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JUL 10 2012 UNC CHARLOTTE

Proposal Number: ESCI 5-3-12b

Proposal Title: Revised B.S. in Earth Sciences Degree

College of Liberal Arts and Sciences

Originating Department: Geography and Earth Sciences

TYPE OF PROPOSAL: UNDERGRADUATE X GRADUATE _____ UNDERGRADUATE & GRADUATE _____
 (Separate proposals sent to UCCC and Grad. Council)

DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
01/19/2012	2/14/2012	07/02/2012	Approved	<u>DEPARTMENT CHAIR</u> [Craig Allan]
			Approved	<u>COLLEGE CURRICULUM COMMITTEE CHAIR</u> [print name here]
		2/27/13	Approved	<u>COLLEGE FACULTY CHAIR (if applicable)</u> [print name here]
			Approved	<u>COLLEGE DEAN</u> [print name here]
			Approved	<u>GENERAL EDUCATION</u> (for General Education courses) [print name here]
			Approved	<u>UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR</u> (for undergraduate courses)
			Approved	<u>GRADUATE COUNCIL CHAIR</u> (for graduate courses)
			Approved	<u>FACULTY GOVERNANCE ASSISTANT</u> (Faculty Council approval on Consent Calendar)
				<u>FACULTY EXECUTIVE COMMITTEE</u> (if decision is appealed)

University of North Carolina at Charlotte ESCI 2-14-11

Revised Undergraduate Course and Curriculum Proposal

Course and Curriculum Proposal from the Department of Geography and Earth Sciences.

Revised BS in Earth Sciences Degree

1. Summary The Department of Geography and Earth Sciences proposes to significantly modify the structure of its BS Earth Sciences Degree and to add four new courses to the modified degree GEOG 3220, Regional Energy Markets and Renewable Energy, GEOL 3105 The Earth's Mineral Resources: Sustainability and the Environmental Impacts of Recovery, ESCI 3101 Global Environmental Change and ESCI 4000 Water Resources.

BACHELOR OF SCIENCE IN EARTH SCIENCES

A major in Earth Sciences leading to a B.S. degree consists of a minimum of 64 hours of required and elective coursework. The General Degree consists of 22 hours of required Earth Science (ESCI), Geography (GEOG) and Geology (GEOL) courses, 24 hours of elective courses and 18 hours of required extra departmental coursework. The Atmospheric Sciences Concentration consists of a minimum of 39 hours of required Earth Science (ESCI), Geography (GEOG), Meteorology (METR) and Geology (GEOL) courses, 8 hours of elective courses and 17 hours of required extra departmental coursework. The Environmental Sciences Concentration consists of a minimum of 38 hours of required Earth Science (ESCI), Geography (GEOG) and Geology (GEOL) courses, 3 hours of elective courses and 23 hours of required extra departmental coursework. The Hydrologic Sciences Concentration consists of a minimum of 43 hours of required Earth Science (ESCI), Geography (GEOG), Meteorology (METR) and Geology (GEOL) courses, 4 hours of elective courses and 17 hours of required extra departmental courses.

Required Departmental Courses All Options (22 hours)

- ESCI 1101 Earth Science-Geography (3)
- ESCI 1101L Earth Science-Geography Lab (1)
- GEOL 1200 Physical Geology (3)
- GEOL 1200L Physical Geology Lab (1)
- ESCI 2010 Environmental Dilemma (3)
- ESCI 2210 Field Methods (3)
- ESCI 3101 Global Environmental Change (3)
- GEOG 4120 Fundamentals of GIS (4)
- ESCI 4600 Earth Sciences Seminar (1)

Additional Out of Department Required Courses General Degree (18 hours)

- CHEM 1251 Principles of Chemistry (3)
- CHEM 1251L Principles of Chemistry Lab (1)

- PHYS 1101 Introductory Physics I (3)
- PHYS 1101L Introductory Physics I Lab (1)
- MATH 1241 Calculus I (3)
- MATH 1242 Calculus II (3) or
- STAT 112X Elements of Statistics I (3)
- CHEM 1252 Principles of Chemistry (3) and
- CHEM 1252L Principles of Chemistry Lab (1) or
- PHYS 1102 Introductory Physics II (3) and
- PHYS 1102L Introductory Physics II Lab (1)

Elective Courses General Degree Option (24 hours)

Twenty four hours from Earth Sciences electives list below or other required courses from the Atmospheric, Environmental or Hydrological Sciences Concentrations of this Degree.

