Mary Eberhardt
Sabbatical Proposal Packet
September 13, 2019

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ABSTRACT

CCSU made a commitment to improving sustainability on campus over ten years ago and has had much success in this area, being nationally recognized as a "Green College". One component of assessing the university's sustainability program is the course offerings which directly address issues of sustainability. The Department of Chemistry and Biochemistry has no courses which address sustainability. This project aims to incorporate topics of sustainability into four introductory chemistry laboratory courses which annually service over 1100 students at CCSU. Laboratory experiments in CHEM 162, 201, 211 and 213 will be evaluated using the principles of Green Chemistry to reduce hazardous waste, seek renewable sources of raw materials, conserve energy and save money. Green Chemistry principles and the issues of sustainability will be incorporated into the laboratory manuals for the four courses. This project will increase the number of courses that address sustainability at the University and continue CCSU's efforts toward improving sustainability on campus.

Sabbatical Leave Request and Recommendation Form
BOT/AAUP Contract Article 13.7
BOT/ SUOAF-AFSCME Contract Article 24.8

Please Forward To Department Chair or Administrative Officer by September 13, 2019

Name _____Mary A Eberhardt_____ Date ___September 10, 2019_____
Department ____Chemistry and Biochemistry_____ AAUP _____ SUOAF-AFSCME _____X_____

Preferred Time of AAUP Sabbatical: Fall 2020___ Spring 2021___ AY 2020-2021___ (please check one)
Start and End Date of SUOAF-AFSCME Sabbatical: _____March 1, 2021 – August 31, 2021_____

Candidate Must Have Completed At Least Six Years Of Full-Time Service Since Initial Appointment Or Any Previous CCSU Sabbatical. (Candidates may apply in their sixth year of service; however only tenured members may take a sabbatical leave.)

Please Indicate Semester and Year of Appointment: _____June 28, 2013_____

Semester and Year of Last Sabbatical: _____NA_____

_____Check here if your sabbatical leave is dependent on your receipt of a Fulbright or other fellowship. If, yes, please be sure to include information and explanation of the fellowship in the narrative below including the anticipated date of notification of award.

Plan of Study

In preparing the application, please be specific and detailed, while keeping in mind that not all members of the Sabbatic Leave Committee will share your exact background.

I. Title of Project

Incorporating the Principles of Green Chemistry into 100 and 200 Level Chemistry Laboratory Courses

II. Statement of purpose (or hypothesis) and objective(s)

This project will investigate how the introductory chemistry laboratory courses can be made to be "more green" and "sustainable". The project will 1) increase my knowledge of Green Chemistry principles, 2) increase my knowledge of sustainability initiatives at academic institutions, 3) explore curriculum resources specific to undergraduate laboratory courses, 4) evaluate modifications to current Chemistry and Biochemistry Department laboratory experiments to improve the sustainability of the process, 5) evaluate the inclusion of novel laboratory experiments which illustrate green chemistry principles.

Background:
In Fall 2008 the Faculty Senate passed a resolution calling for all academic departments to take an active role in "promoting sustainability in all aspects of CCSU's academic life." The University has been nationally recognized for its efforts toward improving sustainability on campus in the 2009 *Princeton Review's Guide to Green Colleges*. As the *Princeton Review's Guide to Green Colleges* notes, "We know that students are increasingly interested in this issue [sustainability] and we are happy to be able to help them make an informed decision. Among more than 10,000 teens and parents who participated in our 2017 College Hopes & Worries Survey, 64% told us that having information about a school's commitment to the environment would influence their decision to apply to or attend the college." There are several other studies which point to millenials' interest in and concern for sustainability (2017 Cox Sustainability Survey, "Meet the Teenagers Leading the Climate Change Movement", "Millennials Re-envisioning Environmentalism and Climate Policy"). These millenials are in our classrooms.

The most recent reporting on the University's sustainability efforts lists 14 courses offered at CCSU which address the topic of sustainability (2016 Second Nature Report). The Department of Chemistry and Biochemistry has no courses which directly address sustainability.

