Biochemistry

Coordinator: Associate Professor Wright
Professor: Gooch
Associate Professor: Matera

Biochemistry focuses on those processes that occur at the molecular level in living organisms. The goal of the biochemistry major is to provide an in-depth, interdisciplinary foundation in the chemistry and biology needed to understand these processes. Students completing this major will be prepared for careers in the biotechnology industry or graduate studies in biochemistry, pharmaceutical chemistry, molecular biology or medically-related fields.

Administered by the Department of Chemistry, a Bachelor of Science degree in Biochemistry (61-65 semester hours) is offered in a three-tiered structure. Foundational courses are taken from biology, chemistry, mathematics and physics. Intermediate courses in biochemistry, genetics and organic chemistry provide in-depth knowledge. Advanced electives in biochemistry, biology and chemistry allow students flexibility in tailoring a curriculum to fit their post baccalaureate goals. The major concludes with a capstone experience focusing on an advanced topics in biochemistry coupled with the creation of a scientific research proposal.

Students who major in biochemistry will gain access to state-of-the-art technology and be able to put their knowledge into practice through internships and/or undergraduate research. Biochemical research may be offered by appropriate faculty in either the Department of Biology or the Department of Chemistry. Undergraduate researchers are encouraged to present their results at local, regional and national scientific meetings.

A Bachelor of Science degree in Biochemistry requires the following courses:

<table>
<thead>
<tr>
<th>BIO</th>
<th>111</th>
<th>Introductory Cell Biology</th>
<th>3 sh</th>
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<tbody>
<tr>
<td>BIO</td>
<td>112</td>
<td>Population Biology</td>
<td>3 sh</td>
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<tr>
<td>BIO</td>
<td>113</td>
<td>Cell Biology Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>BIO</td>
<td>114</td>
<td>Population Biology Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>CHM</td>
<td>111</td>
<td>General Chemistry I</td>
<td>3 sh</td>
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<tr>
<td>CHM</td>
<td>112</td>
<td>General Chemistry II</td>
<td>3 sh</td>
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<tr>
<td>CHM</td>
<td>113</td>
<td>General Chemistry I Lab</td>
<td>1 sh</td>
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<tr>
<td>CHM</td>
<td>114</td>
<td>General Chemistry II Lab</td>
<td>1 sh</td>
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<tr>
<td>CHM</td>
<td>115</td>
<td>Advanced General Chemistry</td>
<td>3 sh</td>
</tr>
<tr>
<td>CHM</td>
<td>116</td>
<td>Advanced General Chemistry Lab</td>
<td>1 sh</td>
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<tr>
<td>PHY</td>
<td>111</td>
<td>General Physics I</td>
<td>4 sh</td>
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<tr>
<td>PHY</td>
<td>112</td>
<td>General Physics II</td>
<td>4 sh</td>
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<tr>
<td>PHY</td>
<td>113</td>
<td>General Physics I with Calculus</td>
<td>4 sh</td>
</tr>
<tr>
<td>PHY</td>
<td>114</td>
<td>General Physics II with Calculus</td>
<td>4 sh</td>
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<tr>
<td>MTH</td>
<td>121</td>
<td>Calculus I</td>
<td>4 sh</td>
</tr>
<tr>
<td>BIO</td>
<td>245</td>
<td>Principles of Genetics</td>
<td>4 sh</td>
</tr>
<tr>
<td>CHM</td>
<td>211</td>
<td>Organic Chemistry I</td>
<td>3 sh</td>
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<tr>
<td>CHM</td>
<td>212</td>
<td>Organic Chemistry II</td>
<td>3 sh</td>
</tr>
<tr>
<td>CHM</td>
<td>213</td>
<td>Organic Chemistry I Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>CHM</td>
<td>214</td>
<td>Organic Chemistry II Lab</td>
<td>1 sh</td>
</tr>
</tbody>
</table>
CHM 311 Quantitative Analysis 4 sh
CHM 351 Biochemistry 3 sh
CHM 352 Biochemistry Lab 1 sh
CHM 353 Advanced Biochemistry 3 sh
CHM 354 Advanced Biochemistry Lab 1 sh
CHM 495 Senior Seminar in Biochemistry 3 sh

Students must take a minimum of 10 hours with at least 4 hours from CHM and 4 hours from BIO:

BIO 321 Microbiology
BIO 422 Molecular and Cellular Biology
BIO 445 Advanced Genetics
BIO 499 Research
CHM 321 Instrumental Analysis
CHM 332 Physical Chemistry I
CHM 334 Physical Chemistry II
CHM 472 Special Topics: NMR
CHM 473 Special Topics: Medicinal Chemistry
CHM 499 Research

TOTAL 61-65 sh

1 Other elective can be substituted with approval of the department.
2 BIO/CHM 499 must be approved by the coordinator as having biochemical content.
3 Special topics courses (2 sh each) and BIO/CHM 499 can count up to 4 sh toward the major.
4 MTH 221 is a prerequisite for this optional course.

Students majoring in Biochemistry may not also declare a minor in either Biology or Chemistry.

CHM 495. SENIOR SEMINAR IN BIOCHEMISTRY 3 sh

This capstone course for senior biochemistry majors includes (1) analyzing and understanding advanced biochemical topics using current literature as the major source of information, (2) developing and writing a novel scientific research proposal, and (3) presenting information through both informal in-class discussions of journal articles and a more formal oral seminar presentation. Prerequisites: CHM 351, 351 (required); CHM 353, 354 (recommended). Offered spring.

Biology

Chair, Department of Biology: Associate Professor Niedziela
Associate Chair, Department of Biology: Associate Professor Vick
Professors: H. House, S. House
Associate Professors: M. Clark, Haenel, N. Harris, Kingston, MacFall, Touchette
Assistant Professors: Coker, Gallucci, Gammon, Izzo, Miyamoto, Vandermast
Adjuncts: DeVries, Mackin, Train

Biology is the study of life in all its diverse forms. As a species, we have always been deeply fascinated by other living creatures. Early human’s dependence on other animals and plants for food, medicine and shelter fostered an appreciation for life’s interconnectedness. Modern society has rediscovered these relationships in the face of such challenges as global warming, rain forest destruction, antibiotic resistance, emerging diseases, pollution and rising cancer rates.
Our approach to biology at Elon University stresses hands-on experiences in the classroom, laboratory and field. The course of study includes off-campus experiential opportunities and research seminars that encourage creative approaches to biological problems. The focus is on science as a process, not merely a collection of established facts.

The faculty strives to provide students with a high quality program that enables them to (1) develop critical thinking and problem-solving skills to better understand and meet present and future biological challenges; (2) develop competency in information retrieval, use and analysis; (3) develop an understanding of the latest technologies utilized in biological investigation; (4) acquire broad-based knowledge of biological concepts from molecules to ecosystems; and (5) acquire an experiential learning opportunity through either research, internship or laboratory assistantship.

The Bachelor of Science in Medical Technology (MT) consists of three years of preprofessional training at Elon followed by application to the 12-month clinical program at our affiliated hospital. Admission to the affiliated program is competitive and based on overall GPA, evaluation by faculty and personal interviews. Students may also apply to a variety of Medical Technology programs once a bachelor’s degree is completed with the appropriate prerequisites.

In all of Elon’s biology offerings, students receive a strong foundation in biology that prepares them for graduate studies, medical and other allied health-related professional schools, teaching and industry.

The Department of Biology and Allied Health offers programs leading to the Bachelor of Arts or Bachelor of Science degree with a major in Biology, the Bachelor of Science degree with a major in Medical Technology and a minor concentration in biology for students majoring in another discipline.

The Department of Biology has divided its laboratory course offerings that serve as electives into three functional categories to assist students in the development of a broad-based major with the necessary fundamental biological concepts while at the same time providing the student with the flexibility to build a program that meets their individual interests and needs.

