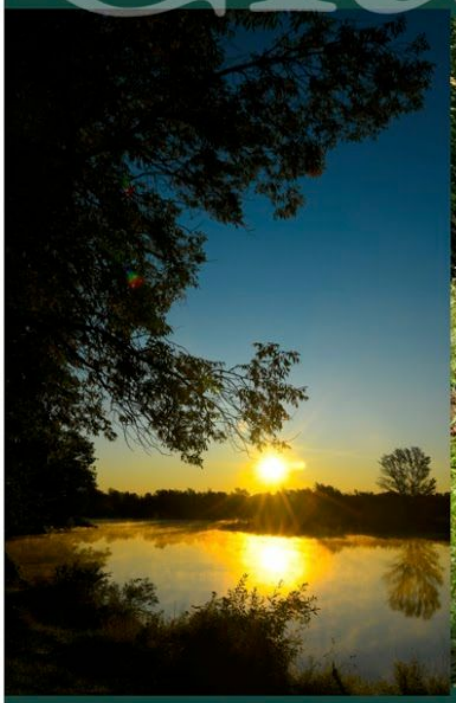
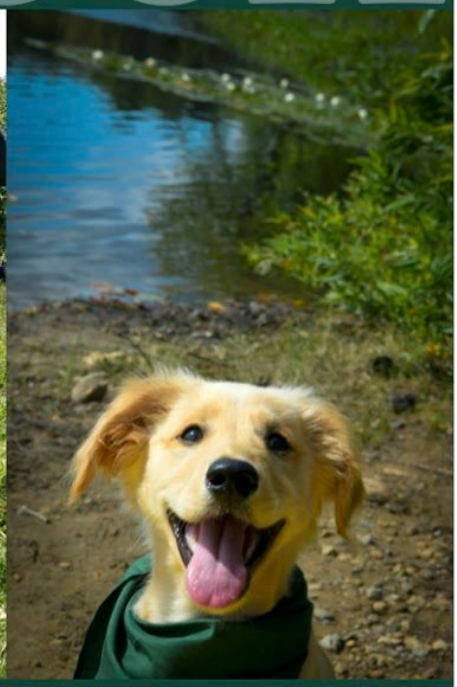
Clarkson





Clarkson University

Institute for Sustainable Environment

Environmental Health Science

Environmental Science & Policy

Undergraduate Student Handbook

PREFACE

*****The Environmental Science curriculum at Clarkson University is composed of two programs:

Environmental Health Science (EHS) and **Environmental Science and Policy** (ES&P). Students completing the EHS program receive a degree in Environmental Health Science. Students who complete the ES&P program receive a Bachelor of Science in Environmental Science and Policy. This Handbook has been prepared for prospective and current students, parents, and employers. Clarkson University offers a competitive edge with its interdisciplinary teaching approach and collaborative working environment necessary to succeed in any future endeavors.

The goal of the EHS and ES&P Environmental Science programs at Clarkson is to provide students with fundamental and applied scientific knowledge and to develop hands-on skills in the laboratory and field activities to succeed in their professions. Individual and team-based learning provide students skills to address the many challenging environmental problems faced by our society. Students are provided with a broad understanding of environmental policies and how they impact our communities, workplace and environment.

The Clarkson **Environmental Health Science** program (formerly Industrial Hygiene) is unique because it is interdepartmental, with participating course requirements from biology, chemistry, engineering, and industrial hygiene. Students can tailor their studies to emphasize special interests in these areas. Those who want to perform research can work with faculty who are nationally recognized scientists in related fields.

The Clarkson **Environmental Science & Policy** program provides students with a quality experiential-based education that they can use to begin their careers as environmental professionals. Clarkson ES&P graduates are knowledgeable of the tools and techniques of environmental science and policy, and have an appreciation for the interdependence of law, science, and government.

This handbook contains a detailed description of the EHS and ES&P programs, as well as career opportunities, graduate school possibilities, and research options.

Revised 10.01.2020

Clarkson University

Undergraduate Environmental Health Science and Environmental Science & Policy Programs

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Institute for a Sustainable Environment: Faculty

Stephen Bird

Associate Professor of Political Science/Director of ISE Adirondack Semester

Humanities & Social Sciences

Dr. Bird teaches Energy Policy, Environmental Policy, US Politics, Public Policy and Adirondack semester classes. He primarily focuses on energy and environmental policy, and is currently doing research focused on microgrid governance, energy conflict and social acceptance, Smart Housing and split incentives, Fracking, green data centers, and various aspects of social influence.

Alan Christian

Professor/Director of Assessments for Student Learning Outcomes

Biology

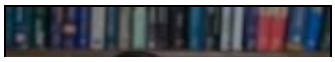
Dr. Christian teaches Landscape Ecology and Biogeochemistry and Ecosystem Science. He is also the Director of Assessments for Student Learning Outcomes.

Michelle Crimi

Professor/Director of Engineering and Management

Engineering and Management

Dr. Crimi's research interests include the development of *in situ* remediation technologies for treating contaminated groundwater, chemical oxidization of organic contaminants, impacts of *in situ* remediation on aquifer quality, and the integration of treatment technologies for optimized risk reduction. Current projects focus on developing novel approaches for treating recalcitrant compounds such as 1,4-dioxane, per- and polyfluoroalkyl substances (PFAS) and developing new approaches to implement technologies more efficiently.



Andrea Ferro

Professor/ISE Associate Director for Research

Civil & Environmental Engineering

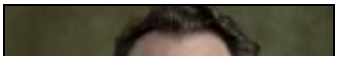
Dr. Ferro teaches Intro to Environmental Engineering, Atmospheric Chemistry, Senior Design, Human Exposure Analysis, and Sustainable Development Engineering. Her research interests include indoor air quality, fate and transport of pollutants in the built environment, resuspension of particulate matter, human exposure to pollutants, and exposure versus health effect relationships for airborne particulate matter.

Beatrice Hernout

Assistant Professor

Institute for a Sustainable Environment

Dr. Hernout teaches Environmental Toxicology, Conservation Biology, Ecology and Epidemiology. Hernout's research interests focus mainly on understanding the effects of chemicals on wildlife species. She is interested in understanding how stressors impact living organisms and ecosystems. Her research integrates techniques from molecular toxicology, spatial analyses, analytical chemistry, ecological monitoring and computational biology, as well as working collaboratively in a multi-disciplinary environment.



Tom Langen

Professor/Interim Dean, School of Arts and Sciences

Biology

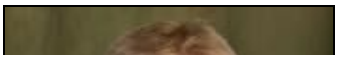
Dr. Langen teaches Ecology & Lab, Conservation Biology, Behavioral Ecology and Sociobiology, Animal Learning and Cognition, and Biological Systems and Environmental Change. His research interests focus on environmental management, including public-private partnerships for wetland restoration, environmental impacts on road ecology, and habitat management and conservation for endangered species.

Susan Powers

Director of the Institute for a Sustainable Environment

Institute for a Sustainable Environment

Dr. Power's teaches Industrial Ecology, Climate Change and capstone design projects. Her recent research projects include environmental life cycle management issues, energy systems and residential energy conservation programs. Her current research is especially focused on defining and quantifying metrics that can be used to assess the energy and environmental benefits and liabilities associated with energy systems.



Christopher Robinson

Professor of Political Science/Associate Provost for Faculty Achievement
Humanities & Social Sciences

Dr. Robinson teaches Environmental Law and Policy, American Politics, Constitutional Law, Human Rights Law and Politics, Law and Bioethics, and Political Theory. His research interests include contemporary political theory as a series of responses to political trauma, and politics of sustainable development. This includes more specific areas of the larger political effects of acknowledging the illogic limitless economic growth on a planet of limited natural resources.

Alan Rossner

Professor/Associate Director for Education
Institute for a Sustainable Environment

Dr. Rossner teaches Fundamentals of Industrial Hygiene, Introductory Industrial Hygiene Laboratory, Technical aspects of Safety & Safety Management, Introduction to Toxicology & Epidemiology, Industrial Hygiene Controls, Environmental Monitoring & Analysis, Advanced Topics in Environmental and Occupational Hygiene, Introduction to Environmental Science & Policy, Environmental Science, Risk Analysis, Environmental Sustainability & Risk Analysis, Adirondack Semester – Environmental. Health Science, Adirondack Semester-Integrated Research Project. Dr. Rossner directs his research in areas that minimize people's exposure to contaminants, improve working conditions, improve living conditions and minimize risk of disease. His current research projects look at the development of air sampling methodologies, exposure assessment strategies for occupational and environmental air sampling, and indoor/outdoor air contaminant monitoring.

