# Biological Sciences (BA) (17BIOBA)

## Freshman Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Credit</th>
<th>Spring Semester</th>
<th>Credit</th>
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</thead>
<tbody>
<tr>
<td>BIO 181 Intro Bio: Ecol, Evol, Biodiv</td>
<td>4</td>
<td>BIO 183 Intro Bio: Cell &amp; Molecular</td>
<td>4</td>
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<tr>
<td>CH 101 Chemistry-A Molecular Sci.</td>
<td>3</td>
<td>Organic Chemistry and Lab</td>
<td>4</td>
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<tr>
<td>CH 102 General Chemistry Lab</td>
<td>1</td>
<td>ENG 101</td>
<td>4</td>
</tr>
<tr>
<td>LSC 101 Critical &amp; Creative Life Sci</td>
<td>2</td>
<td>GEP Elective*</td>
<td>3</td>
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<tr>
<td>Calculus</td>
<td>3</td>
<td>GEP Health and Exercise Studies*</td>
<td>1</td>
</tr>
<tr>
<td>LSC 103 Exploring Life Sci Disciplines</td>
<td>1</td>
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## Sophomore Year

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<tr>
<th>Fall Semester</th>
<th>Credit</th>
<th>Spring Semester</th>
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<tbody>
<tr>
<td>Statistics</td>
<td>3</td>
<td>Life Science Elective</td>
<td>3</td>
</tr>
<tr>
<td>Advanced Communication Requirement</td>
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<td>Life Science Elective</td>
<td>4</td>
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<tr>
<td>Life Science</td>
<td>3</td>
<td>Cross Discipline Elective ( Advised)</td>
<td>3</td>
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<tr>
<td>GEP Elective*</td>
<td>3</td>
<td>GEP Elective*</td>
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<td>Free Elective</td>
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<td>Free Elective</td>
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## Junior Year

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<th>Fall Semester</th>
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<tbody>
<tr>
<td>PY 131 Conceptual Physics</td>
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<td>Life Science Elective</td>
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<tr>
<td>Experiential Learning Requirement</td>
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<td>Life Science Elective</td>
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<tr>
<td>Cross Discipline Elective ( Advised)</td>
<td>3</td>
<td>Cross Discipline Elective ( Advised)</td>
<td>3</td>
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<tr>
<td>GEP Elective*</td>
<td>3</td>
<td>Advanced Communication Requirement</td>
<td>3</td>
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<tr>
<td>Free Elective</td>
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<td>GEP Elective*</td>
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## Senior Year

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<tr>
<td>Life Science Elective</td>
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<td>Life Science Elective</td>
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<tr>
<td>Life Science Elective</td>
<td>3</td>
<td>Cross Discipline Elective ( Advised)</td>
<td>3</td>
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<tr>
<td>Cross Discipline Elective ( Advised)</td>
<td>3</td>
<td>Free Elective</td>
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<td>Fall Semester</td>
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<tr>
<td>Cross Discipline Elective (Advised) (^8)</td>
<td>3</td>
<td>Cross Discipline Elective (Advised) (^8)</td>
<td>3</td>
</tr>
<tr>
<td>GEP Elective*</td>
<td>3</td>
<td>GEP Health and Exercise Studies*</td>
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<td>BIO 481 Senior Capstone Project</td>
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Minimum Credit Hours Required for Graduation: 121

**Footnotes**
A grade of C- or better is required in the following courses:

- LSC 101 Critical and Creative Thinking in the Life Sciences
- LSC 103 Exploring Life Science Disciplines
- BIO 181 Introductory Biology: Ecology, Evolution, and Biodiversity
- BIO 183 Introductory Biology: Cell and Molecular Biology
- CH 101 Chemistry – A Molecular Science
- CH 102 General Chemistry Lab
- ENG 101 Academic Writing & Research
- Calculus \(^3\)

**IMPORTANT NOTES:**

- Students should check with their adviser before electing to take any course with S/U grading if it is normally graded A-F. Up to 12 hours of Free Electives can be taken S/U.
- Students cannot use the same course both as a Cross Discipline Elective and to meet a GEP requirement (with the exception of Global Knowledge and US Diversity).
- Students are responsible for determining the pre-requisites for any course they are interested in taking.
- Students interested in graduate school or professional school should check the courses required for admission to the programs to which they plan to apply.
- The B.A. in Biological Sciences cannot be used as a second major for many students already in a degree program in the life sciences – students interested in a second major should first check with the coordinator of their desired second major.