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<tbody>
<tr>
<td>BIO 325</td>
<td>BIO 316</td>
<td>BIO 335</td>
<td>BIO 321</td>
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<td>BIO 348</td>
<td>BIO 318</td>
<td>BIO 342</td>
<td>BIO 335</td>
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<td>BIO 351/352</td>
<td>BIO 321</td>
<td>BIO 344</td>
<td>BIO 341</td>
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<td>BIO 353/354</td>
<td>BIO 331</td>
<td>BIO 350</td>
<td>BIO 342</td>
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<td>BIO 422</td>
<td>BIO 332</td>
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<td>BIO 445</td>
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<td>BIO 442</td>
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Both the Bachelor of Arts and the Bachelor of Science degrees in Biology require the following Core Courses:

<table>
<thead>
<tr>
<th>BIO</th>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>111</td>
<td>Introductory Cell Biology</td>
<td>3 sh</td>
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<tr>
<td>112</td>
<td>Introductory Population Biology</td>
<td>3 sh</td>
</tr>
<tr>
<td>113</td>
<td>Cell Biology Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>114</td>
<td>Population Biology Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>231</td>
<td>Biodiversity</td>
<td>4 sh</td>
</tr>
<tr>
<td>245</td>
<td>Principles of Genetics</td>
<td>4 sh</td>
</tr>
</tbody>
</table>
BIO 261 Introductory Seminar 2 sh

Upper level biology electives (300-400 level)
- One course - Molecular/Cellular Biology category 4 sh
- One course - Organismal Biology category 4 sh
- One course - Supraorganismal Biology category 4 sh

Eight additional semester hours chosen from 8 sh
- Molecular/Cellular Biology category
- Organismal Biology category
- Supraorganismal Biology category
- Special topics seminars (non-lab courses)
- Undergraduate Research (BIO 499) up to 4 sh

Additional Requirement:
- At least one elective must have Diversity designation

BIO 462 Senior Seminar 2 sh

TOTAL 40 sh

A Bachelor of Arts degree in Biology requires the following courses:

Core Courses in Biology 40 sh

CHM 111 General Chemistry I 3 sh
CHM 113 General Chemistry I Lab 1 sh
CHM 112 General Chemistry II 3 sh
CHM 114 General Chemistry II Lab 1 sh

or (in lieu of CHM 111, 113, 112, 114)

CHM 115 Advanced General Chemistry (3 sh)
CHM 116 Advanced General Chemistry Lab (1 sh)

Choose one course 4 sh

MTH 112 General Statistics
MTH 212 Statistics in Application

In addition, a required experiential component selected from the following:
- (a) internship
- (b) research
- (c) a specialized approved laboratory assistantship

TOTAL 48-52 sh

A Bachelor of Science degree in Biology requires the following courses:

Core Courses in Biology 40 sh

CHM 111 General Chemistry I 3 sh
CHM 113 General Chemistry I Lab 1 sh
CHM 112 General Chemistry II 3 sh
CHM 114 General Chemistry II Lab 1 sh

or (in lieu of CHM 111, 113, 112, 114)

CHM 211 Organic Chemistry I 3 sh
CHM 212 Organic Chemistry II 3 sh
CHM 213 Organic Chemistry I Lab 1 sh
CHM 214 Organic Chemistry II Lab 1 sh
**BIOLOGY**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHY 111</td>
<td>General Physics I</td>
<td>4 sh</td>
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<tr>
<td>PHY 112</td>
<td>General Physics II</td>
<td>4 sh</td>
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<td>or</td>
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<tr>
<td>PHY 113</td>
<td>General Physics I with Calculus</td>
<td>4 sh</td>
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<tr>
<td>PHY 114</td>
<td>General Physics II with Calculus</td>
<td>4 sh</td>
</tr>
<tr>
<td>MTH 112</td>
<td>General Statistics</td>
<td>4 sh</td>
</tr>
<tr>
<td>MTH 212</td>
<td>Statistics in Application</td>
<td>4 sh</td>
</tr>
</tbody>
</table>

In addition, a required experiential component selected from:

(a) internship  
(b) research  
(c) a specialized approved laboratory assistantship.

**TOTAL** 64-68 sh

**A Bachelor of Science degree in Medical Technology** requires 40-47 semester hours of coursework at Elon University and completion of the clinical curriculum.

<table>
<thead>
<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>BIO 111</td>
<td>Introductory Cell Biology</td>
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<tr>
<td>BIO 112</td>
<td>Introductory Population Biology</td>
<td>3 sh</td>
</tr>
<tr>
<td>BIO 113</td>
<td>Cell Biology Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>BIO 114</td>
<td>Population Biology Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>BIO 245</td>
<td>Principles of Genetics</td>
<td>4 sh</td>
</tr>
<tr>
<td>BIO 321</td>
<td>Microbiology</td>
<td>4 sh</td>
</tr>
<tr>
<td>CHM 111</td>
<td>General Chemistry I</td>
<td>3 sh</td>
</tr>
<tr>
<td>CHM 113</td>
<td>General Chemistry I Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>CHM 112</td>
<td>General Chemistry II</td>
<td>3 sh</td>
</tr>
<tr>
<td>CHM 114</td>
<td>General Chemistry II Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>CHM 115</td>
<td>Advanced General Chemistry (3 sh)</td>
<td></td>
</tr>
<tr>
<td>CHM 116</td>
<td>Advanced General Chemistry Lab (1 sh)</td>
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</tr>
<tr>
<td>CHM 211</td>
<td>Organic Chemistry I</td>
<td>3 sh</td>
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<tr>
<td>CHM 212</td>
<td>Organic Chemistry II</td>
<td>3 sh</td>
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<tr>
<td>CHM 213</td>
<td>Organic Chemistry I Lab</td>
<td>1 sh</td>
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<tr>
<td>CHM 214</td>
<td>Organic Chemistry II Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>PHY 111</td>
<td>General Physics I</td>
<td>4 sh</td>
</tr>
<tr>
<td>PHY 112</td>
<td>General Physics II</td>
<td>4 sh</td>
</tr>
<tr>
<td>MTH 112</td>
<td>General Statistics (or higher)</td>
<td>4 sh</td>
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</tbody>
</table>

A course in immunology: Immunology as a separate course or as part of a microbiology course 0-3 sh

Recommended additional courses:

- CHM 311 Quantitative Analysis
- CIS 112 Problem Solving with Spreadsheet Applications
- CIS 114 Introduction to Web Site Development
- BIO 162 Human Physiology
- BUS 303 Introduction to Managing

A mathematics course higher than MTH 112

Completion of the clinical curriculum

**TOTAL** 40-47 sh
A minor in Biology requires the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIO 111</td>
<td>Introductory Cell Biology</td>
<td>3 sh</td>
</tr>
<tr>
<td>BIO 113</td>
<td>Cell Biology Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td></td>
<td>Sixteen semester hours chosen from the following:</td>
<td>16 sh</td>
</tr>
<tr>
<td>BIO 112</td>
<td>Introductory Population Biology</td>
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<tr>
<td>BIO 114</td>
<td>Population Biology Lab</td>
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<tr>
<td></td>
<td>Biology courses at the 200-400 level</td>
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<td></td>
<td>TOTAL</td>
<td>20 sh</td>
</tr>
</tbody>
</table>

**BIO 101. TOPICS IN GENERAL BIOLOGY**
This topical approach to the foundational concepts of biology examines theories and issues in biology as they relate to varying special topics selected by the instructor. To satisfy the General Studies laboratory science requirement, BIO 101 should be taken concurrently. No credit to students with prior credit for BIO 111. No credit toward biology major or minor. Offered fall and spring.

**BIO 102. GENERAL BIOLOGY LABORATORY**
This two-hour laboratory provides experiences to complement selected foundational concepts from BIO 101. To satisfy the General Studies laboratory science requirement, BIO 101 and 102 should be taken concurrently. No credit to students with prior credit for BIO 113. No credit toward biology major or minor. Offered fall and spring.

**BIO 103. REINVENTING LIFE**
Can humans responsibly direct evolution? Reinventing Life explores how human activities are rapidly changing life and what this means for the future. Basic concepts are linked with the cutting-edge science of environmental manipulations, stem cells, genetic engineering, synthetic biology and bioethics. Laboratory included. No credit toward biology major or minor. Satisfies General Studies laboratory science requirement. Offered fall and spring.

**BIO 105. CURRENT ISSUES IN BIOLOGY**
Designed for nonscience majors, this course focuses on reading, interpreting and evaluating facts behind biological issues and exploring the implications for science and human society. Students conduct library research, present oral reports, discuss and write papers on these issues. No credit toward biology major or minor. Satisfies General Studies nonlaboratory science requirement. Offered winter.

**BIO 111. INTRODUCTORY CELL BIOLOGY**
In this introduction to organization and function at the cellular level, topics of study include basic cell chemistry and structure, transport, energetics and reproduction. Required for biology majors/minors. Corequisite: BIO 113. Offered fall and spring.

**BIO 112. INTRODUCTORY POPULATION BIOLOGY**
Topics of study in this introduction to organization and function at the population level include reproduction and transmission genetics, patterns and mechanics of evolutionary change and basic concepts of ecology. Required for biology majors/minors. Corequisite: BIO 114. Offered fall and spring.

**BIO 113. CELL BIOLOGY LABORATORY**
Students have three hours of laboratory experience per week with topics complementing concurrent study in BIO 111. Required for biology majors/minors. Corequisite: BIO 111. Offered fall and spring.

