spring Break)
March 27	Variations on a Blot/Alternatives to Blots
April 3	Genomic Libraries: Types, Construction, Uses
April 10	A Look at the Literature: Hot, New Techniques
April 17	ELISA
April 23-24	Final Exam

Attendance and Grading
Attendance at labs is MANDATORY. Role will NOT be taken at lecture. Be advised, however, that the introduction to the lab for the week will usually be given in lecture rather than in lab. Some (and possibly all) of the questions on your lab quizzes and the final exam will be written by Dr. Pattison and will be based on material covered in lecture. Therefore, it is in your best interest to attend lecture. Attending labs alone will not prepare you for the quizzes or the final exam. The grading policy can be found on the lab syllabus.

Students with Special Needs: The Americans with Disabilities Act of 1990 requires that universities make reasonable accommodations to persons with disabilities as defined in the act. Students who feel they need assistance as defined by the guidelines set forth in the act should contact the lab coordinator, Dr. Pattison, to discuss appropriate arrangements.

BIOCHEMISTRY LABORATORY II
BCHS 4311
Spring 2010

Lab Coordinator: Dr. Donna Pattison
Office: Room 124B, Old Science Building
Phone Number: 713-743-2642
e-mail: dpattison@uh.edu

Teaching Assistant:_____
TA e-mail:_____

Text: Laboratory DNA Science; Bloom, Freyer, and Micklos (1996) [ISBN: 0-8053-3040-2]

A calculator may be helpful.
Lab Coats are REQUIRED. Safety glasses will be needed for some labs. You may provide your own or use the class set provided in the lab.

Course Overview and Objectives: Students will gain first-hand experience using some of the most common and useful tools employed by biochemists and molecular biologists today. By the end of the course students will understand and be able to set up a polymerase chain reaction, clone a gene into a vector, transform a cloning vector into a cell line, and purify expressed protein. Students will be able to explain when and why scientists would use these particular methods in the laboratory. Students will be able to communicate their findings in the form of a scientific journal article in the style appropriate for the biological sciences.

Week	Lab
January 14-15	Lab Orientation and Safety
January 16-17	Micropipetting, Sterile Techniques and Bacterial Culture Techniques (Labs 1 and 2)
January 21-22	No class (Martin Luther King, Jr. Day)
January 23-24	Effects of DNA Methylation on Restriction (Lab 4)
January 28-29	Green Fluorescent Protein Plasmid Transformation (Separate handout)

January 30-31	Purification and Identification of Recombinant GFP
February 4-5	Purification and Identification of Recombinant GFP
February 6-7	Assay for an Antibiotic Resistance Enzyme (Separate handout)
February 11-12	Recombination of Antibiotic Resistance Genes (Lab 7)
February 13-14	Transformation of *E. coli* with Recombinant DNA (Lab 8)
February 18-19	Replica Plating (Lab 9)
February 20-21	Purification and Identification of Recombinant DNA (Lab 10)
February 25-26	Purification and Identification of Recombinant DNA Continued
February 27-28	Cloning by PCR (Lab 18-21)
March 3-4	Cloning by PCR (continued)
March 5-6	Cloning by PCR (continued)
March 10-11	Cloning by PCR (continued)
March 12-13	Human DNA Fingerprinting (Lab 23)
March 17-21	Spring Break
March 24-25	Southern Hybridization of λ DNA (Lab 13)
March 26-27	Southern Hybridization of λ DNA (continued)
March 31-April 1	Southern Hybridization of λ DNA (continued)
April 2-3	Construction of a Genomic Library of λ DNA (Lab 14-16)
April 7-8	Construction of a Genomic Library of λ DNA (continued)
April 9-10	Construction of a Genomic Library of λ DNA (continued)
April 14-15	Construction of a Genomic Library of λ DNA (Colony Hybridization)

April 16-17	Construction of a Genomic Library of λ DNA (continued)
April 21-22	ELISA (separate handout)
April 23-24	Final Exam

Please note the above schedule is TENTATIVE. The schedule is subject to change based on the availability of materials from our suppliers and the need to allow some flexibility in the time needed to complete the lab exercises. Time will be allotted each week to work on an on-going research project under the direction of Dr. Pattison. The nature of the project will evolve based on the results gathered and is therefore not specifically delineated in the schedule above.

