Environmental and Natural Resource Economics

Degree Offered

• Bachelor of Science

Nature of the Program

The objective of this major is to provide students with the necessary training for the application of economic theory and analysis to environmental and natural resource issues. The flexibility of this major allows students to design (with their advisor) a program of study which focuses on environmental and natural resource issues tailored to the student’s own interests (such as water use and quality, soil protection, waste management, ecosystem management, and land use). The curriculum reflects the breadth of training required to prepare students for careers in private and government sectors dealing with environmental and natural resource management and policy analysis.

Students with this major can expect to find employment with state and federal government agencies or with private industry in environmental policy analysis and management of natural resources. Many students, upon completion of this degree, may find it desirable to obtain a graduate degree to expand their career opportunities. Students completing this degree will be prepared for graduate study in environmental and natural resource economics and policy.

Click here to view the Suggested Plan of Study (p. 2)

General Education Foundations

Please use this link to view a list of courses that meet each GEF requirement. (http://registrar.wvu.edu/gef)

NOTE: Some major requirements will fulfill specific GEF requirements. Please see the curriculum requirements listed below for details on which GEFs you will need to select.

General Education Foundations

<table>
<thead>
<tr>
<th>F1 - Composition &amp; Rhetoric</th>
<th>3-6</th>
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</thead>
<tbody>
<tr>
<td>ENGL 101</td>
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<tr>
<td>&amp; ENGL 102</td>
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<tr>
<td>or ENGL 103</td>
<td></td>
</tr>
<tr>
<td>Introduction to Composition and Rhetoric and Composition, Rhetoric, and Research</td>
<td></td>
</tr>
<tr>
<td>Accelerated Academic Writing</td>
<td></td>
</tr>
</tbody>
</table>

| F2A/F2B - Science & Technology  | 4-6   |
| F3 - Math & Quantitative Reasoning | 3-4 |
| F4 - Society & Connections      | 3     |
| F5 - Human Inquiry & the Past   | 3     |
| F6 - The Arts & Creativity      | 3     |
| F7 - Global Studies & Diversity | 3     |
| F8 - Focus (may be satisfied by completion of a minor, double major, or dual degree) | 9     |

Total Hours 31-37

Please note that not all of the GEF courses are offered at all campuses. Students should consult with their advisor or academic department regarding the GEF course offerings available at their campus.

CURRICULUM REQUIREMENTS

GEF Requirements

*Must include two 4 credit courses each with a laboratory.

<p>| ANRD 191 | First-Year Seminar | 1 |
| AGEE 110 | Microcomputer Applications in Agricultural Education | 3 |
| ARE 150  | Introductory Agricultural and Agribusiness Economics (GEF 4) | 3 |
| ARE 187  | Energy Resource Economics (GEF 8) | 3 |
| ARE 220  | Introductory Environmental and Resource Economics | 3 |
| ARE 382  | Agricultural and Natural Resources Law | 3 |
| ARE 410  | Environmental and Resource Economics (Counts as Writing Course Requirement) | 3 |
| ARE 445  | Energy Economics | 3 |
| ARE 450  | Agriculture, Environmental and Resource Policy | 3 |
| ARE 494  | Seminar | 1 |</p>
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ARE 496</td>
<td>Senior Thesis (Capstone Experience)</td>
<td>3</td>
</tr>
<tr>
<td>ECON 202</td>
<td>Principles of Macroeconomics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 225</td>
<td>Elementary Business and Economics Statistics (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>ECON 301</td>
<td>Intermediate Micro-Economic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECON 302</td>
<td>Intermediate Macro-Economic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECON 421</td>
<td>Introduction to Mathematical Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 425</td>
<td>Introductory Econometrics</td>
<td>3</td>
</tr>
<tr>
<td>Calculus Requirement:</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>MATH 150</td>
<td>Applied Calculus</td>
<td></td>
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<tr>
<td>MATH 153</td>
<td>Calculus 1a with Precalculus</td>
<td></td>
</tr>
<tr>
<td>&amp; MATH 154</td>
<td>and Calculus 1b with Precalculus</td>
<td></td>
</tr>
<tr>
<td>MATH 155</td>
<td>Calculus 1</td>
<td></td>
</tr>
<tr>
<td>RESM 440</td>
<td>Foundations of Applied Geographic Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>RESM 442</td>
<td>Introduction Geographic Information Systems Social Science</td>
<td>2</td>
</tr>
<tr>
<td>RESM 480</td>
<td>Environmental Regulation</td>
<td>3</td>
</tr>
<tr>
<td>Restricted Electives (selected in consultation):</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>AGRN 202</td>
<td>Principles of Soil Science</td>
<td></td>
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<tr>
<td>AGRN 203</td>
<td>Principles of Soil Science Laboratory</td>
<td></td>
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<tr>
<td></td>
<td>Student must select either an approved minor or at least four courses at the 300 or 400 level in AGRN, ARE, ECON, ENVP, FMAN, or FOR.</td>
<td></td>
</tr>
<tr>
<td>Free Electives</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>120</td>
</tr>
</tbody>
</table>