**BIO 114. POPULATION BIOLOGY LABORATORY**
Students have three hours of laboratory experience per week with topics complementing concurrent study in BIO 112. Required for biology majors/minors. Corequisite: BIO 112. Offered fall and spring.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>BIO 161</td>
<td>HUMAN ANATOMY</td>
<td>4 sh</td>
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<td>This course builds a basic foundation in regional human anatomy. Lectures emphasize macroscopic and some microscopic studies of the human body. Special emphasis will be placed on musculoskeletal and neuromuscular anatomy. Laboratory involves progressive anatomical dissections of human cadavers, use of human anatomy instructional software and examination of osteological models. Three class hours, one laboratory per week. No credit toward biology major/minor. Offered fall and spring.</td>
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<tr>
<td>BIO 162</td>
<td>HUMAN PHYSIOLOGY</td>
<td>4 sh</td>
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<td>This study of human physiology emphasizes skeletal, muscular, nervous, endocrine, heart, blood, respiratory, digestive and urinary aspects. Three class hours, one laboratory per week. No credit toward biology major or minor. Offered fall and spring.</td>
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<tr>
<td>BIO 181</td>
<td>BIOLOGY LABORATORY TECHNIQUES</td>
<td>2 sh</td>
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<td>Skills taught in this training course for prospective laboratory assistants include laboratory procedures, materials preparation and grading procedures. Offered spring.</td>
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<tr>
<td>BIO 215</td>
<td>DIVERSITY OF LIFE</td>
<td>4 sh</td>
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<td>This course examines the basic concepts of biological form and function, based on evolutionary relationships and diversity. Students investigate the natural history of local species and their role in community dynamics. Laboratory experiences emphasize field investigations, including sampling techniques, species identification and data analysis. Satisfies the General Studies lab science requirement. This course can be used for the major in Environmental Studies and the Elementary Education concentration in Society and Environment, as well as a minor in Biology. No credit toward the Biology major. Prerequisites: ENS 111/113 or BIO 112/114. (BIO 215 is cross-listed with ENS 215). Offered spring.</td>
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<tr>
<td>BIO 231</td>
<td>BIODIVERSITY</td>
<td>4 sh</td>
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<td>This course is an integrated lab/lecture which will teach students lab and field techniques to measure and understand the diversity of the living world. Concepts include the measurement of biodiversity, the evolutionary relationships among organisms and the construction of phylogenies. Three two-hour lab/lectures per week. Required for biology majors. Prerequisites: BIO 111, 112, 113, 114. Corequisite: BIO 261. Offered fall and spring.</td>
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<tr>
<td>BIO 245</td>
<td>PRINCIPLES OF GENETICS</td>
<td>4 sh</td>
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<td>Students learn basic concepts and laboratory techniques used in classic and modern genetics. Topics covered include transmission, molecular and population genetic principles and their implications in the modern world. Three class hours, one laboratory per week. Required for biology majors. Prerequisites: BIO 111, 112, 113, 114. Offered fall and spring.</td>
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<tr>
<td>BIO 261</td>
<td>INTRODUCTORY SEMINAR</td>
<td>2 sh</td>
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<td>Students learn to use primary information sources and gain practice in manual and computer information retrieval, read and interpret research and review papers, write abstracts and present scientific information orally. Corequisite: BIO 231. Offered fall and spring.</td>
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<tr>
<td>BIO 271</td>
<td>SPECIAL TOPICS SEMINAR</td>
<td>2-4 sh</td>
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<td>Study focuses on one biological topic per seminar in this nonlaboratory discussion course for biology majors. Topics are determined by student and faculty interest. Must have instructor’s consent. Offered winter.</td>
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<tr>
<td>BIO 316</td>
<td>DEVELOPMENTAL BIOLOGY</td>
<td>4 sh</td>
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<td>This course examines the changes that occur at the cellular and subcellular level as a single-cell zygote develops into a multi-cellular organism. Topics include fertilization, blastula formation, gastrulation and organogenesis. Three class hours, one laboratory per week. Prerequisites: BIO 231; CHM 111, 112, 113, 114 or CHM 115/116. Offered spring of even-numbered years.</td>
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<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
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<tr>
<td>BIO 318.</td>
<td>COMPARATIVE VERTEBRATE STRUCTURE AND FUNCTION</td>
<td>4 sh</td>
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<td>This course is an evolutionary approach to the form and function of vertebrates. Students will investigate a diversity of traits and follow the evolutionary changes of these traits from the earliest vertebrates to mammals. The primary focus is on the move from aquatic to terrestrial habitats, the evolution of flight and the evolution of endothermy. Students will compare changes in form and function of the major organ systems through laboratory dissection of the jawless fish, shark, amphibian and mammal. Prerequisites: BIO 112, 114, 231. Offered fall of even-numbered years.</td>
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<td>BIO 321.</td>
<td>MICROBIOLOGY</td>
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<td>In a general survey of microorganisms, study emphasizes bacteria, their cytophysiological characteristics and classification, viruses, microbial diseases and immunity, and the role of microorganisms in human affairs. Three class hours, one laboratory per week. Prerequisites: BIO 111, 113; CHM 111, 112, 113, 114 or CHM 115/116. Junior standing or consent of instructor. Offered spring.</td>
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<tr>
<td>BIO 325.</td>
<td>HUMAN HISTOLOGY</td>
<td>4 sh</td>
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<td>Students survey human body tissues (especially of the cardiovascular, alimentary, respiratory, urinary and reproductive systems), stressing tissue identification and the relationship of microanatomy to physiology of the human body. Three class hours, one laboratory per week. Prerequisite: BIO 231. Offered fall of odd-numbered years.</td>
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<tr>
<td>BIO 331.</td>
<td>THE BIOLOGY OF ANIMAL BEHAVIOR</td>
<td>4 sh</td>
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<td></td>
<td>This course examines why animals behave the way they do. Specific topics include the causation, development, function and evolution of behavior in wild and captive animals. Three class hours and one laboratory per week. Prerequisites: BIO 112, 114 and 231 or consent of instructor.</td>
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<tr>
<td>BIO 332.</td>
<td>ZOOLOGY</td>
<td>4 sh</td>
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<td>Students survey the animal kingdom (emphasizing selected vertebrates and invertebrates) investigating basic concepts of morphology, anatomy, physiology and taxonomy as they affect the ecology of the animal. Three class hours, one laboratory per week. Prerequisite: BIO 231.</td>
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<tr>
<td>BIO 335.</td>
<td>FIELD BIOLOGY</td>
<td>4 sh</td>
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<td>In this field-oriented course, restricted to selected natural taxa, environments or biological phenomena, in-depth field study may include identification, classification, life histories and relationships among organisms. Prerequisite: consent of instructor. Offered winter and/or summer.</td>
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<tr>
<td>BIO 341.</td>
<td>BOTANY</td>
<td>4 sh</td>
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<td></td>
<td>This survey of the plant kingdom (emphasizing vascular plants) includes general morphology, anatomy, physiology of metabolism and growth, economic importance and identification. Three class hours, one laboratory per week. Prerequisite: BIO 231. Offered fall.</td>
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<tr>
<td>BIO 342.</td>
<td>AQUATIC BIOLOGY: THE STUDY OF INLAND WATERS</td>
<td>4 sh</td>
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<td></td>
<td>Aquatic Biology considers the chemical, physical and biological properties of freshwater ecosystems including streams, rivers, ponds and lakes. Topics include the geomorphology of inland waters, thermal stratification, nutrient cycles, community metabolism, plankton community dynamics, seasonal succession and eutrophication resulting from human activities. Weekly laboratory meetings provide hands-on experience with the field techniques of freshwater scientists. Prerequisites for biology major: BIO 231; CHM 111, 112, 113, 114 or CHM 115/116. Prerequisites for environmental studies major: BIO 112, 114, 215; CHM 111,112, 113, 114 or CHM 115/116. Junior standing or consent of instructor. Offered spring of even-numbered years.</td>
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</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
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<tr>
<td>BIO 343.</td>
<td><strong>CLINICAL ANATOMY</strong></td>
<td>4 sh</td>
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<tr>
<td>BIO 344.</td>
<td><strong>EVOLUTION</strong></td>
<td>4 sh</td>
</tr>
<tr>
<td>BIO 348.</td>
<td><strong>BIOTECHNOLOGY</strong></td>
<td>4 sh</td>
</tr>
<tr>
<td>BIO 350.</td>
<td><strong>GENERAL ECOLOGY</strong></td>
<td>4 sh</td>
</tr>
<tr>
<td>BIO 351.</td>
<td><strong>BIOCHEMISTRY</strong></td>
<td>3 sh</td>
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<tr>
<td>BIO 352.</td>
<td><strong>BIOCHEMISTRY LABORATORY</strong></td>
<td>1 sh</td>
</tr>
<tr>
<td>BIO 353.</td>
<td><strong>ADVANCED BIOCHEMISTRY</strong></td>
<td>3 sh</td>
</tr>
<tr>
<td>BIO 354.</td>
<td><strong>ADVANCED BIOCHEMISTRY LABORATORY</strong></td>
<td>1 sh</td>
</tr>
</tbody>
</table>
Corequisite: BIO 354. (BIO 354 is cross-listed with CHM 354.) Offered spring of even years.