Atmospheric Sciences Concentration

Additional Required Departmental Courses (17 hours)

- METR 3140 Introduction to Meteorology and Climatology (3)
- METR 3210 Atmospheric Thermodynamics (3)
- METR 3220 Physical Meteorology (3)
- METR 3245 Synoptic Meteorology (4)
- ESCI 4170 Fundamentals of Remote Sensing (4)

Required Out of Departmental Courses (18 hours)

Same course requirements as the General Degree option with the exception that Math 1242 Calculus II is required for this concentration.

Electives for Atmospheric Sciences Concentration (8 hours)

Eight hours from Earth Sciences electives list below or other required courses from the Environmental or Hydrological Sciences Concentrations.

Environmental Sciences Concentration

Additional Required Departmental Courses (16 hours)

- GEOG 4000 Urban Ecology (3)
- GEOG 3190 Biogeography (3)
- GEOG 4131 Environmental Modeling with GIS (4)
- GEOL 3190 Environmental Geology (3)
- GEOL 3105 The Earth's Mineral Resources: Sustainability and the Environmental Impacts of Recovery (3) or
- ESCI 4000 Water Resources (3)

External Required Courses Environmental Sciences Concentration (23 hours)

- BIOL 2120 General Biology I (3)

- BIOL 2130 General Biology II (3)
- BIOL 2130L General Biology II Laboratory (2)
- BIOL 3144 Ecology (3)
- BIOL 3144L Ecology Laboratory (W) (1)
- CHEM 1251 Principles of Chemistry (3)
- CHEM 1251L Principles of Chemistry Lab (1)
- CHEM 1252 Principles of Chemistry II (3)
- CHEM 1252L Principles of Chemistry II Lab (1)
- CHEM 2130 Survey of Organic Chemistry (3) or CHEM 2131 Organic Chemistry I (3)

Electives for Environmental Sciences Concentration

- Three hours from Earth Sciences electives list below or other required courses from the Atmospheric or Hydrological Sciences Concentrations.

Hydrology Concentration

Additional Required Departmental Courses (21 hours)

- ESCI 3105 Oceanography (3)
- ESCI 4140 Hydrologic Processes (4)
- ESCI 4222 Watershed Science (3)
- ESCI 4155 Fluvial Processes (4)
- GEOL 4145 Fund. Of Hydrogeology (4)
- ESCI 4000 Water Resources (4)

External Required Courses (17 hours)

Same course requirements as the General Degree Concentration with the exceptions that PHYS 1101 and PHYS 1101L is an option on the required course list and MATH 1241 and STAT 112X along with MATH 1242 or STAT 2223 are required.

Electives for the Hydrological Science Concentration

- Four hours from Earth and Environmental Sciences electives list below or other required courses from the Atmospheric or Environmental Sciences Concentrations of this Degree.

Earth and Environmental Sciences Elective Courses Students are responsible for meeting all required prerequisites for elective courses.

- BIOL 3215 Economic Botany (3) (W)
- BIOL 4162 Environmental Biotechnology I (3)
- BIOL 4163 Environmental Biotechnology II (3)
- CEGR 3143 Hydraulics and Hydrology (3)
- ESCI 3170 Environmental Quality Management (3)
- ESCI 3180 Environmental Impact Analysis (3)
- ESCI 4120 Soil Science (4)
- ESCI 4160 Contaminant Transport (3)
- ESCI 4180 Digital Image Processing in Remote Sensing (4)
- ESCI 4233 Geoenvironmental Site Characterization (3)
- GEOG 3215 Environmental Planning (3) (W)
- GEOG 3250 World Food Problems (3)
- GEOG 4000 Landscape Ecology (3)