Attendance and Grading

Attendance is **MANDATORY**. If you miss a lab for an excused reason, inform your TA as soon as possible. Make arrangements with the lab coordinator, Dr. Pattison, to attend another lab section the same week. You will take the quiz for the lab section you are visiting. As the main point of a laboratory course is to gain hands-on experience in lab techniques, if you fail to attend more than two labs, you will automatically fail the course unless you provide evidence of extenuating circumstances that are excused under university policies. Failure to hand in 2 or more lab reports will result in an F even if you attended the lab. You are expected to arrive in class on time. Points will be deducted from your participation grade for tardiness. If you are more than 15 minutes late, you are considered absent and will not be allowed to participate in the lab. You will need to guest in another lab to obtain credit for that lab. It is **YOUR** responsibility to deal with attendance issues **PROMPTLY**. You must speak with both your TA AND Dr. Pattison.

Guesting: You may guest in another lab no more than twice during the semester. You must inform your regularly assigned teaching assistant and Dr. Pattison (e-mail will be sufficient). You are also required to fill out a guesting form (located on the TA bench at the front of the room) and submit it to the teaching assistant in the section you are guesting.

Incomplete Grade Policy: A temporary grade of "I" can be assigned by the instructor when a student is currently (A) passing a course or (b) still has a reasonable chance of passing in the judgment of the instructor, but for non-academic reasons beyond their control have not completed a relatively small part of all course requirements. After the student and the instructor agree that the student shall receive an "I" grade, an "Incomplete Grade Agreement" form must be completed and filed with the Office of Undergraduate Affairs (124F, Science Building). Further information on "I" grades can be found at http://www.uh.edu/academics/catalog/general/acade2.html#grades.

Students with Special Needs: The Americans with Disabilities Act of 1990 requires that universities make reasonable accommodations to persons with disabilities as defined in the act. Students who feel they need assistance as defined by the guidelines set forth in the act should contact the lab coordinator, Dr. Pattison, to discuss appropriate arrangements.

Grades

Lab reports (Tear-out)	20%	200 points (see below)
Formal Lab Paper #1	10%	100 points
Formal Lab Paper #2	20%	200 points
Participation	10%	100 points
Quizzes	25%	250 points (5 quizzes / 50 points each)
Final	15%	150 points
		1000 points total

Formal Lab Reports:

1) Recombination of Antibiotic Resistance Genes, Transformation of *E. coli* with Recombinant DNA, Replica Plating, and Purification and Identification of Recombinant DNA (100 points)

2) Research Project (200 points)

Tear-Out Lab Reports:

Purification and Identification of Recombinant GFP (30 points)
Assay for an Antibiotic Resistance Enzyme (15 points)
Cloning by PCR (65 points)
Southern Hybridization (60 points)
Human DNA Fingerprinting (15 points)
ELISA (15 points)

Grade Assignments

92.0 – 100%	A
90.0 - 91.9%	A-
88.0 - 89.9%	B+
82.0 – 87.9%	B
80.0 – 81.9%	B-
78.0 – 79.9%	C+
72.0 – 77.9%	C
70.0 – 71.9%	C-
68.0 – 69.9%	D+
62.0 – 67.9%	D
60.0 – 61.9%	D-

Important Dates:

January 28th: Last day to drop class without a grade
April 1st: Last day to drop class with a W

Biochemistry Lab II (BCHS4311)
Formal Laboratory Report Grading Worksheet

Components	Comments	Points	
		Max	Earned
Title ▪ identifies theme of study and nature of work ▪ avoids unnecessary words or phrasing ▪ cites author, date, and TA name below title		2	
Abstract ▪ summarizes briefly all aspects of study including objectives, hypothesis, methods, results, and conclusions ▪ avoids unnecessary details		10	
Introduction ▪ states purpose of study ▪ justifies why study needs to be done ▪ reviews previous results by others ▪ states hypothesis, predictions, and possible outcomes		20	
Materials and Methods ▪ provides details of materials and equipment (described in paragraphs, not as a list) ▪ describes experimental treatments and procedures for collecting the data ▪ provides sufficient detail to allow precise replication		10	
Results ▪ uses graphs and tables to report data ▪ provides title and correct labeling on graphs and tables ▪ uses text (words) to describe important aspects of data (refers to tables and graphs) ▪ presents data objectively (without interpretation)		20	
Discussion ▪ provides interpretation of experimental results with regard to your hypothesis ▪ addresses limitations and possible sources of errors ▪ indicates importance and possible applications of experimental findings ▪ proposes new questions that arise from your study ▪ summarizes major conclusion(s)		20	
References ▪ contains at least three references (at least one reference a journal article or book; no Wikipedia or blogs or other unrefereed web source); listed at end and cited in text; references appropriate for topic		8	
Writing Proficiency and Format ▪ uses appropriate nomenclature throughout ▪ uses correct grammar, spelling, and punctuation ▪ organizes report according to specified format ▪ presents ideas clearly, concisely and logically		10	
Overall Grade:		100	

Plagiarism

- Plagiarism: representing as one's own work the work of another without acknowledging the source or inappropriate use of a cource with or without a citation.
- No part of the paper may be plagiarized.