1 *Calculus alternatives (take one course)*

Students interested in taking more than one semester of calculus should start with either MA 131 or MA 141, because MA 121 does not serve as a pre-requisite for either MA 231 or MA 241. Additional semesters of calculus can be used toward Life Science Electives requirements.

- MA 121 Elements of Calculus
- MA 131 Calculus for Life and Management Sciences A (first of two-semester series)
- MA 141 Calculus I (first of three-semester series)

2 *Organic chemistry alternatives (take one)*

CH 220 is a single semester organic chemistry course, with lab included. CH 221 is the first of a
two semester sequence (with CH 223) in organic chemistry, with CH 222 serving as the lab. Students earning a B.A. in Biological Sciences can take either CH 220 or CH 221 plus CH 222 to meet their organic chemistry requirement. Students who wish to take two semesters of organic chemistry should NOT start with CH 220, but should take CH 221/222 and CH 223/224.

3 LSC 103 Exploring Life Science Disciplines
LSC 103 deals with transition-to-college issues while exploring degree program options within the life sciences. If a student transfers into the B.A. in Biological Sciences after taking a similar course in another program, that course can be substituted for LSC 103 on the degree audit, an action initiated by the academic advisor.

4 ENG 101 and the General Education Program (GEP) All NC State students take 26 credit hours as part of the General Education Program (GEP). This includes ENG 101, which can be taken either the first or second semester of the first year, and LS 101, which meets 2 credit hours of the Interdisciplinary Perspectives GEP requirement. For their GEP Elective(s) in the first year, students are encouraged to explore the GEP course lists (http://oucc.ncsu.edu/gep-courses) for Interdisciplinary Perspectives, Humanities, or Social Sciences and choose a course in which they are interested.

5 Statistics alternatives (take one course)
ST 305
ST 311
ST/BUS 350

6 Advanced Communication Requirement (take one course from each list, minimum 6 cr hrs)

Communication courses
COM 110 Public Speaking
COM 112 Interpersonal Communication
COM 201 Introduction to Persuasion Theory
COM 202 Small Group Communication
COM 203 Theory and Practice of Acting
COM 211 Argumentation and Advocacy
COM 213 Oral Interpretation of Literature
COM 226 Introduction to Public Relations
COM 240 Communication Inquiry

Advanced Writing courses
ENG 201 Writing Literary Analysis
ENG 214 Introduction to Editing
ENG 232 Literature and Medicine
ENG 287 Explorations in Creative Writing
ENG 288 Fiction Writing
ENG 289 Poetry Writing
ENG 292 Writing About Film
ENG 316 Principles of News and Article Writing
ENG 323 Writing in the Rhetorical Tradition
ENG 331 Communication for Engineering and Technology (Junior standing required)
ENG 332 Communication for Business and Management (Junior standing required)
ENG 333 Communication for Science and Research (Junior standing required)
ENG 381 Creative Nonfiction Writing Workshop
ENG 422 Writing Theory and the Writing Process

7 Life Science Electives (take a total of 25 credit hours) A total of 25 credit hours must be taken from the courses listed below. At least 19 of these hours must be at the 300 level or higher. With adviser approval, students can use a total of up to 3 hours of learning experience (e.g., BIO 492, 493) or honors research experience toward Life Science Electives or toward Cross Discipline Electives (Advised) – whichever category the experience appropriately fits. Some experimental courses (295, 495, and 592) and graduate (500-) level courses may also be used as Life Science Electives, with adviser and departmental approval. Students should check the prerequisites and restrictions on courses in which they are interested.

Microbiology and Biochemistry courses
BCH 220 Role of Biotechnology in Society
BCH 351 or BCH 451 Biochemistry
BCH 452 Introductory Biochemistry Lab
BCH 453 Biochemistry of Gene Expression
BCH 454 Advanced Biochemistry Laboratory
BCH 455 Proteins and Molecular Mechanisms
BIT/MB 210 Phage Hunters
BIT/MB 211 Phage Genomics
BSC 478 Research Fundamentals in Biological Sciences
CH 223 Organic Chemistry II
CH 224 Organic Chemistry II Lab
MB 200 Microbiology and World Affairs
MB 320 Fundamentals of Microbial Cell Culture
MB 351 General Microbiology
MB 352 General Microbiology Laboratory
MB 354 Inquiry-Guided Microbiology Lab
MB 360 Scientific Inquiry in Microbiology: At the Bench
MB 405 Food Microbiology
MB 406 Food Microbiology Lab
MB 411 Medical Microbiology
MB 412 Medical Microbiology Laboratory
MB 414 Microbial Metabolic Regulation
MB 420 Fundamentals of Microbial Cell Biotransformations
MB 435 Bacterial Pathogenesis
MB 451 Microbial Diversity
MB 452 Microbial Diversity Lab
MB 455 Microbial Biotechnology
MB 461 Molecular Virology
MB 470 Emerging and Re-emerging Infectious Diseases
SSC 332 Environmental Soil Microbiology