- GEOL 3120 Geochemistry (3)
- GEOL 3120L Geochemistry Lab (1)
- GEOL 3124 Sedimentology (4) (W)
- GEOL 4105 Geomorphology (3)
- GEOL 4105L Geomorphology Lab (1)
- GEOL 4120 Geologic Mapping and Interpretation (3)
- GEOL 4125 Geologic Summer Field Camp (6)
- GEOL 4140 Coastal Geology (3)
- GEOL 4165 Aqueous Geochemistry (3)
- GEOL 4410 Applied Soil Science (4)
- METR 4240 Boundary Layer Meteorology (3)
- METR 3250 Dynamic Meteorology (4)
- METR 3252 Weather Analysis Lab (1)
- METR 4150 Applied Climatology (3) (W)

Consult the Department of Geography and Earth Sciences for a suggested schedule to complete the B.S. degree with a major in Earth Sciences or see the Department [website](#) for further information.

B. JUSTIFICATION

1. The revised BS Earth Sciences degree will provide a destination degree program for students who wish to focus on the study of human/environmental interactions and environmental sustainability at UNC Charlotte. The lack of such an undergraduate degree program represents a critical gap in the curricular offerings at one of the state's largest academic institutions. Enrollment totals from similar degree programs elsewhere in the state including: UNC Asheville, Appalachian State, Western Carolina, UNC Pembroke, UNC Wilmington, Duke University, North Carolina Central, UNC Chapel Hill, NC State, NC A&T, Elon University, Queens and Davidson College (many in overlapping service markets) all support healthy and growing enrollment totals and projections from the Bureau of Labor Statistics and N.C. Labor Market Division both indicate a growing labor market for graduates from degree programs with an environmental focus (Bureau of Labor Statistics 2011, ELC NC 2012). Given the size of the Charlotte service market and the increasing societal awareness of the importance of environmental sustainability, there is considerable potential for the revised ESCI degree to become an extremely popular option for our students. The revised Earth Sciences degree broadens and updates the course offerings of our already successful Earth Sciences degree program which currently serves approximately 82 majors. Beyond the current existing local BS Environmental Science programs at Davidson College and Queens University the nearest pre existing Environmental Science program at a public institution is the BS degree in Environmental Sciences at Appalachian state (~100 miles away). The Department of Geography and Earth Sciences has recently hired faculty in the areas of Global Change Science and Urban Ecology and is fully prepared to offer the proposed degree changes with its current faculty resources and with no curricular interruption to students in its existing degree programs.

Bureau of Labor Statistics. 2011. Employment Projections by Occupation. <http://bls.gov>.

ELC NC <http://eslmi23.esc.state.nc.us/projections/index.asp?section=2&periodID=08>

2. Prerequisites for the new courses associated with the proposed degree changes:

GEOL 3105 The Earth's Mineral Resources: Sustainability and the Environmental Impacts of Recovery-
GEOL 1200, 1200L

ESCI 3101 Global Environmental Change – ESCI 1101, 1101L

ESCI 4000 Water Resources- ESCI 1101, 1101L

3. The proposed 3000 and 4000 level courses associated with this proposal are consistent with the courses that are approved for graduate credit.