Michael Twiss

Professor/Chair of Biology
Biology

Dr. Twiss teaches Limnology & Lab, Microbiology & Lab, Great Lakes Water Protection, Plant Science of Northern New York, and Adirondack Ecology & Environmental Science & Lab. His research interests include interactions of microbes with chemicals (nutrients, toxic substances) in lakes and rivers and the use of advanced technologies for assessing phytoplankton community structure and health. He mainly focuses his studies on the North American Great Lakes and St. Lawrence River ecosystems.

Revised 10.01.2020

Environmental Health Science (EHS): Program Description

A **BS in Environmental Health Science** has three concentrations: (1) Industrial Hygiene, (2) Occupational Ergonomics and (3) Environment and Security. Environmental Health Science involves the recognition, evaluation, and control of health hazards in work and community environments. The EHS program at Clarkson integrates courses in biology, chemistry, engineering, and industrial hygiene.

The EHS degree requires students to select an area of concentration that allows students the ability to align themselves for a specific career or academic focus. These include: Environment and Security, Ergonomics or Industrial Hygiene. Classes are small and students benefit from working closely in mentoring relationships with their instructors. Students in the EHS program also have the opportunity to study under and work with professors who are recognized leaders in their fields.

Companies are expanding their efforts to anticipate, recognize, evaluate and control exposure to chemical, biological, ergonomic and physical agents that harm workers and decrease productivity. The EHS program partners with companies to conduct health hazard assessments in actual work environments. Clarkson EHS undergraduates work hand-in-hand with managers and other personnel on the job to assess exposures to chemicals, noise and particulate, and Industry partners have such confidence in the EHS program at Clarkson that they allow students to develop recommendations for the control of these hazards at their workplaces. This experience allows students to gain a full appreciation of real-world problem solving.

An education at Clarkson positions our students to make an immediate impact in helping eliminate health hazards by changing workplace practices, adding controls, or by recommending procedures or equipment. Demand is high for these skills in small and large businesses, government agencies, and consulting firms. This is highly important and rewarding work.

EHS Mission and Objectives

The **mission** of Clarkson University's Environmental Health Science Program is to promote the prevention of illness and injury due to occupational and environmental hazards through education, training, and applied research.

Objectives:

- Recognize and evaluate types of occupational and environmental health hazards present in modern workplace and community environments.
- Study methods used to detect and quantify hazards, and the implement technologies used to control health hazards.
- Prepare students for a career in Environmental Health Science with a coordinated multidisciplinary education using a curriculum based on a strong foundation in mathematics, physical sciences, biology, engineering and health sciences such as toxicology and epidemiology.
- The program in Environmental Health Science stresses background in the basic sciences, specific course work in Environmental Health and safety, and Environmental Health Science experience gained through laboratory exercises in environmental monitoring, field trips, co-op and internships.

**Photograph on Left: Student dressed in Level B personal protective equipment in a simulation during a an OSHA HAZWOPER training course
**Photograph on Right: Clarkson faulty work closely with EHS and ES&P students on environmental research to improve the quality of our working and living

environments. Pictured here are students monitoring particulate at the Peace Bridge in Buffalo, NY.

Environmental Health Science: Sample Curriculum
BS in Environmental Health Science

FIRST YEAR FALL				FIRST YEAR SPRING		
BY140	Biology I	3		BY160	Cellular & Molecular Biology	3
BY142	Biology Lab	2		BY162	Cellular Biology Lab (Optional)	2
CM131	General Chemistry I w/Lab **OR** CM103 Structure & Bonding & CM105 Chemistry Laboratory I	4		CM132	General Chemistry II w/Lab **OR** CM 104 Equil. & Dynamics & CM106 Chemistry Laboratory II	4
MA180	Intro to College Math **OR** MA 131 Calculus I	4		MA181	Basic Calculus **OR** MA 132 Calculus II	3
EV100	Intro to Env. Science & Policy	1			Knowledge Area #1	3
UNIV190	The Clarkson Seminar	3				
FY100	Freshman Seminar	1				
	Total Credits	**18**			**Total Credits**	**15**
SECOND YEAR FALL				**SECOND YEAR SPRING**		
CM241	Organic Chemistry I	3		BY/CM/ENG Elective*		3
EV280	Environmental Science	3		BY/CM/ENG Elective*		3
PH141	Physics for Life Science I **OR** PH 131 Physics I	4		PH142	Physics for Life Science II **OR** PH132 Physics II	4
BY222	General Ecology	3		EHS309	Environ & Occupational Health	3
	Knowledge Area #2	3		EHS310	Intro to Industrial Hygiene Lab	2
	Total Credits	**16**			**Total Credits**	**15**
THIRD YEAR FALL				**THIRD YEAR SPRING**		
CM221	Spectroscopy[2]	3		CE340	Intro to Environmental Engineering	3
CM223	Spectroscopy Laboratory[2]	3		STAT318	Biostatistics	4
EHS405 or ES 433	Methods & Analysis Human Exposure Assessment +EHS 408 lab	4		BY/CM/ENG Elective*		3
EHS406	Industrial Hygiene Control Methods	3		Knowledge Area #3		3
EHS330	Occup. Safety and Ergonomics	3				
	Total Credits	**16**			**Total Credits**	**13**
FOURTH YEAR FALL				**FOURTH YEAR SPRING**		
BY/CM/ENG Elective*		3		EHS481	Advanced Topics in Env. Occup.	3
EHS416	Princ of Toxic. & Epidemiology	3		ES432	Risk Analysis[1]	3
EV400	Capstone Project	2		EV401	Capstone Project	1
Professional Elective		3		Free Elective		3
Knowledge Area #4		3		Knowledge Area #5 or University Course		3
	Total Credits	**14**			**Total Credits**	**13**

Note: Students must be registered for at least 14 credits to qualify for Dean's List or as a Presidential Scholar.
*BY/CM/ENG Elective includes any courses at the 300 or 400 level. Courses, sequences, and credits may vary depending on concentration chosen. Clarkson requires at least 120 credits for graduation.

[1] or other suitable Engineering/Technology course
[2] BY471 & 472 for the Ergonomic concentration

Environmental Health Science: Concentration Requirements

The EHS degree requires students to select one of **three concentrations** within the EHS program that allows students the ability to align themselves for a specific career or academic focus:

1) *Environment and Security*
2) *Ergonomics*
3) *Industrial Hygiene*

All students in the EHS degree will still be required to take the full EHS curriculum for the EHS degree, then select their upper-level electives from a designated course list to satisfy the chosen concentration. The Capstone Project (EV 400 and EV 401) will be required to be in the specific area of the concentration resulting in a minimum of 16 credits required for any given track.

The courses for the concentrations will consist of courses designated as "Science/Engineering Concentration courses" and professional electives in the 8 semester curriculum. The total credits for the concentrations are comprised of the science/engineering designated courses, professional electives and the capstone project.

Environment and Security Concentration.
Requires 20 or more credits as outlined below; completion of an approved concentration will be designated *on the student's transcript.*

Professionals in the field of EHS often interact and collaborate with professionals in criminal justice & homeland security; the inclusion of specific criminal justice courses will better prepare graduates for these interactions. While there are many aspects to security, the relationship to the environment will be considered here, including environmental, forensic, water, air, and energy.

Required Courses				**In addition, students may select 2 of the following courses from SUNY Canton***		
CM221	Spectroscopy	3		JUST230	Fundamentals of Homeland Security	3
CM223	Spectroscopy Lab	3		JUST326	Threats to Homeland Security	3
BY320	Microbiology I & Lab	3		JUST420	The Corporate Role in Homeland Security	3
BY322	Microbiology Lab	2		EM	Emergency Management Elective	3
EV400/401	Capstone Project, Environment & Security	3				

*Other suitable Criminal Justice/Homeland security courses can be approved by the Director of the ISE or designee.

Ergonomics Concentration.

Requires 16 or more credits as outlined below; completion of an approved concentration will be designated on the student's *transcript.*

Currently ergonomic related injuries are one of the largest causes of workers compensation costs to US industry. Ergonomic related injuries or workplace musculoskeletal disorders (MSDs) are one of the most significant occupational safety and health problems in the United States, according to the NIOSH.

Required Courses				**In addition, students must select at least 2 of the following courses***		
BR200	Intro to Biomedical & Rehab Engineering	3		ME380	Special topics Biomechanics (MA132, PH131 pre-requisites)	3
EHS330	Occup. Safety and Ergonomics	3		BY350	Comparative Anatomy	3
				BY360	Comparative Physiology	3
EV400/401	Capstone Project, Ergonomics	4		BY460	Neurobiology	3
				BY471	Anatomy & Physiology I	3
				BY472	Anatomy & Physiology II (BY471 pre-requisite)	3

* Other suitable course Ergonomics related courses can be approved by the Director of ISE or designee.