Examples of Plagiarism

- Two or more individuals submitting substantially identical papers, reports, or other assignments.
- Copying substantial portions of a source verbatim, with or without citing the source.
- Failing to cite references.

Laboratory Reports

- Common group data must be organized by each individual into the lab report.
- Tables containing group data must be prepared independently by each student.
- While data may be discussed with other students, the lab report must be an individual effort.
- The protocol handout must not be copied directly into lab report.

Penalty for Plagiarism

- At the discretion of the Laboratory Coordinator, minor infractions involving failure to follow laboratory report guidelines may result in the loss of all points for entire sections of the report.
- Obvious cases of plagiarism appearing to constitute academic dishonesty (see Article 3.02b of the Academic Policy section of the 2007-2008 Student Handbook) will be reported to the Associate Chair for Undergraduate Affairs of the Biology and Biochemistry Department and could result in penalties ranging from zero points on the report to a grade of F for the course to university sanctions as outlined in the student handbook.

Courses for Bachelor of Science*, Biochemistry, Fall 2009

Total of 122 semester hours with 36 hours of advanced courses (3000-4000 level)

Course	*University Core Requirements*	*SCH*
ENGL 1303	English Composition I	3
ENGL 1304	English Composition II	3
HIST 1337	The United States to 1877	3
HIST 1378	The United States since 1877	3
POLS 1336	American Government: National, State, and Local	3
POLS 1337	American Government: National, State, and Local	3
Humanities	See UH Approved List	3
Social & Behavioral Science	See UH Approved List	3
Visual & Performing Arts	See UH Approved List	3
	TOTAL	**27**

Course	*Biochemistry*	*SCH*
BCHS 3201	Biochemistry Laboratory I	2
BCHS 3304	General Biochemistry I	3
BCHS 3305	General Biochemistry II	3
BCHS 4304	Biophysics	3
BCHS 4306	Nucleic Acids	3
BCHS 4307	Proteins	3
BCHS 4311	Biochemistry Laboratory II**	3
Biochemistry Electives	Nine additional hours of advanced BCHS electives	9
	TOTAL	**29**

Course	*Chemistry*	*SCH*
CHEM 1331,1111	Fundamentals of Chemistry I Lecture and Lab	4
CHEM 1332, 1112	Fundamentals of Chemistry II Lecture and Lab	4
CHEM 3331, 3221	Fundamentals of Organic Chemistry I Lecture and Lab	5
CHEM 3332, 3222	Fundamentals of Organic Chemistry II Lecture and Lab	5
Choose: CHEM 4370 OR CHEM 4373	Physical Chemistry Survey of Physical Chemistry	3
	TOTAL	**21**

Course	*Biology*	*SCH*
BIOL 1161, 1361	Introduction to Biological Science I Lecture and Lab	4
BIOL 1162, 1362	Introduction to Biological Science II Lecture and Lab	4
BIOL 3301	Genetics	3
	TOTAL	**11**

Course	*Physics*	*SCH*
Choose:		8
PHYS 1301, 1101	Introductory General Physics I Lecture and Lab	
PHYS 1302, 1102	Introduction to Biological Science II Lecture and Lab	
OR		
PHYS 1321, 1121	University Physics I Lecture and Lab	
PHYS 1322, 1122	University Physics II Lecture and Lab	
	TOTAL	**8**

Course	*Formal Sciences*	*SCH*
MATH 1431	Calculus I	4
MATH 1432	Calculus II	4
Choose one of the followings:		4
MATH 2433	Calculus III	
MATH 3338	Probability	
MATH 3397	Statistics for Scientists	
	TOTAL	**12**

Course	*NSM Capstone*	*SCH*
	Minor or other NSM Capstone Option	6
	TOTAL	**6**

Course	*Free Electives*	*SCH*
	Additional hours to complete a total of 122 hours, including at least 36 advanced hours.	8
	TOTAL	**8**

* B.A. Biochemistry degree consists of identical requirements as B.S. Biology degree, with an addition of six semester-hours of one foreign language at sophomore level or higher. Free electives are adjusted accordingly to give a total of 122 semester-hours in the B.A. Biology degree.

** Fulfills core curriculum IDO requirement for Writing in the Disciplines.