4. The revised BS in Earth Sciences along with the revised BA in Earth Sciences addresses a significant gap in the undergraduate curriculum at UNC Charlotte where there is currently no recognized B.S. curriculum dedicated to studying interactions between humans and the natural environment beyond the BS in Civil and Environmental Engineering program and ecology coursework within the B.S. Biology degree. In relation to the Department's existing B.S. Earth Sciences degree, the revised curriculum represents a move to better incorporate the Department's expertise in the areas of Atmospheric Sciences, Hydrology and Landscape Ecology in order to offer a curriculum that more comprehensively examines the interactions between humankind and their physical environment. The proposed degree program expands the scope of the current B.S. which primarily examines the Earth's physical environment to encompass a more holistic treatment of the Earth's human and natural system that is direct reflection of the five interdisciplinary themes that define the Department of Geography and Earth Sciences: the study of Human Environmental Interactions, Global Change, Sustainability, Hazards and a Geospatial Perspective. The Department most recent faculty hires in the area of Urban Ecology and Global Climate Change reflect the Department's reorientation towards these five themes. By increasing the availability of coursework concerning human environmental interactions and by been more explicitly identified as an environmentally related degree as compared to the existing Earth Sciences degree, a significantly wider choice of career options are likely to be available to graduates of the new degree program. The revised Earth Sciences degree is designed in such a way that that student's presently enrolled in the existing B.S. Earth Sciences degree will be able to complete their current degree program or switch degree programs with no delay in their progress to graduation.

C. IMPACT

1. This revised degree will serve all undergraduate students currently enrolled in the BS Earth Sciences degree program (current major count 74 students 2010-11) and also those students who wish to focus their studies on a degree program specifically examining human/environmental interactions and sustainability.

2. What effect will this proposal have on existing courses and curricula?

The revised Earth and Environmental Sciences degree program is expected to continue to attract students with the same degree interests as those presently enrolled in the existing B.S. Earth Sciences degree program as well as those more broadly interested in studying human/environmental interactions. It is not anticipated that the Earth and Environmental Sciences B.S. will noticeably impact the Department's existing Geography, Geology and Meteorology B.S. degree programs. The Department's Geography degrees focus on the methodologies of the social sciences and coursework that prepares students for careers in urban and regional planning, cartography, Geographic Information

Systems (GIS), marketing research, transportation planning, real estate development and teaching. The Department's Meteorology program is designed to meet the degree requirements suggested by the American Meteorology Society (AMS) and is characterized by a rigorous mathematically intense curriculum necessary to meet employment standards for meteorologist at the federal level (http://www.ametsoc.org/policy/2010degree_atmosphericscience_amsstatement.html). The Atmospheric Sciences track in the revised ES degree is designed to accommodate those students with a more general interest in the Atmospheric Sciences and who would prefer more coursework related to climatology and air quality in comparison to the Meteorology degree. The Department's BS Geology degree specifically examines the Earth's lithosphere focusing on the planet's composition, history and structure. The revised B.A. Earth Sciences degree is related to but differs significantly from the revised B.S. Earth Sciences degree. The B.A. Earth Sciences degree focuses on human environmental interaction using a combination of scientific, social science, and humanistic approaches. While the revised Earth Sciences degree is designed to attract students interested in a more scientifically focused and technical degree that applies physical, chemical and ecological principles to the study of the physical environment and the solution of environmental problems. We expect both of the revised degree programs to attract significantly more majors than the existing B.A. and B.S. Earth Sciences degree programs which they are designed to replace. It is possible that some B.S. Biology majors with a specific interest in Ecology may be drawn towards the revised degree programs. However, the B.S. Biology and the revised B.S. Earth Sciences degree comprise very different coursework with the Biology degree focusing on providing a firm foundation in the basic principles of Biology in order to understand the biological world while the B.S. Environmental Sciences degree is specifically designed to study the physical environment and human/environmental interactions focusing on the concept of sustainability

D. RESOURCES REQUIRED TO SUPPORT PROPOSAL

1. Personnel

a) No new faculty lines are required to offer the revised degree.

b) The newly proposed courses are part of or will become part of the regular course offerings of Dr. John Bender GEOL 3105 The Earth's Mineral Resources: Sustainability and the Environmental Impacts of Recovery (course revision of GEOL 4185 Mineralogy, Economics, and the Environment regularly taught by Dr. Bender), Dr. Brian Magi ESCI 3101 Global Environmental Change (new course offering of new faculty member Dr. Magi that will become part of his regular course rotation), Dr. Sandra Clinton ESCI 4000 Water Resources (new course offering that will become part of her regular course rotation) and Mr. Bill Garcia ESCI 3190 Biogeography (new course offering by Mr. Garcia that will become part of his regular course rotation).

c) The Environmental Sciences concentration requires BIOL 2130 General Biology II and BIOL 2130L General Biology II Laboratory. After initial consultations with Biology faculty it was apparent that this course was at capacity and the BIOL program would require additional laboratory sections and TA support to accommodate any additional student enrollment. This requirement was relayed to the college.