Industrial Hygiene Concentration.

Requires 19 or more credits as outlined below; completion of an approved concentration will be designated on the student's transcript.

Industrial hygiene involves the recognition, evaluation and control of health hazards arising in or from the work environment. The ability to qualitatively and quantitatively assess work and community exposures to hazardous agents, and then develop effect control strategies to minimize the risk or harm to workers and the general public highly is a highly sought after skill set.

Required Courses				**In addition, students may select following courses as electives**		
CM221	Spectroscopy	3		OM380	Project Management	3
CM223	Spectroscopy Lab	3		POL470	Environmental Policy	3
EHS	330 Occ Safety and Ergonomics	3		BY471	Anatomy and Physiology I	3
				CE 340	Intro to Environmental Engineering	3
EV400/401	Capstone Project	3				

Recommended Electives for EHS majors (all concentrations).

Recommended Business Electives				**Recommended Knowledge Areas**		
OS286	Organizational Behavior I			LW466	The Law of the Workplace	
EV360	Env Economics (Pre-req EC150 Microeconomics)			PHIL370	Environmental Ethics	
OM371	Strategic Sourcing			POL470	Environmental Policy	
OM451	Quality Mgmt & Lean Enterprise			POL471	Energy Policy	
OM380	Project Management			POL375	Environmental Law	
Recommended Engineering Electives				**Recommended Science Electives**		
CE301	Geographical Info Systems			MA239	Elementary Linear Algebra	
CE340	Intro to Env Eng			CM300	Instrumental Laboratory	
CE/CM477	Atmospheric Chemistry			BY320	Microbiology	
CE479	Water & Wastewater Trmt Processes			BY471	Anatomy and Physiology I	
CE481	Hazardous Waste Mgmt Eng			BY472	Anatomy and Physiology II	
CE486	Industrial Ecology					
CE434	Sustainable Development Eng					
CE435	Groundwater Hydrology & Geochemistry					
ES436	Global Climate Change: Science, Eng & Policy					

Notes:
Adirondack semester is a very beneficial set of courses (see Adirondack semester section of this handbook).
There are additional electives acceptable for the major, check with program director or advisor.

Minor in Environmental Health Science

The requirements for a Minor in Environmental Health Science are list below. This minor is available to all undergraduate students (except EHS majors). The Minor will enable students to satisfy the accreditation requirements of their particular major while focusing electives on pertinent courses in Environmental Health Science. Electives used to satisfy requirements of the Minor include science and engineering courses that address the core concepts of Environmental Health Science as defined by the American Board of Environmental Health Science. Students will receive a Bachelor of Science degree in their major with a Minor in Environmental Health Science.

Required Courses				**Any one course from the following[1] (Prof. Elective)**		
EHS309	Environ & Occupational Health	3		CE380	Fundamentals of Env. Engineering	3
EHS310	Intro to Industrial Hygiene Lab	2		CE477	Atmospheric Chemistry	3
EV280/CE340	Env Science **or** Intro to Env Eng	3		CE479	Water & Wastewater Treatment Processes	3
				CE481	Haz. Waste Mgmt Engineering	3
Any two courses from the following (EHS Elective)				CE580	Environmental Chemistry	3
EHS330	Occupational Safety and Ergonomics	3		CM371	Physical Chemistry I	3
EHS405	Methods and Analysis	4		BY320	Microbiology	3
EHS406	Industrial Hygiene Control Methods	3		BY425	Biological Systems & Env. Change	3
EHS416	Principles of Tox. & Epidemiology	3		BY471	Anatomy & Physiology I	3
EHS481	Adv. Topics in Env. & Occ. Health	3				
ES432	Risk Analysis	3				
CE433	Human Exposure	3				
Total Credit Hours for Minor (minimum): 17						

Note: In addition to the required courses, it is recommended that STAT282 or STAT383 or STAT318 Statistics be taken as a mathematics elective course for this minor. A minimum grade point average of 2.0 is required in the courses taken for the minor.

[1] or other suitable science elective approved by the Director

Minor in Environmental Health Science Worksheet

Students will receive a Bachelor of Science degree in their major with a Minor in Environmental Health Science.

Student Name **Student #**

Signature **Email**

Phone **Major**

Director's Signature

Required:	**Credits:**	**Grade:**
EHS309 Environ & Occupational Health	**3**	
EHS310 Introduction to Industrial Hygiene Laboratory	**2**	
EV280 Environmental Science or CE340 Intro to Env Eng.	**3**	
Select two EHS Electives:		
EHS	**3**	
EHS	**3**	
OR		
ES432 Risk Analysis		
One additional Professional Elective:		
Elective:	**3**	
Total:	**17**	

*Additional course may be taken to fulfill the minor requirement with permission from the director.

Environmental Health Science: Projects and Career Opportunities

Class Projects & Research

- Industrial noise monitoring at Alcoa
- Air sampling for hazardous chemicals in "potlines" at Alcoa
- Sampling for mold contamination in homes with water damage
- Assessment of Ergonomic Factors in Clarkson University Classroom Design
- Exposure assessments of phenol and formaldehyde in cadaver teaching laboratories
- Exposure to lead at an indoor firing range
- Community Noise Project

Capstone Projects

EHS Students are required to complete a Capstone Project dealing with one of the many areas in Environmental and Occupational Health. Recent student projects include:

- Formaldehyde Exposure during Necropsies of Embalmed Ruminant Animals
- Exposure characterization for veterinary workers and veterinary lab to Isoflurane

Student Professional Organizations

- American Industrial Hygiene Association (AIHA), Clarkson University Student Chapter
- American Society of Safety Engineers
- NYWEA

After Graduation

Clarkson students that graduate with a degree in EHS have an outstanding placement record. Recent EHS graduates have been hired by companies such as:

- Alcoa
- Precision Castparts
- General Electric
- IBM
- OSHA
- Colden Corporation
- U.S. Environmental Protection Agency
- Mallinckrodt Pharmaceuticals
- Lockheed Martin
- Greystone, Inc.
- Global Foundries
- Dana Farber Cancer Research Ins.

Many EHS graduates from Clarkson pursue advanced degree programs. Among graduate schools where our students have recently enrolled include:

- University of Iowa
- Harvard
- University of Cincinnati
- University of Washington

- University of Michigan
- Clarkson University
- Upstate (NY) Medical University

Revised 10.01.2020

Environmental Science and Policy: Program Description

Clarkson's ES&P program prepares students to become leaders in addressing environmental challenges. Students in ES&P learn to master basic life science concepts, understand complex social and political systems, the subtlety of communication, understand the lessons of history, and become knowledgeable about environmental regulation and policy. The program prepares students by combining rigorous courses in the sciences with "big picture" courses in law, policy, economics, and ethics. Clarkson's ES&P program offers students a solid grounding in the tools and techniques of science and policy, as well as working knowledge of interdependence. The ES&P program also recognizes the importance of developing a deep and abiding awareness, respect, and affection for the natural world.

Serious, focused research is a requirement for ES&P students. Clarkson provides labs equipped with state-of-the-art technology. The highly qualified faculty gives students individual guidance. Faculty members also assist students in supervised internships during the summer, or work experiences relevant to your interests during the academic year.

The ES&P program is small and friendly, but its seriousness is difficult to underestimate. Although the ES&P program is rigorous in its demands, it is also flexible, allowing students to design and tailor a program suited to individual interests. Because the ES&P program offers so many varied choices, students have the opportunity to focus on their desired scientific field while maintaining a broad policy prospective.

Picture on Left: Students work together to preserve "Nature's Course," a natural wild area on Clarkson's campus where the Clarkson community can go to learn, relax, and simply enjoy the natural environment of the region without the need to travel.
Top Picture on Right: ADK Semester relaxation time
Bottom Picture on Right: Students participate in a campus cleanup.