**Molecular, Genetic, Cellular, and Developmental Biology courses**
BIO 240 Principles of Human Anatomy & Physiology (A)
BIO 245 Principles of Human Anatomy & Physiology (B)
BIO 267 Research in the Life Sciences I: Research Skills
BIO 269 Research in the Life Sciences II: Guided Research
BIO 361 Developmental Biology
BIO 370 Developmental Anatomy of the Vertebrates
BIO 375 Developmental Anatomy Lab
BIO 405 Functional Histology
BIO/PB 414 Cell Biology
BIO 432 Evolutionary Medicine
BIO 434 Hormones and Behavior
BIO 440 The Human Animal: An Evolutionary Perspective
BIT 200 Early Research in Biotechnology
BIT/MB 210 Phage Hunters
BIT/MB 211 Phage Genomics
BIT 410 Manipulation of Recombinant DNA
BIT 462 Gene Expression Analysis: Microarrays
BIT 464 Protein Purification
BIT 465 Real-time PCR Techniques
BIT 466 Animal Cell Culture Techniques
BIT 467 PCR and DNA Fingerprinting
BIT 468 Genome Mapping
BIT 471 RNA Interference and Model Organisms
BIT 473 Experimental Analysis of Protein-Protein Interactions
BIT 474 Plant Genetic Engineering
BIT 476 Applied Bioinformatics
BIT 481 Plant Tissue Culture and Transformation
GN 301 Genetics in Human Affairs -or- ANS 215 Basic Agricultural Genetics
GN 311 Principles of Genetics
GN 312 Elementary Genetics Lab
GN 421 Molecular Genetics
GN 423 Population, Quantitative, and Evolutionary Genetics
GN 425 Advanced Genetics Laboratory
GN 427 Introductory Bioinformatics
GN 434 Genes and Development
GN 441 Human and Biomedical Genetics
GN 451 Genome Science
GN 456 Epigenetics, Development, and Disease
GN 461 Advanced Bioinformatics
MB 461 Molecular Virology
PB 476 Applied Bioinformatics
PB 480 Introduction to Plant Biotechnology
PB 481 Plant Tissue Culture and Transformation