2. Physical Facility

The current facilities in the McEniry building are adequate to accommodate the revised degree

program.

3. Equipment and Supplies

Current equipment and supplies are adequate.

4. Computer

Current computer resources are adequate.

5. Audio-Visual

Current facilities are adequate.

6. Other Resources

None needed.

7. Sources of Funding

N/A

E. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS OR UNITS

1. Library Consultation – included on new course proposals.

2. Consultation with other departments or units

Department of Biology

Department of Chemistry

F. INITIATION AND CONSIDERATION OF THE PROPOSAL

1. Originating Unit: Department of Geography and Earth Sciences, College of Liberal Arts and Sciences, UNC Charlotte. The Department of Geography and Earth Sciences approved the BA Earth Sciences degree revisions unanimously on May 13, 2011.

2. Other Considering Units- None

G. ATTACHMENTS

1. Letters of Support

2. Original Draft Catalog Copy With Mark-Ups

ATTACHMENTS

From: Brody, Charles
Sent: Thursday, February 07, 2013 1:25 PM
To: Allan, Craig
Subject: RE: ESCI Curriculum

Craig,

While the College cannot make additional GTA support available without a specific request from the Department of Biology, the curricular changes that you are proposing --to move more in the direction of environmental studies-- are in line with CLAS goals. In the short term, I am sure that we can manage the needs of this revised curriculum through part-time funding until a more thorough assessment is made of the need for support.

Charles J. Brody, PhD | Professor, Sociology
Associate Dean for Academic Affairs
College of Liberal Arts and Sciences
UNC Charlotte | Fretwell, 430G
9201 University City Blvd. | Charlotte, NC 28223
Phone: 704-687-2362 | Fax: 704-687-0089
cbrody@unc.edu | <http://www.unc.edu>

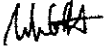
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Department of Biology
9201 University City Boulevard
Charlotte, NC 28223-0001
Ph. (704) 687-6686 ~ Fax. (704) 687-3128

Memorandum

TO: Craig Allen, PhD
Professor and Chair
Department of Geography and Earth Sciences

FROM: Martin G. Klotz, Ph.D. 
Professor and Chair
Department of Biology

RE: Long Form, Revision of BS in Earth Sciences

DATE: January 23, 2012

This note is to express my support for the revision of the Bachelor of Science degree in Earth Sciences to be offered by the Department of Geography and Earth Sciences. The proposed curriculum includes BIOL 2120 (General Biology I, presently offered in Fall only), BIOL 2130 (General Biology II, presently offered in Spring only), BIOL 2130L (General Biology Laboratory, presently offered in Spring only), BIOL 3144 (Ecology, presently offered in the Fall and Spring semesters) and BIOL 3144L (Ecology Laboratory, presently offered in the Fall and Spring semesters) as requirements and BIOL 3215 (Economic Botany, presently offered in the Fall and Spring semesters), BIOL 4162 (Environmental Biotechnology I, offered in the future) and BIOL 4163 (Environmental Biotechnology II, offered in the future) are listed as electives for the major.

General Biology I & II and General Biology Laboratory are required courses for entering the Biology Major and approximately 900 registered PBIO students compete presently for enrollment in these courses (Spring 2012, UNCC Fact Book). Thus this letter of support cannot promise increased enrollment capacity of either course without significant allocation of additional GTA support to the Department of Biology. BIOL 3144L (Ecology Laboratory) is also restricted to existing enrollment levels without additional GTA support.