Revised 10.01.2020

Environmental Science & Policy: Sample Curriculum
BS in Environmental Science & Policy

FIRST YEAR FALL				FIRST YEAR SPRING		
BY140	Biology I	3		BY160	Cellular & Molecular Biology	3
BY142	Biology Lab	2		BY162	Cellular Biology Lab (Optional)	2
CM131	General Chemistry I w/Lab **OR** CM103 Structure & Bonding & CM105 Chemistry Laboratory I	4		CM132	General Chemistry II w/Lab **OR** CM 104 Equilibrium & Dynamics & CM106 Chemistry Laboratory II	4
MA180	Intro to College Math **OR** MA 131 Calculus I	4		MA181	Basic Calculus **OR** MA 132 Calculus II	3
EV100	Intro to Env. Science & Policy	1			Knowledge Area #1	3
UNIV190	The Clarkson Seminar	3				
FY100	Freshman Seminar	1				
	Total Credits	**18**			**Total Credits**	**15**
SECOND YEAR FALL				**SECOND YEAR SPRING**		
BY222	General Ecology	3		Physic II		4
BY224	General Ecology Lab	2		POL 260	Public Policy[1] (KA # 2)	3
EV280	Environmental Science	3		Prof. Science/Engineering/Math Elective[3]		3
PH141	Physics I	4		EHS309	Environ & Occupational Health	3
CM241	Organic Chemistry I	3		EHS 310	Intro to Industrial Hygiene Lab	2
	Total Credits	**15**			**Total Credits**	**15**
THIRD YEAR FALL				**THIRD YEAR SPRING**		
POL470	Environmental Policy	3		COMM 428	Environmental Communication[2]	3
POL 220	American Poltics[2]	3		EC360	Environmental Economics' (KA#3)	3
CE301	Geographical Information Systems	3		BY 320 Microbiology		3
EC150	Microeconomics	3		POL375	Environmental Law[1]	3
EV305	Sustainability & the Environment	3		Free Elective		3
	Total Credits	**15**			**Total Credits**	**15**
FOURTH YEAR FALL				**FOURTH YEAR SPRING**		
EV400	Capstone Project	2		ES432	Risk Analysis	3
Prof. Science/Engineering/Math Elective[3]		3		EV401	Capstone Project	1
Knowledge Area #4		3		Knowledge Area #5 (UNIV course)		3
Free Elective		3		Free Elective		3
Free Elective		3		Free Elective		3
	Total Credits	**14**			**Total Credits**	**13**

*Courses, sequences, and credits may vary. Clarkson requires at least 120 credits for graduation.

[1] or other suitable **Core Policy Elective**

[2] or other suitable Hum/Social Science Elective

[3] or other suitable Science or Engineering, or Math Elective

Environmental Science & Policy: Professional Electives

Professional Electives are defined as electives appropriate to the professional and career objectives of students in the ES&P Program. Professional electives are typically upper-level courses (300-level or above) chosen with the advice and consent of the student's advisor, and focused on a minor, concentration or double major (in Biology, Chemistry, Environmental Engineering, Environmental Health Science, Law, or Technical Communications, for example). The following courses are suitable professional electives in the ES&P Program.

Science/Engineering Electives (select minimum of 2)				
BY214	Genetics		CE330	Water Resources Engineering
BY302	Plant Science of Northern NY		CE340	Intro to Environmental Engineering
BY304	Zoology		CE413	Geology for Engineers
BY328	Conservation Biology		ES436	Climate Change
BY330	Great Lakes Water Protection		CE477	Atmospheric Chemistry
BY340	Behavioral Ecology & Sociobiology		CE479	Water and Wastewater Treatment
BY358	Animal Learning and Cognition		CE481	Hazardous Waste Management
BY420	Evolution		CE486	Industrial Ecology
BY425	Biological Systems & Environ. Change		EHS330	Occupational Safety and Ergonomics
BY431	Limnology		EHS405	Methods and Analysis
CM221	Spectroscopy		EHS406	Industrial Hygiene Control Methods
CM223	Spectroscopy Lab		EHS416	Princ. of Toxicology & Epidemiology
CM300	Instrumental Lab		EHS481	Advanced Topics in EOH
			EV435	Groundwater Hydrology & Geochemistry
Core Policy Related Course (select min of 2 of 5)				
POL 260	Intro to Public Policy		POL 375	Environmental Law
LW 270	Law and Society I		POL 471	Energy Policy
PHIL 370	Environmental Ethics			
Humanities/Social Science: ENVIRONMENTAL AND SUSTAINABILITY ELECTIVES (Select 2 (6 Credits) of the following)[2]				
ANTH225	Culture and the Environment		POL220	American Politics
BY 330	Great Lakes Water Protection		POL250	Politics in Cross-Nat. Perspective
COMM 428	Environment Communication		POL301	Political Theory
LW466	The Law of the Workplace		POL302	Social and Political Thought
LW471	Law and Society II		POL341	Professional Ethics
PHIL341	Professional Ethics		POL 374	Environmental Political Theory
PHIL405	Sustain. Theory & Practice: A Critical Asses.		SOC 330	Health, Wealth, Inequality and the Environment
PHIL410	Where the Wild Things Are			
POL 350	Intl. Development and Social Change			
ADK Semester Classes (students accepted into the ADK Semester)				
CE301	Geographical Information Systems (Sc/Eng)		EV316	ADK Env. Science (Sc/Eng)
EV312	ADK Ecology & Env. Science		EV320	Social & Political Issues ADK

	(Sc/Eng)			(Policy)
EV314	ADK Integ. Research Project (Sc/Eng)		EV322	ADK: A Sense of Place (Policy)
EV315	Entrepreneurship & Ec Dev in ADK (Policy)			

***Additional courses may be taken pending permission from the program director. Some professional electives require prerequisites.**

Minor in Environmental Science or Policy

Minors in Environmental Science or Environmental Policy are split between environmental science and environmental policy elective choices. The courses listed here offer examples; substitute courses may be taken to fulfill the minor requirements with permission from the director.

For the Environmental Science Minor:

1. 15 credits of environmental science, nine credits of which must be in the 300 level or higher courses. Courses are selected from Category I. EV 280 Environmental Science is required for the science minor
2. Six credits of environmental policy. Courses are selected from Category II.
3. One option from Category III

No more than six (6) credits of the engineering classes can be applied towards an Environmental Science Minor. Note: Please check for pre-requisites for many of these courses

For the Environmental Policy Minor:

1. 15 credits of environmental policy, nine of which must be in the 300 hundred level or higher courses. Courses are selected from Category II.
2. Six credits of environmental science. Courses are selected from Category I.
3. Three credits spread across the following areas:
   a. An independent research project
   b. An ES&P Multidisciplinary Project Course
   c. One option from Category III.

Category I: Environmental Policy **15 credits of Policy course and 6 credits of Science course**				
ANTH255	Culture and the Environment		PHIL370	Environmental Ethics
COMM428	Environmental Communication		PHIL405	Where the Wild Things Are
COMM429	Full Stack Development		PHIL410	Sustainability: Theory and Practice
EC360	Environmental Economics		POL220	American Politics
ES436	Global Climate Change: Sci, Eng & Policy		POL250	Politics in Cross-National Perspective
EV314	Adirondack Integrated Research Project		POL260	Public Policy
EV/EC315	Entrepreneurship & Econ. Dev. in ADK		POL371	Environmental Law
EV322	Adirondack Park		POL400	Constitutional Law
EV/SS320	Social & Pol. Issues in the ADK		POL470	Environmental Policy
LW270	Law & Society I		POL471	Energy Policy
LW466	Law of the Workplace		SOC330	Health, Wealth, Inequality & the Environ.
LW471	Law and Society II			
OM451	(EM451) Quality Mgmt and Lean Enterprise			

Category II: Environmental Science 15 credits of Science course and 6 credits of Policy course				
BY140	General Biology I		CE486	Industrial Ecology
BY160	General Biology II		CE491	Senior Design Project
BY222	General Ecology		CH434	Air Pollution Controls
BY224	General Ecology Lab		CM221	Spectroscopy
BY314	Genetics		CM223	Spectroscopy Lab
BY320	Microbiology		CM371	Physical Chemistry
BY322	Microbiology Lab		CM476	Atmospheric Chemistry
BY328	Conservation Biology		ECE470	Hydraulic Engineering
BY340	Behavioral Ecology and Sociobiology		EHS309	Environ & Occupational Health
BY420	Evolution		EHS310	Intro to Industrial Hygiene Lab
BY425	Biological Systems and Environ. Change		EHS405	Methods and Analysis
BY431	Limnology		EHS416	Principals of Toxicology & Epidemiology
CE301	Geographical Info Systems		ES432	Risk Analysis
CE340	Intro to Environmental Engineering		EV/CE435	Groundwater
CE380	Fundamentals of Env. Engineering		BY/EV312	Adirondack Ecology & Env. Science
CE474	Engineering Hydrology		EV314	Adirondack Integrated Research Project
CE479	Water & Wastewater Treatment Processing		EV316	Adirondack Environmental Science
CE481	Hazardous Waste Management		BY/EV330	Great Lakes Water Protection
CE482	Env. Systems Analysis Design			
No more than 6 credits of the engineering classes can be applied towards an environmental science minor.				