**Physiology, Neurobiology, and Behavioral Biology courses**
ANT 251 Physical Anthropology
ANT 371 Human Variation
AEC 441 Biology of Fishes
AEC 442 Biology of Fishes Lab
ANS 205 Physiology of Domestic Animals
ANS 206 Anatomy of Domestic Animals Lab
ANS 220 Reproduction and Lactation in Domestic Animals
ANS 221 Reproduction and Lactation in Domestic Animals Lab
ANS 225 Principles of Animal Nutrition or ANS 230 Nutrition of Domestic Animals
ANS 231 Nutrition of Domestic Animals Lab
ANS 330 Laboratory Animal Science
ANS/PO/NTR 415 Comparative Nutrition
BIO 212 (Basic Human Anat & Phys) -or- 250 (Animal Anatomy & Physiology)
BIO 233 Human-Animal Interactions (IP)
ENT 201 (Insects and People) -or- 207 (Insects and Human Disease; IP)
BIO 410 Animal Behavior
BIO 421 Advanced Human Anatomy and Physiology
BIO 422 Biological Clocks
BIO 424 Endocrinology
BIO 434 Hormones and Behavior
BIO 426 Advanced Human Anatomy and Physiology Lab
BIO 444 The Biology of Love and Sex
BIO 456 Epigenetics, Development, and Disease
BIO 478 Research Fundamentals in Biological Sciences
BIO 488 Neurobiology
ENT 305 Introduction to Forensic Entomology
FW 444 Mammalogy
MB 441 Immunology
NTR 301 Introduction to Human Nutrition
NTR 401 Advanced Nutrition and Metabolism
NTR 410 Maternal and Infant Nutrition
NTR 419 Human Nutrition and Chronic Disease
NTR 421 Life Cycle Nutrition
NTR 454 Lactation, Milk and Nutrition
PB 215 Medicinal Plants
PB 321 Introduction to Whole Plant Physiology
PB 421 Plant Physiology
PO 405 Avian Physiology
PY 212 College Physics II
TOX 201 Poisons, People and the Environment
Ecology, Evolution, Biodiversity, and Conservation Biology courses
AEC 380 Water Resources (IP)
AEC 400 Applied Ecology
AEC 419 Limnology
AEC 420 Introduction to Fisheries Science
AEC 423 Introduction to Fisheries Sciences Laboratory
AEC/BIO 460 Field Ecology and Methods
BIO 315 Parasitology
BIO 317 Primate Ecology and Evolution
AEC/BIO/PB 330 Evolutionary Biology
BIO 333 Captive Animal Biology
BIO 350 Animal Phylogeny and Diversity
BIO 353 Wildlife Management
BIO/PB 360 Ecology
BIO 402 Invertebrate Biology
BIO 425 General Entomology
COM 436 Environmental Communication
CS 230 Introduction to Agroecology
CS 430 Advanced Agroecology
ENT 212 Basic Entomology
ENT 305 Introduction to Forensic Entomology
ENT 402 Forest Entomology
ENT 425 General Entomology
ES 200 Climate Change and Sustainability
ES 300 Energy and Environment
ES 400 Analysis of Environmental Issues
FOR 260 Forest Ecology
FOR 261 Forest Communities
FW 444 Mammology
FW 465 African Ecology and Conservation
MA 331 Differential Equations for the Life Sciences
MA 331 Differential Equations for the Life Sciences
MA 432 Mathematical Models in Life and Social Sciences
MEA 200 Introduction to Oceanography
MEA 210 Oceanography Lab
MEA 220 Marine Biology
MEA 250 Introduction to Coastal Environments
MEA 251 Introduction to Coastal Environments Laboratory
MEA 300 Environmental Geology
MEA/CH 323 Earth System Chemistry
MEA 369 Terrestrial Paleontology
MEA 384 Paleoeocology
MEA/BIO 449 Principles of Biological Oceanography
NR 303 Humans and the Environment
NR 406 Conservation of Biological Diversity
PB 200 (Plant Life) -or- 250 (Plant Biology)
Students in the B.A. in Biological Sciences will identify a second discipline of interest in which to also focus their studies. These 21 credit hours will be planned by the student in consultation with their advisor and must be approved by the advisor and by the program. This second disciplinary focal area can be selected from a wide range of fields outside of the life sciences (below). At least 15 of these hours must be at the 300 level or higher and the rest must be at the 200 level or higher. With adviser approval, students can use a total of up to 3 hours of learning experience (e.g., BIO 492, 493) or honors research experience toward Life Science Electives or toward Cross Discipline Electives – whichever category the experience appropriately fits. Some experimental courses (295, 495, and 592) and graduate (500-) level courses may also be used as Cross Discipline Electives, with adviser and program approval. Students should check the prerequisites and restrictions on courses in which they are interested. For example, most ELM courses are restricted to Elementary Education majors and therefore would be appropriate only to those with a second major in Elementary Education. Courses used to meet Cross Discipline Electives requirements cannot also be used to meet GEP requirements (with the exception of Global Knowledge and US Diversity).