* Consult with Undergraduate Coordinator for approval of Capstone Experience (Senior Thesis).

**SUGGESTED PLAN OF STUDY**

**First Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARE 187 (GEF 8)</td>
<td>3 AGEE 110</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 101</td>
<td>4 ARE 150 (GEF 4)</td>
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<tr>
<td>&amp; BIOL 103 (GEF 2B)</td>
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<tr>
<td>ENGL 101 (GEF 1)</td>
<td>0 or 3 ENVP 155 (Suggested GEF 8)</td>
<td>3</td>
</tr>
<tr>
<td>ANRD 191</td>
<td>1 GEF 5, 6, 7</td>
<td>3</td>
</tr>
<tr>
<td>Select one of the following (GEF 3):</td>
<td>3 Select one of the following:</td>
<td>3</td>
</tr>
<tr>
<td>MATH 124</td>
<td>STAT 211</td>
<td></td>
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<tr>
<td>MATH 126</td>
<td>ECON 225</td>
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11-14  15

**Second Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARE 220</td>
<td>3 AGRN 202 (Suggested Restricted Elective)</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 102 (GEF 1)</td>
<td>0 or 3 AGRN 203 (Suggested Restricted Elective)</td>
<td>1</td>
</tr>
<tr>
<td>ECON 202</td>
<td>3 GEF 5, 6, 7</td>
<td>6</td>
</tr>
<tr>
<td>MATH 150</td>
<td>0 or 3 Restricted Elective</td>
<td>3</td>
</tr>
<tr>
<td>CHEM, GEOL, or GEOG w/ Lab (GEF 8)</td>
<td>4 Free Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

10-16  16

**Third Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours Spring</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>ARE 382</td>
<td>3 ARE 440 (Suggested Restricted Elective)</td>
<td>3</td>
</tr>
<tr>
<td>ARE 494</td>
<td>1 ARE 445</td>
<td>3</td>
</tr>
<tr>
<td>ECON 301</td>
<td>3 ECON 302</td>
<td>3</td>
</tr>
<tr>
<td>ECON 421</td>
<td>3 RESM 480</td>
<td>3</td>
</tr>
<tr>
<td>Restricted Elective</td>
<td>3 Free Elective</td>
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</tbody>
</table>
Environmental and Natural Resource Economics

Fourth Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Hours</th>
<th>Spring Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVP 355 (Suggested Restricted Elective)</td>
<td>3</td>
<td>ARE 410</td>
</tr>
<tr>
<td>RESM 440</td>
<td>3</td>
<td>ARE 450</td>
</tr>
<tr>
<td>RESM 442</td>
<td>2</td>
<td>ARE 496</td>
</tr>
<tr>
<td>Restricted Electives</td>
<td>6</td>
<td>ECON 425</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Free Elective</td>
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<tr>
<td></td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

Total credit hours: 111-120

Major Learning Outcomes

ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS

After completing this major students will be able to:

1. Apply the tools of economic analyses to environmental issues.
2. Demonstrate how to apply economic theory to the management of renewable and non-renewable natural resources.
3. Articulate the laws and regulations related to environmental protection, energy use, and management of natural resources.
4. Demonstrate the utilization of quantitative analysis tools.
5. Communicate effectively in a business or professional setting (written and oral).