**BIO 371. SPECIAL TOPICS SEMINAR**  
2-4 sh  
Each seminar — a nonlaboratory discussion course for biology majors — focuses on one biological topic determined by faculty interest. Offered winter.

**BIO 422. MOLECULAR AND CELLULAR BIOLOGY**  
4 sh  
This course is a study of the structure and function of prokaryotic and eukaryotic cells at the molecular level. It examines in depth specific biochemical pathways and processes essential to life. Topics include considerable coverage of the principles, techniques and applications of molecular biology. Four class hours. Prerequisites: BIO 245; CHM 211, 212, 213, 214. Offered spring of even-numbered years.

**BIO 442. PLANT PHYSIOLOGY**  
4 sh  
Topics in this study of the life processes of plants include photosynthesis, mineral nutrients, movement of materials, plant growth substances and senescence. Three class hours, one laboratory per week. Prerequisites: BIO 231; CHM 211, 212, 213, 214 or permission. Offered spring of odd-numbered years.

**BIO 445. ADVANCED GENETICS**  
4 sh  
Advanced problem solving in prokaryotic and eukaryotic genetics. The focus is on the applications of advanced concepts in transmission, molecular and population genetics to problem solving in the modern world. Three class hours, one laboratory per week. Prerequisites: BIO 245; CHM 211, 212, 213, 214. Offered fall of even-numbered years.

**BIO 462. SENIOR SEMINAR**  
2 sh  
This course provides students with the opportunity to conduct both individual and group literature research projects of their own choosing based on recently published scientific papers. Students participate in group discussions of the current literature, research and write a scientific review paper, and develop a formal oral presentation. Recommended for senior year. Offered fall.

**BIO 471. SPECIAL TOPICS SEMINAR**  
2-4 sh  
Each seminar — a non-laboratory discussion course for biology majors — focuses on one biological topic determined by student and faculty interest. Must have instructor’s consent.

**BIO 481. INTERNSHIP IN BIOLOGY**  
1-4 sh  
Advanced-level work experience in a biological field is offered on an individual basis when suitable opportunities can be arranged. Prerequisite: permission of department.

**BIO 499. RESEARCH**  
1-4 sh  
Students conduct laboratory and/or field research under the direction of the biology faculty. Maximum eight semester hours total credit. Prerequisite: permission of the biology faculty.

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**Business Administration**

Martha and Spencer Love School of Business mission statement: To provide instruction and experiences for our students so they graduate with the knowledge, skills and character essential for responsible business leadership in the 21st century.

*Chair, Department of Business Administration: Associate Professor Stevens  
Professors: Burbridge, Gowan, Honeycutt, Noer, O’Mara, Valle  
Associate Professors: Burpitt, Garber, Hodge, Manring, Nienhaus, Powell, Strempke, Yap  
Assistant Professors: Buechler, Gunby  
Lecturers: Rich, Riney  
Senior Lecturer and Executive Director of the Doherty Center for Entrepreneurial Leadership: Palin*
The study of Business Administration at Elon University begins with a solid grounding in the traditional liberal arts and sciences. This preparation is an integral part of becoming an informed, responsible and capable business leader. An Elon education emphasizes the development of the whole person — mind, body and spirit. Business Administration courses at Elon University advance that commitment by emphasizing business knowledge acquisition, skill development through hands-on learning and experiential activities and the development of discipline, integrity and an ethic of service.

Students majoring in Business Administration at Elon University take courses in a common core representing the functional business disciplines (e.g., accounting, finance, management, marketing, etc.). They also have the opportunity to develop specialized knowledge in one of five areas of concentration: Entrepreneurship, Finance, International Business, Management, and Marketing.

Our coursework emphasizes active learning and appreciative inquiry. Rather than dictate a set of principles to be memorized, our programs emphasize the integration of business knowledge and the application of that knowledge to organizational problems. We emphasize hands-on learning through internships, co-op experiences, service learning and classroom instruction which engages students in the study and practice of business. Students also develop skills in written and oral communications, team-building and problem solving, and decision-making in our increasingly global business environment.

The Bachelor of Science in Business Administration (BSBA) program at Elon University emphasizes academic challenge, mature intellectual development and a lifetime of learning. Our graduates go on to leadership positions in business and industry in for-profit and not-for-profit organizations. Our graduates are prepared for a variety of assignments because they possess an extensive array of knowledge, skills and abilities.

A major in Business Administration requires the following:

At least 50% of the business credit hours required for the degree (B.S. in Business Administration) must be earned at Elon University.

Select one course from:

- MTH 116 Applied Calculus
- MTH 121 Calculus and Analytic Geometry I
- ECO 111 Principles of Economics
- ECO 203 Statistics for Decision-Making
- ECO 301 Business Economics
- ACC 201 Principles of Financial Accounting
- ACC 212 Principles of Managerial Accounting
- CIS 211 Management Information Systems
- BUS 202 Business Communications
- BUS 221 Legal Environment of Business
- BUS 311 Principles of Marketing
- BUS 323 Principles of Management and Organizational Behavior
- BUS 326 Operations Management
- BUS 465 Business Policy
FIN 343 Principles of Finance  
Select one course from:  
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>LSB 382</td>
<td>Professional Work Experience (0 credit)</td>
<td>0-4 sh</td>
</tr>
<tr>
<td>LSB 381</td>
<td>Internship in Business (1-4 sh)</td>
<td></td>
</tr>
<tr>
<td>BUS 481</td>
<td>Internship in Business Administration (1-4 sh)</td>
<td></td>
</tr>
</tbody>
</table>

Sixteen to twenty semester hours of a concentration 16-20 sh

**TOTAL 70-78 sh**

**Concentrations**

**Finance 16 sh**

One course from the following:

One 300/400 level course from the Studies in Arts and Sciences course offerings (Expression, Civilization, Society or Science). The 300/400 level Studies in Arts and Sciences course selected must be taken in addition to the upper-level GST and Advanced Study courses already required, and it may not also count for any other course in the student’s program of study. Advisors may assist students in selection of an appropriate course which should enhance the subject matter of the student’s concentration.

The following courses are required:

- FIN 413 Advanced Managerial Finance
- FIN 421 Investment Principles
- FIN 419 Financial Services or Seminar: Special Topics
- FIN 471 Seminar: Special Topics

**Marketing 16 sh**

One course from the following:

One 300/400 level course from the Studies in Arts and Sciences course offerings (Expression, Civilization, Society or Science). The 300/400 level Studies in Arts and Sciences course selected must be taken in addition to the upper-level GST and Advanced Study courses already required, and it may not also count for any other course in the student’s program of study. Advisors may assist students in selection of an appropriate course which should enhance the subject matter of the student’s concentration.

The following course is required:

- BUS 414 Marketing Research

Two courses from the following:

- BUS 413 Integrated Marketing Communications
- BUS 415 Consumer Behavior
- BUS 416 Global Marketing
- BUS 417 Business-to-Business Marketing
- BUS 419 Sales Management
- BUS 473 Special Topics in Marketing

**Management 16 sh**

One course from the following:

One 300/400 level course from the Studies in Arts and Sciences course offerings (Expression, Civilization, Society or Science). The 300/400 level Studies in Arts...
and Sciences course selected must be taken in addition to the upper-level GST and Advanced Study courses already required, and it may not also count for any other course in the student’s program of study. Advisors may assist students in selection of an appropriate course which should enhance the subject matter of the student’s concentration.

Three courses from the following:

- BUS 424 Responsible Leadership
- BUS 425 Human Resource Management
- BUS 427 Organizational Improvement
- BUS 428 Advanced Organizational Behavior
- BUS 429 Entrepreneurship/Intrapreneurship
- BUS 430 International Business Management
- BUS 471 Seminar: Special Topics in Management

**Entrepreneurship**  
16 sh

One course from the following:

One 300/400 level course from the Studies in Arts and Sciences course offerings (Expression, Civilization, Society or Science). The 300/400 level Studies in Arts and Sciences course selected must be taken in addition to the upper-level GST and Advanced Study courses already required, and it may not also count for any other course in the student’s program of study. Advisors may assist students in selection of an appropriate course which should enhance the subject matter of the student’s concentration.