The University of North Carolina is composed of the historic public higher institutions in North Carolina
An Equal Opportunity/Affirmative Action Employer



Department of Chemistry

9201 University City Blvd. Charlotte, NC 28223-0001
704.687.4765 704.687.3151 www.chem.uncc.edu

February 4, 2012

Dr. Craig Allan
Professor and Chair
Department of Geography and Earth Sciences
UNC Charlotte

Dear Craig:

The Department of Chemistry is happy to endorse the revised BS Earth Sciences degree program. I understand that the revised degree may have an impact on the enrollment in CHEM 2130 and/or CHEM 2131.

Please contact me if I can be of further assistance.

Best wishes,
Sincerely,

Bernadette T. Donovan-Merkert
Professor and Chair, Department of Chemistry
Director, Nanoscale Science Ph.D. Program
704-687-4436
bdonovan@uncc.edu

The UNIVERSITY of NORTH CAROLINA at CHARLOTTE
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2012
2/4/12

First Draft of Original Catalog Copy with Mark-Up

BACHELOR OF SCIENCE IN EARTH SCIENCES

A major in Earth Sciences leading to a B.S. degree consists of a minimum of 64 hours of required and elective coursework. The General Degree consists of 22 hours of required Earth Science (ESCI), Geography (GEOG) and Geology (GEOL) courses, 24 hours of elective courses and 18 hours of required extra departmental coursework. The Atmospheric Sciences Concentration consists of a minimum of 39 hours of required Earth Science (ESCI), Geography (GEOG), Meteorology (METR) and Geology (GEOL) courses, 8 hours of elective courses and 17 hours of required extra departmental coursework. The Environmental Sciences Concentration consists of a minimum of 38 hours of required Earth Science (ESCI), Geography (GEOG) and Geology (GEOL) courses, 3 hours of elective courses and 23 hours of required extra departmental coursework. The Hydrologic Sciences Concentration consists of a minimum of 43 hours of required Earth Science (ESCI), Geography (GEOG), Meteorology (METR) and Geology (GEOL) courses, 4 hours of elective courses and 17 hours of required extra departmental courses.

Required Departmental Courses All Options (22 hours)

- ESCI 1101 Earth Science-Geography (3)
- ESCI 1101L Earth Science-Geography Lab (1)
- GEOL 1200 Physical Geology (3)
- GEOL 1200L Physical Geology Lab (1)
- ESCI ~~3000~~ 2010 Environmental Dilemma (3)
- ESCI 2210 Field Methods (3)
- ESCI 3101 Global Environmental Change (3)
- GEOG 4120 Fundamentals of GIS (4)
- ESCI 4600 Earth Sciences Seminar (1)

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Additional Out of Department Required Courses General Degree (18 hours)

- CHEM 1251 Principles of Chemistry (3)
- CHEM 1251L Principles of Chemistry Lab (1)
- PHYS 1101 Introductory Physics I (3)
- PHYS 1101L Introductory Physics I Lab (1)
- MATH 1241 Calculus I (3)
- MATH 1242 Calculus II (3) or
- STAT 112X Elements of Statistics I (3)
- CHEM 1252 Principles of Chemistry (3) and
- CHEM 1252L Principles of Chemistry Lab (1) or
- PHYS 1102 Introductory Physics II (3) and
- PHYS 1102L Introductory Physics II Lab (1)

Elective Courses General Degree Option (24 hours)

Twenty four hours from Earth Sciences electives list below or other required courses from the Atmospheric, Environmental or Hydrological Sciences Concentrations of this Degree.

Atmospheric Sciences Concentration

Additional Required Departmental Courses (17 hours)

- METR 3140 Introduction to Meteorology and Climatology (3)
- METR 3210 Atmospheric Thermodynamics (3)
- METR 3220 Physical Meteorology (3)
- METR 3245 Synoptic Meteorology (4)
- ESCI 4170 Fundamentals of Remote Sensing (4)

Required Out of Departmental Courses (18 hours)

Same course requirements as the General Degree option with the exception that Math 1242 Calculus II is required for this concentration.

Electives for Atmospheric Sciences Concentration (8 hours)

Eight hours from Earth Sciences electives list below or other required courses from the Environmental or Hydrological Sciences Concentrations.