ARE 110. Agribusiness Accounting. 3 Hours.
Introduction to accounting for agricultural, rural, and small business managers. Emphasis on the accounting cycle, analysis and interpretation of financial statements, income taxes, and managerial accounting. (Students having prior college credit in accounting are not eligible for this course.).

ARE 150. Introductory Agricultural and Agribusiness Economics. 3 Hours.
Introduction to basic agricultural economics and agribusiness concepts, and the application of these concepts to agricultural and agribusinesses issues.

ARE 187. Energy Resource Economics. 3 Hours.
Dilemmas posed for developing and modern societies by rising energy demands amid concerns for the world's environment. Economics of fuel sources and technologies, and historical and new concerns over resource scarcities.

ARE 191. First-Year Seminar. 1-3 Hours.
Engages students in active learning strategies that enable effective transition to college life at WVU. Students will explore school, college and university programs, policies and services relevant to academic success. Provides active learning activities that enable effective transition to the academic environment. Students examine school, college and university programs, policies and services.

ARE 199. Orientation to Agriculture and Resource Economics. 1,2 Hour.
Orientation to degree programs and requirements, departmental resources, curriculum options, student responsibilities and opportunities.

ARE 201. Principles of Resource and Energy. 3 Hours.
PR: Third-year standing. Analyzes problems important or peculiar to mineral industry economics; exhaustion, externalities, risks, production cycle, industry structure, pricing, role of minerals in development and trade, resource planning. Energy, metals, industrial minerals. (3 hr. lec.).

ARE 204. Agribusiness Management. 3 Hours.
Overview of the agribusiness decision-making process, and the functions of agribusiness management; analysis of financial statements and budgeting for evaluating profitability of alternative enterprises and practices.

ARE 220. Introductory Environmental and Resource Economics. 3 Hours.
Economic analysis of environmental pollution, natural resource conservation and management, outdoor recreation, public land use, wildlife resources, water use, property rights, and benefit-cost issues.

ARE 293. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

ARE 298. Honors. 1-3 Hours.
PR: Students in Honors Program and consent by the honors director. Independent reading, study, or research.

ARE 360. Current Issues In Agriculture. 3 Hours.
Course focusing on the current scientific, ethical, legal, economic and political issues relating to agriculture. Students conduct group and individual research, discuss topics in an informal debate format and summarize positions in a written form.
ARE 380. Agribusiness Sales and Management. 3 Hours.
This course is designed to provide students with essential spreadsheet and sales skills they can apply regardless of their chosen profession. The course will cover spreadsheet basics and students will apply that knowledge to problems related to agricultural and resource economics.

ARE 382. Agricultural and Natural Resources Law. 3 Hours.
Introduction to legal concepts, principles and practices related to environmental, natural resource, and agricultural issues; in the context of the legal system within which statues are enacted, administered and enforced.

ARE 393. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

ARE 401. Applied Demand Analysis. 3 Hours.
Consumer demand economics applied to environmental, natural resource, and agricultural issues; analysis of factors that influence demand and determine prices; special applications to non-market, environmental, and natural resource amenities.

ARE 406. Applied Quantitative Methods. 3 Hours.
PR: ARE 150. Application of basic quantitative concepts and methods applied to agribusiness and natural resources. Topics include applied economics, statistics, mathematics, and financial concepts and decision-making tools for determining optimum allocation of resources for production processes.

ARE 410. Environmental and Resource Economics. 3 Hours.
PR: (ARE 401 and ARE 402) or ECON 301 or consent. Economic analysis of natural resource and environmental problems; management of renewable and non-renewable resources and environmental amenities; market failure, externalities, benefit-cost and risk analysis; property rights and the taking issue.