The following three courses are to be taken in sequence as indicated:

- BUS 341 EEA1 – New Business Concepts and Market Justifications  
  To be taken first term junior year.
- BUS 342 EEA2 – Writing and Defending the Business Plan  
  To be taken second term junior year.
- BUS 441 EEA3 - New Enterprise Start-Up and Operations  
  To be taken first term senior year.

**International Business**  
16 sh

The following two classes are required:

- BUS 416 Global Marketing
- BUS 430 International Business

Two 300/400 level courses should be selected from outside Business Administration. At least one of these must be from the Studies in Arts and Sciences course offerings (Expression, Civilization, Society, or Science). These courses must be taken in addition to the upper level GST and Advanced Study courses already required, and may not also count for any other courses in the student’s program of study. Advisors may assist students in the selection of appropriate courses which should enhance the subject matter of the IB Concentration. Courses selected are subject to approval by the IB coordinator.

Intermediate proficiency in a modern foreign language is a concurrent requirement of the concentration. Proficiency can be demonstrated either by achieving an intermediate-mid level rating on an Oral Proficiency Interview (OPI) or a Simulated Oral Proficiency Interview (SOPI), by passing a modern foreign language course at the 221 level, or by placement in the language at or above the 222 level.
A minor in Business Administration requires the following courses:

Select one course from: 4 sh
- BUS 304 Introduction to Marketing
- BUS 311 Principles of Marketing (prerequisite BUS 202)

Select one course from: 4 sh
- BUS 303 Introduction to Managing
- BUS 323 Principles of Management and Organizational Behavior (prerequisite BUS 202)
- ACC 201 Principles of Financial Accounting 4 sh
- FIN 303 Introduction to Finance 4 sh
- ECO 111 Principles of Economics 4 sh

TOTAL 20 sh

BUS 202. BUSINESS COMMUNICATIONS 4 sh
In addition to studying the theory and principles of good oral and written communications, students practice making oral presentations and writing business reports, letters and memoranda. Prerequisites: ENG 110 and sophomore standing. Offered fall and spring.

BUS 221. LEGAL ENVIRONMENT OF BUSINESS 2 sh
A number of laws influence business decisions and activities. Matters relating to competitive conduct, consumer protection, accounting and financial reporting, public communications and the natural environment are regulated by widely known federal agencies. Most states also have counterpart commissions that set additional standards and rules for business regulation. U.S. businesses enjoy a remarkably free legal environment compared to many other developed markets, and certainly more free than centrally controlled economic systems. This course explores these aspects of the U.S. business scene, with comparisons across states and other nations where appropriate. Its focus is on the legal environment, not on the legal processes, torts or case law. Its appropriate audience is the business student who needs a broad, general understanding of how we govern ourselves in the marketplace. Offered fall and spring.

BUS 303. INTRODUCTION TO MANAGING 4 sh
For non majors and business administration minors, this introductory course examines universal business processes such as goal-setting, planning, decision-making, motivation, human resource management and control which are utilized by both not-for-profit and government organizations. Sophomore standing required. Credit not given in the major for BUS 303 and BUS 323. Offered fall, winter and spring.

BUS 304. INTRODUCTION TO MARKETING 4 sh
For non majors and business administration minors, this introductory course examines marketing principles which are applied by all organizations. Sophomore standing required. Credit not given in the major for BUS 304 and BUS 311. Offered fall, winter and spring.

BUS 311. PRINCIPLES OF MARKETING 4 sh
This study of the marketing and distribution of goods and services includes buyer behavior, the marketing functions, commodity and industrial markets, merchandising considerations, price policies and governmental regulation of competition. Prerequisites: ECO 111 and BUS 202. Sophomore standing required. Credit not given in the major for BUS 304 and BUS 311. Offered fall and spring.

BUS 323. PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOR 4 sh
This course will prepare the student for the challenges of management and leadership in the dynamic new workplace of the 21st century. The course examines the central role of management in the efficient and effective production of goods and services. Students will learn how strategic and operational planning, job and organizational structure design and
human behavior affect operations in manufacturing and service industries. Organizational behavior topics include leadership and ethics, motivation and rewards, communication and teams, and teamwork. The global dimensions of management are also emphasized. Prerequisite: BUS 202. Sophomore standing required. Credit not given in the major for BUS 303 and BUS 323. Offered fall and spring.

**BUS 326. OPERATIONS MANAGEMENT**

As a primary business function, operations plays a vital role in achieving a company’s strategic plans. Since the operations function produces the goods and services, it typically involves the greatest portion of the company’s people and capital assets. Customer service, product/service delivery, product/service quality and overall organizational effectiveness depend on excellence in operations. This course covers manufacturing and service process design, planning and control. Operations strategy, demand forecasting, supply chain management, facility location and design, e-commerce, capacity planning, inventory systems, scheduling and quality control are topics included in the course. Prerequisites: ECO 203, CIS 211, BUS 323 or 303. Sophomore standing required. Offered fall and spring.

**BUS 341. EEA 1 – NEW BUSINESS CONCEPTS AND MARKET JUSTIFICATION**

In the first course of the three-course entrepreneurship concentration (Elon Enterprise Academy) sequence, students identify business ideas, develop them into detailed business concepts and models, undertake research to determine the feasibility of their concepts and structure a preliminary marketing plan. At the conclusion of this course, student groups will present their ideas for evaluation. The best ideas will move on to full business plan development in BUS 342 (Writing and Defending the Business Plan). Prerequisite or corequisite: BUS 311. To be taken first term of junior year.

**BUS 342. EEA 2 – WRITING AND DEFENDING THE BUSINESS PLAN**

In the second course of the three-course entrepreneurship concentration (Elon Enterprise Academy) sequence, students expand their business concepts developed in BUS 341 into full business plans including complete marketing plans, operations plans, schedules and financial projections. A Venture Capital Board of business professionals will critique and judge the plans. Successful student teams will receive funding to operate their ventures the following term in BUS 441 (New Enterprise Start-up and Operations). Prerequisite or corequisite: BUS 323; Prerequisite: BUS 341; or by permission. To be taken second term junior year.

**BUS 365. BUSINESS ADMINISTRATION APPLICATIONS**

Topics vary yearly in the study of applications of business administration principles and theories in various business situations. Sophomore standing required.

**BUS 366. FIELD EXPERIENCE IN BUSINESS**

This course revolves around visits to diverse local businesses and analyses of the businesses visited. Prerequisite: permission of instructor. Sophomore standing required.

**BUS 413. INTEGRATED MARKETING COMMUNICATIONS**

This course focuses on the management of the communication aspects of marketing strategy. Elements of advertising, personal selling, sales promotion, direct marketing and public relations are included. The study of marketing communications includes a review of concepts from economics, behavioral sciences and social sciences, which play a role in creating, executing and evaluating promotional programs. Topics include setting communications objectives and budgets, media planning and creative strategy, all in the context of an integrated communication program. Emphasis will be placed on appreciating the scope, strengths and weaknesses of these marketing communication tools, and particularly on how they can and should be used together. Prerequisite: BUS 311. Offered spring.

**BUS 414. MARKETING RESEARCH**

Students apply various research methods used in business to gather and analyze marketing data. Possible effects and implications of the analyses are discussed in terms of the market-
BUS 415. CONSUMER BEHAVIOR

This course for the marketing concentration focuses on the application of the behavioral sciences to understand consumer behavior. Emphasis is placed on developing an appreciation for the scope of the topic, understanding the essentials underlying consumer behavior and developing an ability to relate such understanding to important issues faced by marketing practitioners. Traditional research-oriented topics include perception, memory, affect, learning, persuasion, motivation, behavioral decision-theory and environmental (e.g., social and cultural) influences. All topic presentations will include a discussion of practitioner-oriented managerial implications. Prerequisite: BUS 311. Offered spring.

BUS 416. GLOBAL MARKETING

This course for the marketing concentration is designed to explore the scope of global marketing. The course examines the impact the global environment has upon marketing decisions and strategy formulations. Through analyses of different types of markets, students will develop an understanding and appreciation of how the world is “shrinking” and the influence this has on U.S. businesses, individuals, households and institutions. Students will monitor the global environment and report their findings on specific regions of the world to the class. The intent is to make students more aware of the global environment and its impact on U.S. businesses. Prerequisite: BUS 311. Offered fall.