Category III: Three courses spread across the following areas (can be projects from classes or specific courses)		
Project based courses; pick ONE of the following:		
EV100	Intro to Environmental Science & Policy	***OR***
EV305	Sustainability & the Environment	***OR***
Adirondack Semester courses		

***Additional courses may be taken to fulfill the minor requirements with permission from the director.**
****Complete the university requirements for knowledge areas, communication points, technology serving humanity course, and the professional experience.**

Environmental Science and Policy
Projects and Career Opportunities

Student Projects

ES&P students are required to complete a Capstone Project dealing with one of the many areas in Environmental Science and Policy. Recent student projects include:

- Anaerobic Digestion and Analysis of Microbial Community Dynamics Acclimating to Ammonia Inhibition.
- Effects of differing agricultural practices on soil carbon and nitrogen stocks.
- Is Geothermal a More Environmental Sustainable Means of Heating and Cooling Residential and Commercial Buildings in the Northeastern United States?
- Results of translocations of spruce grouse from Maine and Ontario to New York to boost local populations and help maintain long-term population viability in New York.
- Investigating the Potential for Community Composting in Potsdam, NY.
- A Study of Mercury Concentrations in a Local Aquatic Ecosystem and a Review of Mercury Ecotoxicity.
- An Analysis of Carbon Sequestration on Clarkson University's Campus

Student Professional Organizations

- Synergy
- NYWEA

After Graduation

ES&P graduates are finding job opportunities in numerous places. Our graduates have worked at, or are currently employed with:

- Ducks Unlimited
- Northern Ecological Associates
- NYC Department of Environmental Protection
- Dynamac
- Washington State Environmental Conservation Agency
- New York State DEC
- Hamilton College
- Regional, County, and Local Environmental Agencies
- Arcadis
- EA Engineering

Many ES&P graduates from Clarkson pursue advanced degree programs. Among graduate schools where our students have recently enrolled include:

- Albany Law School
- University of Arizona

- Rochester Institute of Technology
- SUNY School of Environmental Science and Forestry
- University of Washington
- Harvard

Popular Minors among EHS and ES&P Students

BIOLOGY			
Required Courses (9 credits)		**Elective Courses (9 credits)**	
BY140	Biology I-Inheritance, Evolution & Diversity	Students must take at least 9 credits of biology courses numbered 300+	
BY160	Biology II-Cellular & Molecular Biology	**Lab Requirements (2 credits)**	
At least ONE of the following:		Students must take at least one of the following:	
BY214	Genetics	BY224	General Ecology Lab
BY222	Ecology	BY142	Biology I Lab
BY320	Microbiology	BY162	Biology II Lab
BY360	Physiology	BY322	Microbiology Lab
		BY362	Physiology Lab

CHEMISTRY			
Required Courses (9 credits)		**Students must take 5 of the 14 listed courses, including at least 1 lab**	
CM103	Structure and Bonding	CM221 Spectroscopy	CM320 Sep. & Electrochem
CM104	Chemical Equilibrium & Dynamics	CM223 Spectroscopy Lab	CM345 Advanced Lab
CM105	Chemistry Lab I	CM241 Organic Chemistry	CM371 Phy. Chemistry I
CM106	Chemistry Lab II	CM242 Organic Chemistry II	CM372 Phy. ChemistryII
CM131	General Chemistry I	CM244 Organ Chemistry Lab	CM460 Biochemistry I
		CM300 Instrumental Lab	CM461 Biochemistry II
		CM312 Intro to Inorganic Chem	CM470 Biochem/BioTech Lab

ENVIRONMENTAL ENGINEERING			
Core Required Courses (2)		**Other Professional Electives**	
Complete one of:		BY314	Bioinformatics
CE340	Intro to Env Engineering	BY328	Conservation Biology
CE380	Fundamentals of Env Engineering	BY412	Molecular Biology Laboratory
CH220	Materials Balances	BY425	Biological Systems & Env. Change
Complete one of:		BY431	Limnology & BY432 Limnology Lab
Capstone with specific environmental focus		BY486	Molecular Biotechnology
Environmental related research		CE430	Water Resources Engineering II
Complete One Chemical Principle course:		CE434	Sustainable Development Engineering
CH210	Chem. Engineering Principles	CE435	Groundwater Hydro. & Geochemistry
CH221	Spectroscopy	CE477	Atmospheric Chemistry
CM241	Organic Chemistry I	CE478	Solid Waste Mgmt & Landfill Design
CM371	Physical Chemistry I	CH434/	ES434 Air Pollution Control
Complete One Biological Principle course:		ES436	Global Climate Change: Sci/Eng/Policy
BY214	Genetics	EHS406	Industrial Hygiene Control Methods
BY222	Ecology & BY224 Ecology Lab	EHS416	Principles of Toxicology & Epidemiology
BY320	Microbiology	EV314	Adirondack Integrated Research Project
BY330	/EV330 Great Lakes Water Protection		
Complete Two of the following:			
Core Professional Electives (minimum One required):			
ES432	Risk Analysis		
CE479	Water and Waste Management Eng		
CE481	Hazardous Waste Management Eng		
CE482	Env. Systems Analysis & Design		

CE486	Industrial Ecology		

Environmental Science & Policy and Environmental Health Science Internship Guidelines

All students must participate in a project-based professional experience following the first year such as coop, internship, directed research, or community project related to ES&P or EHS.

Co-operative learning: Students involved in university co-op programs can meet program professional experience expectations by following departmental guidelines and procedures for internships. While co-op work experiences are normally more extensive than internships, they will be tracked as internships.

The University tracks all professional experiences using the software called "Handshake" which is managed by Clarkson's Career Center. The guidelines to accessing Handshake are listed below.

A professional experience must be at least 120 hours and related to your major. It can be paid or it can be a volunteer position.

Handshake

- Log into handshake to document your Professional Experience (https://clarkson.joinhandshake.com)
- Handshake is Clarkson's primary career development resource, it's an excellent way to learn about professional opportunities and how to prepare for them
- Build a profile for potential employers to review, and update it every semester
- Create a resume, have it reviews by the Career Center, and upload it to Handshake, it will automatically be listed in the Clarkson Knight Resume Book and you could choose to have it included in a co-op or internship resume book as well
- Search and apply for internships, co-ops or full-time jobs
- Research companies who recruit Clarkson students before speaking with them
- Learn about many Information Sessions, Workshops and Career Fairs that are scheduled throughout the academic year
- Schedule on-campus interviews
- Receive notifications from the Career Center about opportunities in your field based upon your profile
- **Document your Professional Experience for approval from the ES&P or EHS programs.**
- **Please communicate with your Advisor to assure your professional experience will meet the guidelines for your major. (ES&P & EHS)**

Adirondack Semester - Curriculum Overview

The Adirondack Semester is a 15-credit, off-campus domestic study program for undergraduates pursuing an experience that is enriching both academically and culturally. Students from any major who are committed to learn about environmental science, policy, economics and the human history and contemporary issues of the Adirondack region are encouraged to apply.

The Adirondack Park is the largest park in the contiguous states and is referred to as a great experiment in conservation and regulated economic development. Our mission is to deliver a blend of traditional and experiential education developed from the struggle in the park to find balance and sustainability. Students residing at Paul Smith's College, near Saranac Lake, NY, participate in an interdisciplinary curriculum geared toward cultivating practical skills for the professional world. Our curriculum employs components of experiential education, undergraduate research, collaborative assignments and projects, writing-intensive courses, learning communities, common intellectual experiences and community-based learning. Students acquire content knowledge to analyze complex problems related to environmental, social and economic sustainability.

Students accepted in this program will learn from Clarkson faculty, all of whom are distinguished scholars who have worked in the Adirondacks. Students will be in session with Adirondack Park leaders, policy makers, residents and business owners and learn from peers in mentored team projects. Focus is on the Adirondack Park’s social and natural sciences: its expansive wilderness, residents, governing agencies, economics, organizations and businesses that shape policies and commerce.
Students can attend a fall or spring semester that begins with a three-week "Sense of Place" course, followed by two six-week blocks that run two courses concurrently. The final week of the semester, students present their integrated research projects back on Clarkson’s campus.

Adirondack Semester - Student Life

Students reside and attend Clarkson ADK Semester classes at **Paul Smith's College**, near Saranac Lake, NY. The campus housing is suite-style living and provides students with laundry facilities, Wi-Fi access and an inviting communal space with a small kitchen. Just a fifteen minute drive from Paul Smith's, the Saranac Lake business district hosts a vibrant arts culture, bustling storefronts, cozy pubs, restaurants and music venues. Many agencies and organizations within Saranac Lake that govern and advocate for issues in the Adirondacks are comprised of passionate and colorful people who live, work and love life in the Adirondack Park.