Environmental Sciences Concentration

Additional Required Departmental Courses (16 hours)

- GEOG ~~4000~~ Urban Ecology (3)
- GEOG ~~3190~~ Biogeography (3)
- GEOG 4131 Environmental Modeling with GIS (4)
- GEOL 3190 Environmental Geology (3)
- GEOL ~~3105~~ The Earth's Mineral Resources: Sustainability and the Environmental Impacts of Recovery (3) or
- ESCI 4000 ~~XXX~~ Water Resources (3)

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External Required Courses Environmental Sciences Concentration (23 hours)

- BIOL 2120 General Biology I (3)
- BIOL 2130 General Biology II (3)
- BIOL 2130L General Biology II Laboratory (2)
- BIOL 3144 Ecology (3)
- BIOL 3144L Ecology Laboratory (W) (1)
- CHEM 1251 Principles of Chemistry (3)
- CHEM 1251L Principles of Chemistry Lab (1)
- CHEM 1252 Principles of Chemistry II (3)
- CHEM 1252L Principles of Chemistry II Lab (1)
- CHEM 2130 Survey of Organic Chemistry (3) or CHEM 2131 Organic Chemistry I (3)

Electives for Environmental Sciences Concentration

- Three hours from Earth Sciences electives list below or other required courses from the Atmospheric or Hydrological Sciences Concentrations.

Hydrology Concentration

Additional Required Departmental Courses (21 hours)

- ESCI 3105 Oceanography (3)
- ESCI 4140 Hydrologic Processes (4)
- ESCI 4222 Watershed Science (3)
- ESCI 4155 Fluvial Processes (4)
- GEOL 4145 Fund. Of Hydrogeology (4)
- ESCI ~~4000~~ Water Resources (4)

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External Required Courses (17 hours)

Same course requirements as the General Degree Concentration with the exceptions that PHYS 1101 and PHYS 1101L is an option on the required course list and MATH 1241 and STAT 112X along with MATH 1242 or STAT 2223 are required.

Electives for the Hydrological Science Concentration

- Four hours from Earth and Environmental Sciences electives list below or other required courses from the Atmospheric or Environmental Sciences Concentrations of this Degree.

Earth and Environmental Sciences Elective Courses Students are responsible for meeting all required prerequisites for elective courses.

- BIOL 3215 Economic Botany (3) (W)
- BIOL 4162 Environmental Biotechnology I (3)
- BIOL 4163 Environmental Biotechnology II (3)
- CEGR 3143 Hydraulics and Hydrology (3)
- ESCI 3170 Environmental Quality Management (3)
- ESCI 3180 Environmental Impact Analysis (3)
- ESCI 4120 Soil Science (4)
- ESCI 4160 Contaminant Transport (3)
- ESCI 4180 Digital Image Processing in Remote Sensing (4)
- ESCI 4233 Geoenvironmental Site Characterization (3)
- GEOG 3215 Environmental Planning (3) (W)
- GEOG 3250 World Food Problems (3)
- GEOG ~~4004~~ Landscape Ecology (3)
- GEOL 3120 Geochemistry (3)
- GEOL 3120L Geochemistry Lab (1)
- GEOL 3124 Sedimentology (4) (W)
- GEOL 4105 Geomorphology (3)
- GEOL 4105L Geomorphology Lab (1)
- GEOL 4120 Geologic Mapping and Interpretation (3)
- GEOL 4125 Geologic Summer Field Camp (6)
- GEOL 4140 Coastal Geology (3)
- GEOL 4165 Aqueous Geochemistry (3)
- GEOL 4410 Applied Soil Science (4)
- METR 4240 Boundary Layer Meteorology (3)

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- METR 3250 Dynamic Meteorology (4)
- METR 3252 Weather Analysis Lab (1)
- METR 4150 Applied Climatology (3) (W)

Consult the Department of Geography and Earth Sciences for a suggested schedule to complete the B.S. degree with a major in Earth Sciences or see the Department [website](#) for further information.