BUS 417. BUSINESS-TO-BUSINESS MARKETING

This course for the marketing concentration focuses on exploring and understanding business-to-business (B2B) marketing. The study of business-to-business marketing provides an opportunity for students to synthesize their knowledge of B2B or industrial marketing with other, highly-related business disciplines (accounting, finance and management) in order to move products through the supply chain from producer to the ultimate consumer. Business-to-business relationships, interfaces, strategies, problems and performance are explored through the case method. Prerequisite: BUS 311. Offered spring.

BUS 419. SALES MANAGEMENT

The sales management course is an analysis of professional selling practices with emphasis on the selling process and sales management, including the development of territories, determining potentials and forecasts and setting sales quotas. Prerequisite: BUS 311. Offered spring.

BUS 424. RESPONSIBLE LEADERSHIP

This course addresses the characteristics, behaviors and responsibilities required of contemporary organizational leaders. While focusing on the traditional topics (individual differences and traits of leaders, behaviors of leaders, role of power, types and styles of leadership and theories of motivation), the student will also be introduced to some nontraditional approaches (nontraditional metaphors, leadership as an art and individual differences of followers and followership) to understanding leaders and leadership. The responsibilities of leadership will be specifically addressed in relationship to the concepts of organizational success and effectiveness, social responsibility and ethical decision-making. Prerequisite: BUS 323. Offered fall and spring.

BUS 425. HUMAN RESOURCE MANAGEMENT

Effective human resource management is critical to the long-term value of an organization and ultimately to its success and survival. All aspects of human resource management — including how organizations interact with the environment; acquire, develop and compensate human resources; design and measure work — can help organizations meet their competitive challenges and create value. This course looks at the role of strategic human resource planning, recruitment and selection, performance management, developing and compensating human resources, the legal environment and employee relations, collective
bargaining and labor relations, using technology to increase HRM effectiveness and global issues in HRM. Prerequisite: BUS 323. Offered fall.

**BUS 427. ORGANIZATIONAL IMPROVEMENT**  
4 sh  
This course will introduce the students to material which will cover basic productivity improvement techniques, application of these techniques in his/her work place, teaching coworkers these techniques, leading work teams in problem-solving activities and managing an organizational productivity improvement program. Prerequisite: BUS 323. Offered spring.

**BUS 428. ADVANCED ORGANIZATIONAL BEHAVIOR**  
4 sh  
This course addresses the impact of individual, group and organizational influences in human behavior within organizations. Building on the organizational behavior topics introduced in BUS 323, the focus of this course is on acquiring in-depth knowledge and developing interpersonal skills through the study and application of theories and concepts related to understanding and predicting human behavior in organizations. Personality, perception, job design and goal-setting, appraisal, group dynamics, decision-making, cooperation and conflict, organizational structure and culture, power and organizational politics, organizational learning, innovation and change management, and organizational development are topics included in the course. Prerequisite: BUS 323. Offered fall and spring.

**BUS 429. ENTREPRENEURSHIP/INTRAPRENEURSHIP**  
4 sh  
This course addresses how to go into business and several of the unique problems and circumstances encountered in establishing and operating a small business. Emphasis is also placed on the role of entrepreneurship in large firms through the study of "intrapreneurship." Special emphasis focuses on why small businesses fail and what entrepreneurs can do to minimize the influence of these forces. Family-owned business management is included as one type of small business covered. Prerequisite: BUS 323.

**BUS 430. INTERNATIONAL BUSINESS MANAGEMENT**  
4 sh  
This course covers business management from the perspective of the current global business environment. Students examine the overall nature of international business, the foreign environments that international businesses face and the unique situations associated with doing business across international borders. Prerequisite: BUS 323. Offered fall and spring.

**BUS 441 EEA 3 – NEW ENTERPRISE START-UP AND OPERATIONS**  
4 sh  
In the third course of the three-course entrepreneurship concentration (Elon Enterprise Academy) sequence, student ventures that succeed in receiving funding from the Venture Capital Board in BUS 342 (Writing and Defending the Business Plan) will implement those plans and begin operations. Periodic business reviews will be held to assess progress against projections, identify issues and identify necessary adjustments. Success will be partially determined based on venture performance and demonstrated ability to apply core business concepts. Prerequisite or corequisite: BUS 326; Prerequisite: BUS 342; or by permission. To be taken first term senior year.

**BUS 465. BUSINESS POLICY**  
4 sh  
This capstone course integrates students’ experiences and previous study through case studies and simulated business decision exercises. Prerequisites: BUS 202, 311, 323; BUS 326 for Business Administration majors or ACC 336 for Accounting majors; ECO 301 (Business Administration majors only); FIN 343; and senior status. Offered fall and spring.

**BUS 471. SEMINAR: SPECIAL TOPICS IN MANAGEMENT**  
4 sh  
This advanced study consists of readings and discussion of special topics and involves participation by students, faculty and other resource persons.
BUS 472.  SEMINAR: SPECIAL TOPICS IN INTERNATIONAL BUSINESS  4 sh
This advanced study consists of readings and discussion of special topics and involves participation by students, faculty and other resource persons.

BUS 473.  SEMINAR: SPECIAL TOPICS IN MARKETING  4 sh
This advanced study consists of readings and discussion of special topics and involves participation by students, faculty and other resource persons.

BUS 481.  INTERNSHIP IN BUSINESS ADMINISTRATION  1-4 sh
An internship experience offers the student valuable experience in business and management. Appropriate placement must be arranged by the student with the help and support of business administration faculty and other appropriate resources.

BUS 491.  INDEPENDENT STUDY  1-4 sh

BUS 499.  UNDERGRADUATE RESEARCH IN BUSINESS ADMINISTRATION  1-4 sh
Students may engage in an undergraduate research study in collaboration with a faculty sponsor.

Love School of Business Courses

LSB 350.  PERSONAL MASTERY I  1 sh
The purpose of this course is to further prepare business students for the exciting and challenging world of business. The course will introduce students to some perspectives and themes that are not the primary focus of other courses in the Love School of Business. The course has two primary objectives: 1) internal development, focusing on integrity, ethics, and professional development 2) ability to demonstrate those qualities. Prerequisite: Junior standing in Business Fellows Program. Offered fall.

LSB 351.  PERSONAL MASTERY II  1 sh
The purpose of this course is to further prepare business students for the exciting and challenging world of business. Building on the skills developed in LSB 350, this course will focus on further developing job-search skills, including company research, networking skills, interviewing skills, and the development of a personal portfolio. The primary output for Personal Mastery II is a professional portfolio for students to showcase their academic, extracurricular and internship experiences. Creation of the portfolio will not only enable students to have an impressive visual to present to future employer; the process of creating the portfolio will better prepare them for the interview. Prerequisite: Junior standing in the Business Fellows program. Offered spring.

LSB 381.  INTERNSHIP IN BUSINESS  1-4 sh
This course is designed to provide majors in accounting and in business administration with hands-on experience. Students will work in off campus positions to confirm or clarify career goals, test what they have learned in their classes, gain a clearer sense of what they still need to learn and build their professional network. This program will be managed and monitored by the LSB internship coordinator. Students systematically evaluate themselves and the organization in which they work over the course of the term to determine: “If offered a career employment opportunity with this organization at the end of the term, would I accept? Why or why not?” The “why or why not” will focus on the potential fit between a student’s individual strengths/interests and the organization’s environment and culture.

LSB 382.  PROFESSIONAL WORK EXPERIENCE  0 credits
The objective of the PWE is to provide students the opportunity to learn more about organizational life and about themselves and their responsibilities to an organization, while requiring academic or reflective work. This work requires a minimum of 40 hours of on-the-job work. Students arrange their own work experience, and the program will be managed and monitored by the LSB internship coordinator. This requirement will
be graded as either Satisfactory (S) or Unsatisfactory (U). Offered fall, winter, spring, summer. Special fee: $331.00 if taken during the summer or more than 4 hours during winter term. If the course is taken by a student enrolled in less than 12 semester hours or 18 or more semester hours during fall and spring semesters, the fee is $331.00.

Chemistry

Chair, Department of Chemistry: Associate Professor Wright
Professors: Danieley, Gooch, Grimley
Associate Professors: Karty, Matera, Sienerth
Assistant Professor: Ponton
Adjuncts: Bernhardt, Bowling, Chandler, Schwartz
Science Lab Manager: Weller

The Department of Chemistry offers courses of study leading to either a Bachelor of Science degree (61-65 semester hours), Bachelor of Arts degree (44-48 semester hours) or a minor in Chemistry (20-24 semester hours). Students satisfying the requirements of the Bachelor of Science degree will be certified by the American Chemical Society.