Saranac Lake, NY: "The Adirondacks' Coolest Place"

- Named the best small town in New York State
- Ranked 11th in the United States in The 100 Best Small Towns in America
- Recognized by the National Civic League in 2006 as an All-America City
- Named one of the Dozen Distinctive Destinations by the National Trust for Historic Preservation

Our students are encouraged to work hard to keep pace with the curriculum, but flexibility and breaks in the schedule allow for time to pursue personal interests as well. Outdoor and cultural activities abound. Choose your own adventure! Opportunities include paddling on St. Regis Lake, mountain bike riding on the various trails throughout campus and hiking up St. Regis Mountain to breathtaking views of the High Peaks.

Other nearby outdoor activities include camping, rock and ice climbing, skating, downhill skiing, XC skiing, backcountry skiing, mountaineering and fly fishing. The Olympic Village of Lake Placid is a 35-minute drive away and provides a variety of venues for winter activities, such as world-class skiing at Whiteface mountain, Nordic skiing, bobsledding, luge, biathlon at Mt. Van Hoevenberg and visiting the home rink of "The Miracle on Ice" at the Olympic Center and Museum.

Adirondack Semester - Curriculum

Offered in the fall semesters: A small group of up to 12 students will be in session with a diverse group of Clarkson faculty with specific interests, experience and scholarly work directly related to the Adirondack Park. Our mission is to deliver a dynamic blend of traditional and experiential education in an intimate and community-based learning environment. Students strive to answer broad questions concerning the relationship of social, economic and environmental impacts on the Adirondack Park. They are absorbed in interdisciplinary courses in the natural and social sciences and emerge with critical thinking and collaborative skills that prepare them to analyze complex problems and provide solutions related to environmental, social and economic sustainability.

Faculty involved in chemistry, biology, environmental science, political science, philosophy, literature, economics and entrepreneurship use our Adirondack base and professional network to provide students with a direct experience with the people and agencies that shape policy, conduct business and lobby at local and state levels. Students are engaged through conversations in the classroom with their peers, professors and guest lecturers and in the community with local citizens, all while conducting scientific research in the field.

The curriculum consists of five 3-credit courses providing students with 15 transferable 300-level credits. Each semester offers two University courses, four to five varied Knowledge Area courses, four to five Communication Points, one to two Design Credits for Environmental Engineering students and a Science TECH Credit.

Adirondack Semester - Course Descriptions

CE301 Geographical Information Systems:
An introductory course in the concepts and uses of Geographic Information Systems (GIS) including analysis of GIS-based local and global geographic datasets. Provides basic knowledge of GIS theory and applications using existing state-of-the-art GIS software and current spatial data resources. Applications include: overlay analysis, spatial data query, map generation and terrain surface analysis. Students will also learn the basics of GPS data collection, remote sensing, 3D visualization, probability, statistics, and error analysis.

EV312 - Adirondack Ecology and Environmental Science:
This course introduces ecological and environmental science concepts relevant for understanding the structure and function of terrestrial, aquatic, and human systems in the Adirondack Park. Students will learn to identify important plant and animal species representative of the Adirondack Mountains, and learn major features of ecological systems in the Park. The course will also provide the students an assessment of human impacts on the ecology of the Adirondack Park.

EV314 - Adirondack Integrated Research Project:
This problem-based learning course will task students to analyze and suggest solutions to a complex problem relevant to the economic, social, and environmental welfare of the Adirondack Park. This course is intended to reinforce what they have learned in other Adirondack courses.

EV315 - Entrepreneurship and Economic Development in the Adirondacks
This course will explore the characteristics of the entrepreneurs of the park while also understanding the opportunities and challenges that these entrepreneurs face. It will also explore the theories of externalities and public goods applied to pollution and environmental policy. The students will analyze the options for encouraging entrepreneurship and achieving economic development goals within the Adirondack Park.

EV316 – Adirondack Environmental Science:
A brief history of air, soil, and water pollution in the Adirondacks followed by an investigation into the major sources and concerns of pollution in the region. Through lectures and laboratory experiences the following areas will be studied: air, water, and soil quality parameters and their measurements, material and energy balances, water, air and soil chemistry concepts, toxicology, and risk assessment.

EV 320 - Social and Political Issues in the Adirondacks
The historical, social, political, and environmental factors contributing to the fabric of the Adirondack Park is an evolving social experiment. The course readings will focus upon the New York State constitutional provisions that engendered the park, the policies that shaped the park, along with the political actions that influence the park today. The Adirondack State Park is extraordinary for its history and because it is a place where human residents live and recreate in sustainable ways that conserve resources and 'forever wild' regions of the park.

EV322 – Adirondack Park : A Sense of Place:
To understand a place, one must often understand the views of nature and the environment as seen by writers and essayists. Students will explore the Adirondacks through literature while experiencing the lakes, rivers, streams, and mountains. The readings, discussions, and written assignments will explore the aesthetics, the social and political climate, and the prevailing attitudes toward the environment that helped create the Adirondack Park. In addition, the course will provide students will an opportunity to participate in seasonal outdoor activities to learn how recreational activities have impacted the social, cultural, economic, and physical aspects of the Park.

Student Resources

Add/Drop a Course

- You can add and drop classes through myCU (PeopleSoft), for detailed instructions go to https://intranet.clarkson.edu/student-life/sas/peoplesoft-info.
- Students may add a course through the 10th day of classes with the approval of their academic advisor, department chair, program director or designee. The course add may be done by the student online.
- In order to add a course AFTER the 10th day, a student must obtain written approval from the following persons: their academic adviser, their department chair or program director, the instructor of the course that is being added late, and the Dean of the School in which the student is majoring. These approvals will be shown by signatures on the add-drop form.
- A student may drop a course through the 10th day of classes of a semester after consultation with their academic adviser, department chair, program director or designee. Course drops may be done by the student on-line through the 10th day of classes.
- After the first two weeks of classes and not later than the last day of classes (i.e. the business day preceding the first day of final examinations in the fall semester; business day preceding the first reading day in the spring semester), a student may drop a course. A student must consult with their academic adviser to obtain their signature on the drop form, and then the student must obtain the signature of either the instructor, department chair, program director or designee of the department offering the course. These signatures are required for verification only, and do not denote approval. After the fourth week of classes, Student Administrative Services shall make a permanent notation on the student's transcript assigning the course a grade of W (withdrew between 5th and 10th week) or LW (late withdrawal after the 10th week).
- Students should be aware that adding or dropping a course might change their tuition charges.

Cross-Registration at Associated Colleges

- You must be enrolled in 12 credits or more at Clarkson to be able to cross-register with one of the Associated Colleges.
- A cross-registration from and a copy of the course description must be taken to the chair or the executive officer of the corresponding department at Clarkson for approval of transfer.
- Be aware that enrollment for the course will occur a week before that class at the "host" institution begins. *If there is space, you will be able to take the class. In the event that a course is full, you will be notified via email.*

Off-Campus Forms

- Print and fill out an Off Campus form from https://www.clarkson.edu/sites/default/files/2018-05/off-campusformfillable.pdf.
- Print the course description you would like to have evaluated.
- Bring the Off-Campus Form and the course description to the chair or the executive officer of the department of that course.

Business	Associate Dean	Snell 327
Communication & Media	Department Chair	Snell 165
Engineering	Clarkson Course Instructor	
Humanities & Soc. Sciences	Dr. Alastair Kocho Williams	Snell 276
Physics	Dr. Dipankar Roy	Science Center 269
Chemistry	Dr. Silvana Andreescu	Science Center 123
Math	Dr. Joe Skufca	Science Center 355
Psychology	Dr. Andreas Wilke	Science Center 171
Biology	Dr. Michael Twiss	Science Center 177

- Bring the completed form and course description to your advisor.

Career Center

- www.clarkson.edu/career
- Make contact with the staff of the Career Center in the ERC to find out what they can do for you.
- Make sure to attend Career Fairs held every fall and spring semester to check out various companies where you can learn about co-op and internship opportunities that are available to you.