ARE 411. Rural Economic Development. 3 Hours.
Economic trends, development policies, and analysis of rural economies in the United States. Rural diversity, development concepts, rural planning, public programs and policies, and community analysis methods.

ARE 422. New Venture Creation. 3 Hours.
In this course, students will learn the process of starting a new venture. The student will gain an in depth understanding of the framework and process by practicing the techniques on a startup of the student’s choice.

ARE 431. Marketing Agricultural Products. 3 Hours.
Organization, functions, and analysis of the agricultural marketing system. Food consumption, exports, price analysis, marketing costs, market power, commodities futures market, food safety, and government regulations.

ARE 435. Marketing Livestock Products. 3 Hours.
Livestock marketing practices and policies. Supply and demand, livestock price cycles, grading, marketing alternatives, processing and retailing. Economic analysis of alternatives, current issues, and trends.

ARE 440. Futures Markets and Commodity Prices. 3 Hours.
Analysis of price-making forces which operate in the market place; emphasis on major agricultural and mineral commodity and futures markets.

ARE 445. Energy Economics. 3 Hours.
Analysis of the energy sector and its relationship to the rest of the economy; energy security, deregulation, full cost pricing, substitutability among energy sources, transmission, new technologies, environmental considerations.

ARE 450. Agriculture, Environmental and Resource Policy. 3 Hours.
PR: ARE 150 or ECON 201 or consent. Economic analysis of agricultural, natural resource and environmental policies; problems of externalities and market failure, and alternative policies for addressing such problems; benefits and cost of alternative policies.

ARE 461. Agribusiness Finance. 3 Hours.
An overview of financial analysis and the application of financial principles to small, rural and agricultural businesses. Includes applications of financial analysis computer software.

ARE 462. Records and Analysis for Sustainable Agribusinesses. 3 Hours.
PR: ARE 110 or ACCT 201 or BUSA 202. Managerial and record-keeping concepts and tools needed to run a successful agribusiness. Course materials and lab activities focus on collection and use of information to assist in whole-farm/agribusiness planning, decision-making, performance evaluation, sensitivity analysis, and management. Course stresses the impact of record-keeping and performance evaluation on the ability of an agribusiness to achieve its strategic goals.

ARE 482. Enterprise Operation Law. 3 Hours.
Course focusing on laws applicable to businesses and the management of risks associated with operating a business. Students will learn to read and interpret laws and apply them to real-life business scenarios.

ARE 484. Agribusiness Strategic Management. 3 Hours.
PR: Senior standing. This course is designed to enhance understanding of business strategy formulation and implementation. The course provides a balance between theoretical concepts, principles, and practice of agribusiness management. Case studies are used to illustrate the crafting, implementation, and execution of optimal strategies.
ARE 485. Economics of Water Resources and Energy. 3 Hours.  
PR: Calculus with a grade of B- or better or consent, introductory micro economics with a C- or consent. Allocation under scarcity, water institutions and management, risk, pricing, marketing, demand and supply estimation, interdependence between energy and water resources (Credit cannot be received for both ARE 485 and ARE 585).

ARE 488. Career Development. 1 Hour.  
PR: For Resource Economics and Management majors only. Development of career goals and job search skills. Investigation of topics that advance students in their career goals.

ARE 490. Teaching Practicum. 1-3 Hours.  
PR: Consent. Teaching practice as a tutor or assistant.

ARE 491. Professional Field Experience. 1-18 Hours.  
PR: Consent. (May be repeated up to a maximum of 18 hours.) Prearranged experiential learning program, to be planned, supervised, and evaluated for credit by faculty and field supervisors. Involves temporary placement with public or private enterprise for professional competence development.

ARE 492. Directed Study. 1-3 Hours.  
Directed study, reading, and/or research.

ARE 493. Special Topics. 1-6 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

ARE 494. Seminar. 1-3 Hours.  
PR: Consent. Presentation and discussion of topics of mutual concern to students and faculty.