Students who major in chemistry are qualified for many pursuits. They may choose to work in the chemical industry, continue advanced studies in chemistry, take professional training in medicine, dentistry or other health-related fields, prepare to teach at the secondary level or pursue opportunities in related fields (environmental science, forensics, business and industry).

Elon’s chemistry program provides the opportunity for students to engage with faculty in undergraduate research and to gain direct experience with new instrumentation using today’s state-of-the-art technology. The results of the research projects are presented at local, regional and national scientific meetings.

Another key feature of the program is the introduction and use of instrumentation in the first-year general chemistry sequence and its continued emphasis throughout the chemistry curriculum. Student participation in assisting in laboratory and recitation instruction is strongly advised and supported.

A Bachelor of Science (ACS certified) degree in Chemistry requires the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHM 111</td>
<td>General Chemistry I</td>
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<tr>
<td>CHM 113</td>
<td>General Chemistry I Lab</td>
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<tr>
<td>CHM 112</td>
<td>General Chemistry II</td>
<td>3 sh</td>
</tr>
<tr>
<td>CHM 114</td>
<td>General Chemistry II Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>CHM 115</td>
<td>Advanced General Chemistry (3 sh)</td>
<td></td>
</tr>
<tr>
<td>CHM 116</td>
<td>Advanced General Chemistry Lab (1 sh)</td>
<td></td>
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<tr>
<td>CHM 205</td>
<td>Inorganic Chemistry</td>
<td>4 sh</td>
</tr>
<tr>
<td>CHM 211</td>
<td>Organic Chemistry I</td>
<td>3 sh</td>
</tr>
<tr>
<td>CHM 213</td>
<td>Organic Chemistry I Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>CHM 212</td>
<td>Organic Chemistry II</td>
<td>3 sh</td>
</tr>
<tr>
<td>CHM 214</td>
<td>Organic Chemistry II Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>CHM 125</td>
<td>Chemical Literature</td>
<td>1 sh</td>
</tr>
<tr>
<td>CHM 311</td>
<td>Quantitative Analysis</td>
<td>4 sh</td>
</tr>
<tr>
<td>CHM 321</td>
<td>Instrumental Analysis</td>
<td>4 sh</td>
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</table>
### A Bachelor of Arts degree in Chemistry

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHM 111</td>
<td>General Chemistry I</td>
<td>3 sh</td>
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<tr>
<td>CHM 113</td>
<td>General Chemistry I Lab</td>
<td>1 sh</td>
</tr>
<tr>
<td>CHM 112</td>
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<tr>
<td>CHM 114</td>
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</tr>
<tr>
<td>CHM 115</td>
<td>Advanced General Chemistry (3 sh)</td>
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<tr>
<td>CHM 116</td>
<td>Advanced General Chemistry Lab (1 sh)</td>
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<tr>
<td>CHM 205</td>
<td>Inorganic Chemistry</td>
<td>4 sh</td>
</tr>
<tr>
<td>CHM 211</td>
<td>Organic Chemistry I</td>
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<tr>
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<td>Quantitative Analysis</td>
<td>4 sh</td>
</tr>
<tr>
<td>CHM 332</td>
<td>Physical Chemistry I</td>
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<tr>
<td>CHM 461</td>
<td>Seminar</td>
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<tr>
<td>MTH 121</td>
<td>Calculus &amp; Analytic Geometry I</td>
<td>4 sh</td>
</tr>
<tr>
<td>PHY 111</td>
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</tr>
<tr>
<td>PHY 112</td>
<td>General Physics II</td>
<td>4 sh</td>
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</table>

Six semester hours from chemistry (at least 4 sh at the 300-400 level) 6 sh

**TOTAL** 44-48 sh

### A minor in Chemistry

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<tr>
<td>CHM 115</td>
<td>Advanced General Chemistry (3 sh)</td>
<td></td>
</tr>
<tr>
<td>CHM 116</td>
<td>Advanced General Chemistry II Lab</td>
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</tbody>
</table>

(Physics 113 and 114 may be substituted for Physics 111 and 112.)

**TOTAL** 61-65 sh
CHM 211 Organic Chemistry I 3 sh
CHM 213 Organic Chemistry I Lab 1 sh
CHM 212 Organic Chemistry II 3 sh
CHM 214 Organic Chemistry II Lab 1 sh
Eight additional hours selected from: 8 sh
CHM 205 Inorganic Chemistry (4 sh)
CHM 305 Environmental Chemistry (4 sh)
CHM 311 Quantitative Analysis (4 sh)
CHM 321 Instrumental Analysis (4 sh)
CHM 351 Biochemistry (3 sh) and
CHM 352 Biochemistry Lab (1 sh)
CHM 353 Advanced Biochemistry (3 sh) and
CHM 354 Advanced Biochemistry Lab (1 sh)
CHM 471-79 Special Topics in Chemistry (2-4 sh)

TOTAL 20-24 sh

A Bachelor of Arts Degree in Chemistry/Chemical Engineering: See requirements listed in Engineering.

CHM 101. BASIC CONCEPTS IN CHEMISTRY 3 sh
The course is designed to meet the math/science general studies requirement for nonscience majors. The material covered includes atomic structure, chemical changes, descriptive chemistry of selected elements, introduction to organic chemistry and how chemistry applies to consumer products and the environment. No credit given to students with prior credit for CHM 111. No credit for major/minor. Corequisite: CHM 102. Offered fall and spring.

CHM 102. BASIC CONCEPTS IN CHEMISTRY LABORATORY 1 sh
Laboratory exercises are based upon selected foundational concepts covered in CHM 101. No credit for students with prior credit for CHM 113. No credit for major/minor. Corequisite: CHM 101. Offered fall and spring.

CHM 111. GENERAL CHEMISTRY I 3 sh
This course introduces fundamental principles of chemistry with special emphasis on developing skills in quantitative reasoning. Topics include stoichiometry, nomenclature, gases, atomic structure and periodicity, theories of chemical binding and thermochemistry. Prerequisite: High school chemistry. Corequisites: MTH 111 or higher and CHM 113. Offered fall and spring.

CHM 112. GENERAL CHEMISTRY II 3 sh
The study of fundamental chemical principles continues with chemical kinetics, liquid/solid states, chemical equilibrium (gas phase and acid/base), thermodynamics and electrochemistry. Prerequisite: CHM 111 and CHM 113. Corequisite: CHM 114. Offered spring.

CHM 113. GENERAL CHEMISTRY I LABORATORY 1 sh
The experiments offered familiarize students with basic laboratory techniques and complement topics discussed in CHM 111. Corequisite: CHM 111. Offered fall and spring.

CHM 114. GENERAL CHEMISTRY II LABORATORY 1 sh
This course involves laboratory applications of concepts and principles discussed in CHM 112. Prerequisites: CHM 111, 113. Corequisite: CHM 112. Offered spring.

CHM 115. ADVANCED GENERAL CHEMISTRY 3 sh
This course explores fundamental principles of chemistry with an emphasis on understanding chemical concepts and quantitative reasoning. It consists of a brief review
of stoichiometry, nomenclature, gases, thermochemistry, atomic structure and periodicity and more extensive coverage of chemical kinetics, electrochemistry, equilibrium systems, liquid/solid states and nuclear chemistry. This course is available for students who scored 4 or 5 on the AP chemistry exam and for students with exemplary scores on the Toledo exam. Prerequisites: High school chemistry. Corequisite: CHM 116. Offered fall.

CHM 116. ADVANCED GENERAL CHEMISTRY LAB 1 sh
This course involves laboratory applications of concepts and principles discussed in CHM 115 including mass spectrometry, atomic spectroscopy, molecular modeling, stoichiometry, thermochemistry, chemical kinetics, electrochemistry, equilibrium systems and liquid and solid states. Corequisite: CHM 115. Offered fall (for CHM 115 only).

CHM 125. CHEMICAL LITERATURE 1 sh
This writing-intensive course is centered around an in-depth study of the different ways in which new discoveries in chemistry are communicated to members of the profession. Topics include primary and secondary sources: journals, monographs, patents, communications and reviews as well as foremost references such as Chemical Abstracts, The Ring Index and Science Citation Index. Both classical and online search methods will be integrated into the required writing assignments. Prerequisite: CHM 211 or permission of instructor. Offered spring.