International Center and Study Abroad

- www.clarkson.edu/international-center
- A semester exchange is usually completed in the junior year through exchange programs that Clarkson has with universities in countries such as Australia, Austria, Denmark, England, France, Germany, Hong Kong, Ireland, Korea, Mexico, Scotland, Singapore, South Korea, and Sweden.
- To find out more details, contact the Career Center or visit their website.
- A minimum of 12 transferrable credits must be successfully completed with a C or above to maintain full time status.
- You must complete an application through CU Global at https://clarkson-horizons.symplicity.com
- Participation in the Study Abroad Exchange Program requires that you have at least a 3.0 cumulative GPA. You must also research curriculum requirements so that you can ensure that you will have all necessary prerequisites and courses.

Environmental Health Science & Environmental Science & Policy
Course Descriptions

EHS309 Environmental & Occupational Health
This course will focus on the basic areas of responsibility of the industrial hygienist including recognition, evaluation and control of workplace hazards. Additional topics will include environmental, health and safety regulations and a survey of the health effects of typical workplace stressors such as toxic and hazardous chemicals, noise, and temperature extremes.

EHS310 Introduction to Industrial Hygiene Laboratory
This is a lab course that meets for three hours a week. The course consists of weekly labs. Students must prepare lab reports on a weekly basis. These lab reports are evaluated for consistency, accuracy, presentation and overall quality. The course ends with students individually presenting scenarios that encompass knowledge gained over the length of the course. Students are expected to communicate knowledge of both environmental health and public health. In addition, each student must prepare a final report to accompany their presentation. The written material will be critiqued by the instructor and feedback will be provided to each student. A portion of the labs will be dedicated to instruction on writing and presentation skills.

EHS330 Safety Analysis – Occupational Safety and Ergonomics
This course will provide students with an overview of the contemporary Environmental, Health and Safety (EHS) management techniques for occupational settings. The EHS management systems of today have evolved over many years (ISO 14001, ISO 45001). The Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency are the primary regulatory organizations in the United States. However, compliance is the minimum standard of care. Cost effective systems to minimize risk among the community and workers as well as ensure compliance with state and federal regulation must include a comprehensive and integrated Environment, Health, and Safety Management System (EHS-MS) that is sustainable for the long term. The course will introduce techniques used to assess the risk of injury including job safety analysis, fault tree analysis, systems safety and design for safety. In addition, this course will provide the students with the fundamental elements of occupational ergonomic assessments, risk factors and controls. The course will be a combination of lectures, case studies and projects.

EHS405 Methods and Analysis
This course is a combined lecture/laboratory course. Students complete nine full laboratory assignments requiring complete reports (~10 pages) to be turned in weekly or bi-weekly. Students are provided feedback on content and writing mechanics (technical reporting) and are offered (sometimes requested) the opportunity to resubmit.

CE433 Human Exposure Analysis
Human exposure analysis is an emerging science concerned with how humans come into contact with chemicals in the environment via inhalation, ingestion, and dermal contact. The course focuses on scientific and engineering issues, including direct measurement and model constructs. Students gain an understanding of the complexities, uncertainties, and physical, chemical, and biological issues relevant to human exposures resulting from the use and release of toxic compounds. Topics include human exposure analysis terminology, pollutant fate and transport, human activity patterns, occupational exposure, indoor

air quality, dosimetry, and statistical and mechanistic tools for exposure assessment. For the final project, the students design and perform a small-scale human exposure study using monitoring instruments and/or exposure models.

EHS406 Industrial Hygiene Control Methods
Various ways to prevent and solve common industrial hygiene problems will be considered; topics will include typical engineering controls, administrative controls, and personal protection to control chemistry exposure and releases. In addition, controls for temperature extremes, noise and vibration exposure, and ergonomic stressors will be studied. About two-thirds of the course is devoted to industrial exhaust ventilation design. (2 credits of design, for Civil and Environmental Engineering Majors)

EHS416 Principles of Toxicology and Epidemiology
This is an introductory course in toxicology and epidemiology. Toxicology is the study of the harmful interactions, including absorption, distribution, metabolism and disease effects, of chemical, biological and physical agents with biological systems, when administered by accident or design. Epidemiology is the study of the distribution and determinants of disease frequency in populations exposed to these toxicants and stressors. The first two thirds of this course will focus on the toxicological interaction and effects of environmentally and occupationally derived toxicants with the human body. The last third of the course will focus on the epidemiological tools to evaluate the risk of exposure to such toxins, and will examine, in detail, several important historical and recent case studies of toxic exposures to individuals and populations in the home, the outdoor environment, and the workplace. Toxicology and Epidemiology are important sciences that provide a sound basis for developing measures to reduce the risk of human exposure to toxic chemicals and agents.

EHS481 Advanced Topics in Environmental and Occupational Health
This course is a project based course that requires students to work on a broad array of topics in environmental health. Students will have multiple projects (6-8) running simultaneously and each will require writing assignments and presentations. Literature and text reviews will be necessary for most of the projects. Group communication skills are also developed as some projects are done in groups. Course work and lab preparation call for combining both lab work and lecture material in a cohesive and accessible format. The course also involves consistent review of student work by the instructor, in the form of both written and oral feedback. It also requires for a minimum of three oral presentations by individuals.

EHS490 Internship/Co-op
Students who obtain a summer or semester internship/co-op position may obtain credit for the work experience by registering for this course the semester following the position. Students will be required to keep a journal of work activities and submit the journal entries to the EHS Program Director. During the semester following the internship/co-op, a 10-page report on some aspect of their work experience and a 30-minute presentation will be required.

EHS494/495 Research in Environmental Health Science
Students who obtain a (summer) internship/co-op position may obtain credit for the work experience by registering for this course the semester following the position. Students will be required to keep a daily journal of work activities and submit the journal entries to the EHS Program Director every two weeks.

During the semester following the internship/co-op, a 10-page report on some aspect of their work experience and a 30 minute presentation will be required.

EC360 Environmental Economics
Economic analysis of problems caused by the impact of economic activities of society on the environment, and of the public and private policies that could be used for environmental improvement.

ES432 Risk Analysis
Risk assessment entails the evaluation of the hazardous properties of substances, the extent of human exposure to them and the characterization of resulting risk. It is a systematic approach to organizing and analyzing the scientific knowledge regarding potentially hazardous activities or substances. Variability and uncertainty are used to estimate the level of confidence in the risk assessment. The general approach to risk assessment including the use of default assumptions and uncertainty analysis will be presented along with illustrative examples. Graduate Students will be required to do additional work at the graduate level.

EV100 Introduction to Environmental Science and Policy
The purpose of this course is to introduce students to environmental science and policy issues. The course is an overview of local and global issues relating to safety, health, environmental science and policy, and industrial hygiene concerns in the community and the work place. Students will review journal articles on selected topics and attend 1-2 field trips to local industries. The course will provide an open forum for discussion of curriculum choices and career options in environmental science and policy.

EV280 Environmental Science
This course will investigate the key concepts and principles of environmental science emphasizing the earth's Biogeochemical cycles and how they have been perturbed by human activities. Quantitative analysis or air, soil and water quality on local, regional and global scales will be a significant component of the course. Emerging principles in environmental science, including sustainability, industrial ecology, risk assessment and the precautionary principle will be introduced. In addition to the quantitative aspects, the course will consider the historical, social, and political contexts in which the practice of environmental science takes place.

EV 305 Sustainability & the Environment
This course is an introduction to sustainability and the environment. Students are expected to harness initial knowledge from science, engineering and policy courses, to collectively address environmental problems, and issues on campus or in the local community. Class time is split between lectures on sustainability and the environment and a semester-long (real- world) project on a local or campus environmental problem. In addition, EV 305 allows for direct review and instruction on the quality of the written and oral communication by the students. Written and oral progress reports will be required throughout the semester by each student/group. The final paper and presentations are intended to be professional format to motivate change on campus or in the local community.

EV400 Environmental Science Capstone
This course follows the EV399 Capstone Proposal as the second in a two-course sequence that acts as the cornerstone of the Environmental Science and Policy Program. This course is an independent research course that involves several components of the scientific process. Weekly meetings with a

capstone advisor are required. At these meetings, work that has been completed will be evaluated and subsequent goals will be planned and established. In addition, several drafts of a final Capstone report will be written throughout the length of the semester. The final paper is meant to be similar to the process of writing a thesis, both in scope and quality. The final presentation of this course is designed to be the culmination of a student's experience in the Environmental Science & Policy Program, and it is presented to both faculty and fellow students.

EV401 Capstone Project (continuation)
This senior level course is the conclusion of the Capstone Project. The course is for students who have taken EV400 and will be finishing their Capstone Project. The course will conclude with a final paper and presentation.