ARE 495. Independent Study. 1-6 Hours.  
Faculty supervised study of topics not available through regular course offerings.

ARE 496. Senior Thesis. 1-3 Hours.  
PR: Consent.

ARE 497. Research. 1-6 Hours.  
Independent research projects.

ARE 498. Honors. 1-3 Hours.  
PR: Students in honors program and consent by the honors director. Independent reading, study or research.

RESM 140. Sustainable Living. 3 Hours.  
Explores the personal, social, economic and environmental aspects of making sustainable choices. Sustainability principles and practices are discussed along with assessments of consumption and lifestyle decisions. Also listed as DSGN 140 and PLSC 140.

RESM 180A. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180B. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180C. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180D. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180E. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.


RESM 180G. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180H. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180I. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180J. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180K. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180L. . 1-4 Hours.  
PR: Consent. Investigation of topics not covered in regularly scheduled courses.
RESM 180M. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180N. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180O. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180P. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180Q. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180R. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180S. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180T. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180U. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180V. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180W. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180X. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180Y. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 180Z. . 1-4 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 293. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 390. Teaching Practicum. 1-3 Hours.
PR: Consent. Teaching practice as a tutor or assistant.

RESM 440. Foundations of Applied Geographic Information Systems. 3 Hours.
An introductory course designed to provide the necessary background and techniques to use GIS technology to analyze and solve spatial problems. An emphasis is placed on acquisition, management, and manipulation of spatial data.

RESM 441. Introduction Geographic Information Systems Natural Science. 2 Hours.
PR or CONC: RESM 440. Using Geographic Information Systems (GIS) to solve problems in environmental and natural resource management.

RESM 442. Introduction Geographic Information Systems Social Science. 2 Hours.
PR or CONC: RESM 440. Using Geographic Information Systems (GIS) to solve problems in the social sciences.

RESM 444. Advanced GIS for Natural Resource Management. 3 Hours.
PR or CONC: RESM 440 with a minimum grade of C- or consent. Provides advanced training using geographic information systems to address the spatial issues of managing natural resources.

RESM 445. Spatial Hydrology and Watershed Analysis. 3 Hours.
PR: RESM 440 or consent. Introduction to applied spatial hydrology using GIS; integrates statistical modeling and terrain analysis; provides insights into water quality and quantity analysis for local and regional watershed scales. (Credit cannot be received for both RESM 445 and RESM 545.)

RESM 450. Land Use Planning Law. 3 Hours.
Focus is on identification and understanding of legal issues related to planning and land use. This involves understanding rights, regulations, and responsibilities associated with land use, planning, and related activities.

RESM 455. Practice of Land Use Planning. 3 Hours.
Examines comprehensive land use planning including planning's origin and evolution plus the processes used to create and implement a plan. Focus is on land use and how it relates to other issues.
RESM 460. Energy Project and Program Management. 3 Hours.
PR: Junior or Senior Standing. The concepts and best practices of modern project management as applied to manage activities that meet the requirements of energy and environmental resource industry related programs and projects.

RESM 480. Environmental Regulation. 3 Hours.
Course focusing on laws and policies applicable to the environment. Students will learn to read and interpret statutes, regulations and cases that impact water, air, toxic substances, land and endangered species.

RESM 491. Professional Field Experience. 1-18 Hours.
PR: Consent (may be repeated up to a maximum of 18 hours.) Prearranged experiential learning program, to be planned, supervised, and evaluated by faculty and field supervisors. Involves temporary placement with public or private enterprise for professional competence development.

RESM 493. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 494. Seminar. 1-3 Hours.
PR: Consent. Presentation and discussion of topics of mutual concern to students and faculty.

RESM 495. Independent Study. 1-6 Hours.
Faculty supervised study of topics not available through regular course offerings.

RESM 496. Senior Thesis. 1-3 Hours.
PR: Consent.

RESM 498. Honors. 1-3 Hours.
PR: Students in Honors Program and consent by the honors director. Independent reading, study or research.