8 Cross Discipline Electives — Advised (take 21 credit hours)

ADN >199 (Art and Design)
AES >199 (Agricultural and Environmental Systems)
AFS >199 (Africana Studies)
ANS >199 (Animal Science)
ANT >199 (Anthropology)
ARC >199 (Architecture)
ARE >199 (Agricultural and Resource Economics)
ARS >199 (Arts Studies)
BAE >199 (Biological & Agricultural Engineering)
BBS >199 (Bioprocessing)
BEC >199 (Biomanufacturing Training & Education Center)
BIT >199 (Biotechnology)
BMA >199 (Biomathematics)
BME >199 (Biomedical Engineering)
BUS >199 (Business Management)
CE >199 (Civil Engineering)
CH >199 (Chemistry)
CHE >199 (Chemical Engineering)
CL >199 (Comparative Literature)
COM >199 (Communication)
CS >199 (Crop Science)
CSC >199 (Computer Science)
DS >199 (Design Studies)
EAC >199 (Adult and Higher Education)
EC >199 (Economics)
ECD >199 (Counselor Education)
ECE >199 (Electrical & Computer Engineering)
ECI >199 (Curriculum, Instruction and Counselor Education)
ED >199 (Education)
EDP >199 (Educational Psychology)
EI >199 (Entrepreneurship Initiative)
ELM >199 (Elementary Education)
ELP >199 (Educational Leadership and Policy Studies)
EMS >199 (Mathematics, Science and Technology Education)
ENG >199 (English)
ENT >199 (Entomology)
ET >199 (Environmental Technology)
FL* >199 (Foreign Languages and Literatures)
FM >199 (Feed Mill)
FOR >199 (Forestry)
FS >199 (Food Science)
FTD >199 (Fashion and Textile Design)
FW >199 (Fisheries and Wildlife Science)
GC >199 (Graphic Communications)
GD >199 (Graphic Design)
GEO >199 (Geography)
GPH >199 (Global Public Health)
GTI >199 (Global Training Initiative)
HA >199 (History of Art)
HI >199 (History)
HS >199 (Horticulture Science)
ID >199 (Industrial Design)
IDS >199 (Interdisciplinary Studies)
IS >199 (International Studies)
LAR >199 (Landscape Architecture)
LOG >199 (Logic)
LPS >199 (Leadership in the Public Sector)
MA >199 (Mathematics)
MAE >199 (Mechanical & Aerospace Engineering)
MEA >199 (Marine, Earth, and Atmospheric Sciences)
MIE >199 (Management, Innovation and Entrepreneurship)
MSE >199 (Materials Science & Engineering)
MT >199 (Medical Textiles)
MUS >199 (Music)
NE >199 (Nuclear Engineering)
NPS >199 (Nonprofit Studies)
PA >199 (Public Administration)
PCC >199 (Polymer and Color Chemistry)
PHI >199 (Philosophy)
PO >199 (Poultry Science)
PP >199 (Plant Pathology)
PRT >199 (Parks, Recreation and Tourism Management)
PS >199 (Political Science)
PSE >199 (Paper Science Engineering)
PSY >199 (Psychology)
PY >199 (Physics)
REL >199 (Religion)
SMT >199 (Sustainable Materials Technology)
SOC >199 (Sociology)
SSC >199 (Soil Science)
ST >199 (Statistics)
STS >199 (Science, Technology, and Society)
SW >199 (Social Work)
TC >199 (Textile Chemistry)
TDE >199 (Tech Engr & Des Educ)
TE >199 (Textile Engineering)
TED >199 (Technology Education)
THE >199 (Theatre)
TMS >199 (Textile Materials Science)
TOX >199 (Toxicology)
TT >199 (Textile Technology)
WGS >199 (Women’s and Gender Studies)
WPS >199 (Wood and Paper Science)

9 Free Electives (take 12 credit hours)
These electives cannot be remedial nor can they be taken at an elementary level after you have taken comparable coursework at a more advanced level.

10 Physics Alternatives
PY 211 is a suitable substitute for PY 131.

11 Experiential Learning Requirement
Experiential Learning opportunities can take many forms, but should be relevant to a possible career path for the student. The out-of-class experience to be undertaken to meet this requirement must be approved in advance by the adviser and program director. It is the responsibility of the student to identify an opportunity, to make arrangements with a supervisor to pursue that opportunity, and to complete the contract necessary for credit to be awarded for the experience.

*General Education Program (GEP) requirements and GEP Footnotes:
To complete the requirements for graduation and the General Education Program, the following
category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html.

**Introduction to Writing: ENG 101** (4 credit hours with a C- or better) *Students must complete ENG 101 during their freshman year.*

**Mathematical Sciences** (6 credit hours – one course with MA or ST prefix) *In this degree program, this GEP requirement is met through the Major course requirements.* **Natural Sciences** (7 credit hours – include one laboratory course or course with a lab) *In this degree program, this GEP requirement is met through the Major course requirements.*

**Humanities** (6 credit hours selected from two different disciplines/course prefixes) *Choose from the University approved GEP Humanities course list. Some courses on this list will also meet the U.S. Diversity or Global Knowledge co-requisites.*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes) *Choose from the University approved GEP Social Sciences course list. Some courses on this list will also meet the U.S. Diversity or Global Knowledge co-requisites.*

**Physical Education/Healthy Living** (2 credit hours – at least one 100-level Fitness and Wellness Course)

*Choose from the University approved GEP Physical Education/Healthy Living course list.*

**Additional Breadth** – (3 credit hours) *Choose from the University approved GEP Humanities course list or the GEP Social Sciences course list or the GEP Visual & Performing Arts course list. Some courses on this list will also meet the U.S. Diversity or Global Knowledge co-requisites.*

**Interdisciplinary Perspectives** (5 credit hours) *In this degree program, 2 credit hours are met through a Major course requirement. For the remaining 3 credit hours, choose from the University approved GEP Interdisciplinary Perspectives course list. Some courses on this list will also meet the U.S. Diversity or Global Knowledge co-requisites.*

The following **Co-Requisites** must be satisfied to complete GEP requirements:

**U.S. Diversity** (USD) *Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

**Global Knowledge** (GK) *Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

**Foreign Language proficiency** – Proficiency at the FL_102 level is required for graduation.