In the field of chemistry, sustainability is generally called Green Chemistry. Green Chemistry, in very simple terms, is a different way of thinking about how chemistry and chemical engineering can be done. Over the years different principles, such as using renewable feedstocks or preventing waste, have been proposed that can be used when thinking about the design, development and implementation of chemical products and processes. These principles enable scientists and engineers to protect and benefit the economy, people and the planet by finding creative and innovative ways to reduce waste, conserve energy, and discover replacements for hazardous substances.

It's important to note that the scope of these green chemistry and engineering principles go beyond concerns over hazards from chemical toxicity and include energy conservation, waste reduction, and life cycle considerations such as the use of more sustainable or renewable raw materials and designing for end of life or the final disposition of the product. Many ways to quantify greener processes and products have been proposed. These metrics include ones for mass, energy, hazardous substance reduction or elimination.

The principles of Green Chemistry are presented below in two versions, 1) for chemists, chemical engineers and scientists, and 2) for a general audience.

Green Chemistry
Everyone's Doing It!

The 12 Principles of Green Chemistry

A framework for designing or improving materials, products, processes and systems.

1. Prevent Waste
2. Atom Economy
3. Less Hazardous Synthesis
4. Design Benign Chemicals
5. Benign Solvents & Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis (vs. Stoichiometric)
10. Design for Degradation
11. Real-Time Analysis for Pollution Prevention
12. Inherently Benign Chemistry for Accident Prevention

*Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press: New York, 1998, p.30. By permission of Oxford University Press.

www.acs.org/greenchemistry

A *New* Kind of Chemistry

Green Chemistry is based on a set of principles that when used in the design, development and implementation of chemical products and processes, enables scientists to protect and benefit the economy, people and the planet.

Green Chemistry uses renewable, biodegradable materials which do not persist in the environment.

Green Chemistry is using catalysis and biocatalysis to improve efficiency and conduct reactions at low or ambient temperatures.

Green Chemistry is a proven systems approach.

Green Chemistry reduces the use and generation of hazardous substances.

Green Chemistry offers a strategic path way to build a sustainable future.

To catalyze and enable the implementation of green chemistry and engineering throughout the global chemical enterprise

Green Chemistry
Everyone's Doing It!

Green Chemistry — Sustainable Chemistry in Sync With Nature

The design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances.

- Smarter
- Safer
- More Efficient
- Saves Money
- Conserves Energy
- Prevents Pollution
- Designed for Reuse or Recycle
- Polishes Chem's Public Image

"The best way to predict the future is to invent it."
- Alan Kay

Green chemistry can create a better future.

www.acs.org/greenchemistry

A *New* Kind of Chemistry

- Green Chemistry emulates nature by using renewable materials that biodegrade easily in the environment.
- Green Chemistry uses materials more efficiently with less energy.
- Green Chemistry respects the environment, preventing pollution before it can happen.
- Green Chemistry helps build a sustainable future.
- Green Chemistry fosters innovation, creates jobs and inspires the next generation of chemists.

To catalyze and enable the implementation of green chemistry and engineering throughout the global chemical enterprise

In the Department of Chemistry and Biochemistry, the 100 and 200 level laboratory courses service a large number of students who come from all disciplines. CHEM 162 "General Chemistry Laboratory" has an enrollment of approximately 680 students per year. CHEM 201 "Foundations of Analytical Chemistry Laboratory" enrolls approximately 180 students/year. CHEM 211 "Foundations of Organic Chemistry Laboratory" enrolls approximately 216 students/year. CHEM 213 "Introduction to Organic Synthesis Laboratory" enrolls approx. 108 students/year. All told, these four lower level chemistry lab courses touch approximately **1185 students**. This is a large audience that can be introduced to the principles of Green Chemistry and sustainability. The lab manuals for these four courses are written in-house and can be revised to include Green Chemistry principles.

This project is in line with the University's Mission Statement: "prepares students to be thoughtful, responsible and successful citizens", and also the University's Vision Statement, to be recognized for "fostering societal improvement through responsive and innovative program, and graduating broadly educated, culturally and globally aware students who will contribute meaningfully to their communities…".