EV490-492 Internship/Co-op
Students who obtain a (summer) internship/co-op position may obtain credit for the work experience by registering for this course the semester following the position. Students will be required to keep a daily journal of work activities and submit the journal entries to the ES&P Program Director every two weeks. During the semester following the internship/co-op, a 10-page report on some aspect of their work experience and a 30-minute presentation will be required

EV 494-496 Directed Research for Undergraduates
A research project will be completed; research projects may include laboratory projects, literature research, or individual study of environmental science, environmental engineering, and/or environmental policy topics not available in other
Clarkson courses.

BY222 Ecology
Ecology is the study of factors that control the distribution and abundance of species in nature. Ecological interactions will be explored at the individual through ecosystem level in terrestrial, freshwater, and marine habitats. Emphasis will be on fundamental ecology, but applications to human-related problems will be explored.

BY224 Ecology Laboratory
Field and Laboratory exploration of physical, chemical, and biological factors influencing animal and plant species, populations, and communities in upstate New York. Students will learn field and laboratory techniques in ecology and general identification of some organismal groups. Course will include required field trips to surrounding habitats and laboratory experiments.

BY320 Microbiology
This course will provide a fundamental introduction to the study of microbial life forms. The diverse biology of these organisms will be reviewed and application to human health and society, the natural environment, and biotechnology will be emphasized. Upon completion of the course, students will be capable of assessing microbial growth and metabolism and understand its applications in natural and engineered environments.

BY328 Conservation Biology
This course provides an overview of the core theory of conservation biology, and how conservation biology is applied for environmental conservation and management. Major topics of this course will include conservation prioritization, the problems of small population size on the long-term persistence of

a species, conservation genetics, habitat fragmentation and nature reserve design, invasive species, consequences of extinctions on an ecosystem processes and community structure, and the possible effects on biodiversity of global climate change. A course emphasis will be on the challenge of translating the core lessons of conservation biology to effective policy and environmental management. Prerequisites: BY222 or consent of the instructor.

BY425 Biological Systems and Environmental Change
Human activities are resulting in dramatic global environmental change, in the forms of biodiversity loss, altered biogeochemical cycles, introduced invasive species, chemical toxification of the environmental, climate change, unsustainable exploitation of natural resources, and habitat loss, degradation, and fragmentation. In this course, we will examine how these forms of environmental change disturb biological systems by critically reading key research papers and discussing their implications for future research and policy action.

BY431 Limnology
Limnology is the study of physical, chemical, and biological properties of fresh water bodies, e.g. lakes, rivers, reservoirs, and wetlands. This introductory course will provide an array of topics that will, by the multi-disciplinary nature of limnology, call upon students' knowledge of biology, chemistry, and physics and place them within the context of aquatic science. The focus of the instruction will be aquatic ecology at all levels of biological organization. Upon completion of the course, the student will be able to characterize the physical, chemical, and biological/ecological properties of a freshwater through the selection and application of appropriate sampling methods. Some fieldwork will be required.

CE 301 Geographical Information Systems
An introductory course in the concepts and uses of Geographical Information Systems (GIS) including analysis of GIS- based local and global geographic datasets. Provides basic knowledge of GIS theory and applications using existing state- of-the-art GIS software and current spatial data resources. Applications include: overlay analysis, spatial data query, map generation and terrain surface analysis. Students will also learn the basics of GPS data collection, remote sensing, and 3D Visualization.

CE340 Introduction to Environmental Engineering
An introduction to the fundamentals of environmental engineering and science. Discussion of the role of engineering in current and emerging environmental issues. Topics include materials balances, reactor flow models, and chemical fate and transport, with applications in natural and engineered environmental systems. Laboratory experiences included. (1 credit of design).

CE433 Human Exposure Analysis
Human exposure analysis is an emerging science concerned with how humans come into contact with chemicals in the environment via inhalation, ingestion, and dermal contact. The course focuses on scientific and engineering issue, including direct measurement and model constructs. Students gain an understanding of the complexities, uncertainties, and physical, chemical and biological issues relevant to human exposures resulting from the use and release of toxic compounds. Topics include human exposure analysis terminology, pollutant fate and transport, human activity patterns, occupational exposure, indoor air quality, dosimetry, and statistical and mechanistic tools for exposure assessment. For the final project, the students design and preform a small-scale human exposure model. (2 credits of design.) Prerequisites: Senior or graduate status in engineering or IH or consent of the instructor.

CE477 Atmospheric Chemistry
This course will cover the evolution of the atmosphere from its initial formation to its natural

background condition to its current state perturbed by human activities and reviews appropriate legislation; detailed descriptions of the chemistry of the carbon, nitrogen and sulfur cycles; characterization of the atmospheric aerosol and its role in heterogeneous reaction sand materials transport; stratospheric ozone and problems with its depletion; airborne radioactivity and its role in atmospheric ion chemistry.

CE481 Hazardous Waste Management Engineering
This course is an introduction to the emerging field of hazardous waste management. This course provides an understanding of environmental regulations, management techniques to minimize the generation and disposal of hazardous wastes, and technologies to treat wastes and remediate disposal sites. (1.5 credits of design)

COMM428 Environment Communication
The past twenty-five years have seen environmental issues increasingly debated both in public and in scientific forums. This course will focus on a variety of documents related to current environmental issues, many relevant to northern New York, in order to examine the rhetoric deployed in such documents by industry, environmental organizations, scientists, and politicians. Examples of topics include acid rain, pollution of the St. Lawrence River, and cleanup of an EPA Superfund site. Using contemporary rhetorical theories, we will examine the processes readers and writers engage in as they attempt to create effective environmental documents. Students will engage in discussion, critical reading, case studies, individual research, and possibly, field trips.

LW 270 Law and Society I
A course designed to provide a basic understanding of (1) the nature, functions and limitations of law and legal systems; (2) the basic relationship among justice, ethics, legal systems and social structure; and (3) the relationship among society, law and business activity. Further, it is designed to enlighten with respect to rules, principles, standards and doctrines of law fundamental to a free enterprise system. The course covers the substantive areas of constitutional law, torts, contracts, and property and estate law.

PHIL 370 Environmental Ethics

Environmental issues and concerns are of primary importance as we enter the 21st Century. This course examines the ethical and social approaches to preserving the planet's ecosystems and to developing an environmentally aware culture.

POL 375 Environmental Law
In this course we will be examining the relationship between the Courts and various policies, laws, and regulations pertaining to the restoration and management of the environment. The central issues in the cases we will be examining emerge from the tension between property rights and what has been conceived as a constitutional right to a clean, healthy environment. Areas where this tension plays out include: the Clean Air Act, the Clean Water Act, The Superfund Law, and the National Environmental Policy Act. In general, the course is designed to help students assess whether environmental laws provide us with a route for attaining ecological goals, and to think critically about the role of the Courts as a defender of the environment**.**

POL 470 Environmental Policy
Public policy is developed in response to problems or issues in society that are presumed, for whatever reasons, not to be resolvable by the private sector. In theory, public policy as it relates to environmental issues is used to intervene to alleviate problems, such as industrial pollution, that threaten the integrity of

the natural resource base and the natural and built environments on which our lives and livelihoods depend. However, public policy development and implementation in general and environmental policy in particular, are not immune to political forces and influences. Even scientific institutions that often provide the empirical basis for environmental policy are potentially influenced and shaped by the political process and political and economic interests. This course introduces students to the distinctive features or characteristics of environmental policy development and implementation. The course primarily focuses on the United States but includes international environmental issues and policies. The course will help students understand how environmental policy fits within the large-scale social and economic changes in the U.S. and elsewhere that have resulted in greater environmental awareness. We will also consider how scientific evidence is created and marshaled in support of competing interpretations of environmental problems, and the appropriate policies to address such problems. Case studies of particular environmental policies, such as regulation of transgenic crop development and commercialization, will be used to help students grasp the complexities of, and driving forces behind, environmental policy.

POL 471 Energy Policy

Energy policy is a critical component of state and national public policy. Issues surrounding the reliability and security of energy supplies directly affect national domestic and foreign policy, as well as state level environmental, economic development, and land use concerns. Via emphasis on specific issues unique to North American energy policy (US and Canada), the class will introduce students to the major theoretical frameworks used by political scientists, sociologists, economists, and other intellectual disciplines to understand how societies design and implement public policies related to energy, and how the energy industry responds. Topics covered will include theories of the state, monopoly and regulation, public choice, organizational behavior, international agreements, and innovation. The class will apply these theories to major current and historical issues in energy policy, such as ethanol, climate change, and renewable energy systems, nuclear power, energy efficiency, energy security, the world oil market, and OPEC, electricity production and markets and the California electricity crisis.

Additional relevant courses for EHS and ES&P can be found in the Clarkson Course catalog