CHM 205. INORGANIC CHEMISTRY 4 sh
This course will be an introduction to the field of inorganic chemistry with emphasis on nuclear chemistry, an introduction of symmetry and applications of group theory to vibrational spectroscopy, classical coordination chemistry, solid state chemistry, the periodic relationships of the elements and chemical bonding, the origin of the elements and the chemistry of hydrogen and oxygen. It will also serve as an introduction to the use of physical methods of structure determination of inorganic compounds by magnetic and spectral techniques including magnetic susceptibility, UV/VIS and IR spectroscopies and mass spectrometry. Three hours lecture, three laboratory hours per week. Prerequisites: CHM 112/114 or 115/116. Offered spring.

CHM 211. ORGANIC CHEMISTRY I 3 sh
Organic Chemistry introduces students to the chemistry of carbon compounds, including nomenclature, the influence of structure on physical/chemical properties, reaction mechanisms, stereochemistry, conformational analysis, synthesis and characteristic reactions of different organic compounds. Prerequisites: CHM 112/114 or 115/116. Corequisite: CHM 213. Offered fall.

CHM 212. ORGANIC CHEMISTRY II 3 sh
Continuing the study of organic chemistry, this course emphasizes compounds containing oxygen or nitrogen and culminates with a survey of lipids, carbohydrates and proteins. Prerequisites: CHM 211/213. Corequisite: CHM 214. Offered spring.

CHM 213. ORGANIC CHEMISTRY I LABORATORY 1 sh
Laboratory work includes determination of physical properties, separation of mixtures, some structure identification and synthesis of selected organic compounds. Prerequisites: CHM 112/114 or 115/116. Corequisite: CHM 211. Offered fall.

CHM 214. ORGANIC CHEMISTRY II LABORATORY 1 sh
Procedures include microscale synthetic methods, molecular modeling via IBM-PC and qualitative organic analysis. Prerequisites: CHM 211, 213. Corequisite: CHM 212. Offered spring.

CHM 305. ENVIRONMENTAL CHEMISTRY 4 sh
Environmental Chemistry provides a survey of chemical topics applying to selected pollutants in the air, water and soil. Such topics include production and diffusion, photochemical processes, techniques for analysis, acid-base and redox chemistry, environmental and biological effects. Laboratory work includes acid/base and buffer chemistry, analysis of
heavy metal pollutants sampling techniques and resistance of selected materials to certain pollutants. No credit toward B.S. degree. Prerequisites: CHM 211/213. Offered spring of alternate years.

CHM 311. QUANTITATIVE ANALYSIS 4 sh
This course introduces chemical methods of quantitative analysis, including classical, volumetric and selected instrumental methods, a discussion of error and uncertainty in measurements, and elementary statistics. Discussion also covers the underlying physical and chemical theories and laws with emphasis on chemical equilibrium. Prerequisites: CHM 111-114 or CHM 115-116. Offered fall.

CHM 321. INSTRUMENTAL ANALYSIS 4 sh
Instrumental Analysis offers theory and practice of instrumental methods, with emphasis placed on spectroscopic (UV/VIS, IR, NMR, AA) and mass spectrometric methods of analysis. Prerequisites: CHM 311, and CHM 211-214. Offered spring.

CHM 332. PHYSICAL CHEMISTRY I 4 sh
The mathematical development of the physical principles in chemistry is explored. Topics include development and application of the laws of thermodynamics, equations of states, kinetic molecular theory, elementary electrochemistry and equilibria. Laboratory experiments are designed to complement lectures and include studies of phase relationships, calorimetry and gas laws. Three hours lecture and three hours lab per week. Prerequisites: CHM 111-114 or CHM 115/116; MTH 121; PHY 112 or 114. Offered fall.

CHM 334. PHYSICAL CHEMISTRY II 4 sh
The principles of quantum mechanics are developed and illustrated by use of simple systems. Spectroscopic techniques are investigated as tools for probing structure and properties of molecules. Other topics include kinetics and group theory. Laboratory experiments are designed to complement lectures and include multiple techniques to investigate reaction kinetics, laser spectroscopy, UV-VIS spectroscopy and computational techniques. Three hours lecture, three laboratory hours per week. Prerequisites: CHM 332, MTH 221, PHY 114. Offered spring.

CHM 351. BIOCHEMISTRY 3 sh
This is a survey of biochemistry as it relates to the physiology of organisms. Topics include biochemical methodology, buffers, proteins (structure, function and synthesis), enzymes, bioenergetics, anabolism and catabolism of carbohydrates and lipids and metabolic regulation. Prerequisites: CHM 211-214. (CHM 351 is cross-listed with BIO 351.) Offered fall.

CHM 352. BIOCHEMISTRY LABORATORY 1 sh
This laboratory investigates the rates of enzyme-catalyzed reactions, including the effect of enzyme inhibitors; the isolation/purification/analysis of proteins, lipids and carbohydrates; and some analytical techniques used in clinical chemistry laboratories. Techniques employed include affinity chromatography, electrophoresis, gas chromatography, UV-visible spectrometry and polarimetry. Prerequisites: CHM 211-214. Corequisite: CHM 351. (CHM 352 is cross-listed with BIO 352.) Offered fall.

CHM 353. ADVANCED BIOCHEMISTRY 3 sh
Topics chosen to complement CHM 351 include a detailed study of primary and intermediary metabolism: syntheses and degradation of lipids, amino acids and nucleotides; metabolic coordination; signal transduction; molecular motors; and the role of cytochrome c. The use of selected case studies from medical schools will be integrated into the study of metabolism. The course will also include a student-led discussion of selected articles from the primary literature in biochemistry. Prerequisites: CHM 351-2. (CHM 353 is cross-listed with BIO 353.) Offered fall.

CHM 354. ADVANCED BIOCHEMISTRY LABORATORY 1 sh
This laboratory investigates the analysis of selected proteins and other biomolecules by NMR as well as the methods used in CHM 352. Experiments involving the study of
dynamic processes inside living cells (metabolism) will be included. Prerequisites: CHM 351-2. Corequisite: CHM 354. (CHM 354 is cross-listed with BIO 354.) Offered spring.

**CHM 431. ADVANCED INORGANIC CHEMISTRY**

This course will begin with an accelerated review of the history of inorganic chemistry, atomic structure and simple bond theory. It will then provide an in-depth introduction into symmetry and group theory with applications to the description of chemical bonding in molecular orbital theory. Acid-Base and Donor-Acceptor Chemistry and the descriptive chemistry of the main group elements will be followed by an in-depth survey of organometallic chemistry. The continued application of physical methods of structure determination of inorganic compounds by magnetic and spectral techniques including magnetic susceptibility, UV/VIS and IR spectroscopies and NMR spectrometry will be presented throughout the course. Prerequisites: CHM 205, 211-214 and CHM 334. Offered fall.

**CHM 432. PHYSICAL ORGANIC CHEMISTRY**

The study and applications of Hückel molecular orbital theory toward the understanding of the mechanisms of selected chemical reactions. The focus will be on empirical methods to derive mechanisms including linear free energy relationships and reaction kinetics. Techniques to be covered include photoelectron spectroscopy (PES) and computational chemistry (CC). Prerequisite: CHM 334. Offered spring.

**CHM 461. SEMINAR**

Students make presentations after they do individual library research. Student seminars are supplemented with seminars by practicing scientists. All chemistry-oriented students are encouraged to attend. Credit for junior and senior majors only or by permission of the instructor. Completion of this course satisfies the oral competency requirement for the B.S. and B.A. major in Chemistry. Course is two semesters in length with 0.5 sh each semester. Students must take both semesters. Offered fall and spring.

**CHM 471-479. SPECIAL TOPICS IN CHEMISTRY**

Advanced topics offered to meet the needs and interests of students include methods in forensic and medicinal chemistry, nuclear chemistry, nuclear magnetic resonance spectrometry, advanced organic or polymer chemistry. Prerequisites: CHM 212/214.

**CHM 481. INTERNSHIP**

Students gain advanced-level work experience in a chemical field. Internships are offered on an individual basis when suitable opportunities can be arranged. Prerequisite: permission of department.

**CHM 491. INDEPENDENT STUDIES**

**CHM 499. RESEARCH**

In collaboration with a chemistry faculty member, students undertake experimental or theoretical investigations. Prerequisite: Approval of department chair. Offered fall, winter, spring.

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**Classical Studies**

*Coordinator: Professor Gill*

Classical Studies is an interdisciplinary program of studies in the languages, history, culture and heritage of the ancient and early modern world. This program gives students an opportunity for concentrated study of “Classical” ideas and practices, which form an important part of Western civilization. In addition, the program examines the ways that these ideas and practices have influenced, and been modified by, later generations. A minor in Classical Studies can serve as a valuable complement to many fields, providing depth and context for a student’s other courses, encouraging analytical study of primary sources and allowing the pleasure of reading some of Western civilization’s greatest works.