Objectives:

- Evaluate how "green" the current laboratory experiments are in CHEM 162, 201, 211 and 213.
- Introduce the principles of green chemistry into the laboratory manuals for CHEM 162, 201, 211, and 213.
- Increase students' understanding of safe handling and treatment of laboratory waste for all experiments in these laboratory courses.
- Increase the University's course offerings that address the issue of sustainability.

III. Description of your existing knowledge and/or work to date related to the project (include citations to the literature as appropriate).

I am a chemist with experience working in both the chemical industry and academic settings. When working in the adhesives industry I was a product development chemist. As EPA rules were changing in the 1990's to reduce Volatile Organic Compounds (VOC) emitted into the air, I was charged with reformulating a top-selling adhesive used in the automotive industry. I worked to identify a low hazardous air pollutant (low HAP) solvent system for the adhesive, evaluate the performance of the reformulated adhesive, and conduct customer trials with the low HAP adhesive. These adhesives are being used today, CHEMLOK 205LH and CHEMLOK 207LH (Technical data sheet, CHEMLOK product guide) . Although the phrase was not much in use at the time, I was implementing the two principles of "Green Chemistry": to use benign solvents and prevent (air) pollution.

In my position as Science Technical Specialist for the Department of Chemistry and Biochemistry at CCSU, I work with the Environmental Health and Safety Officer to ensure proper handling, record keeping and disposal of hazardous waste. Chemical waste is often an unavoidable part of laboratory experimentation, but chemists look to reduce the amount of chemical waste generated. In Spring 2014, I worked with Dr. Stephen Watton to identify a way to reduce the waste from one experiment in CHEM 201. We implemented a simple change to the experiment and reduced the waste generated in this experiment, "Spectrophotometric Determination of Manganese in Steel", from approximately 30 Liters/semester to 0 Liters/semester.

I am keenly interested in this area of Green Chemistry and sustainability. I keep informed about topics in Green Chemistry through American Chemical Society (ACS) Webinars such as "How Sustainable Chemistry is Safer Chemistry" and "How Green Chemistry Processes Make Paper Production and Pulp Recycling Environmentally Effective". The applications of Green Chemistry principles to industrial scale processes are wide-reaching, from the manufacture of aspirin and generic drugs to cleaning up the dye industry. There are examples of "real life" greener chemistry that touch students' lives and may interest them.

Since Spring 2015 I have taught laboratory courses, Chem 162 and/or Chem 201 as an adjunct for the Chemistry and Biochemistry Department. The laboratory setting allows the instructor the unique opportunity for extended interactions with the students over the 2.5 hours of a typical class. I've seen that the students are hesitant about handling the final chemical products they make. While the laboratory instructors always provide instructions for handling waste properly, the students seem to have little understanding as to why it is sometimes safe to pour their products down the drain or why another experiment requires that their products are packaged for disposal. I see that we chemists have missed the opportunity to educate the lab students about Green Chemistry.

IV. Description of proposed sabbatical activities and/or methodology (include as much detail as possible).

I will attend the Green Chemistry and Engineering (GC&E) annual conference in June 2021. The GC&E Conference, hosted by the American Chemical Society's Green Chemistry Institute, has been a meeting ground for advancing sustainable science and solutions since 1996. The conference includes industrial experts who are implementing Green Chemistry principles to large scale chemical manufacturing and small scale chemical processes at the product development stage. The conference programs from 2018 and 2019 include several sessions specific to academic attendees: "Green Chemistry in the Classroom", "Towards Safer Design Strategies: Using Toxicology Tools & Concepts within Chemistry Courses & Programs" and "Moving Towards Green and Sustainable Chemical Education". . The 2021 GC&E would give me exposure to a wide range of professionals who are deeply involved in Green Chemistry. This is also the venue to learn the most up-to-date practices in this field.

I will examine the resources available through the Sustainability Curriculum Consortium (SCC) and the Association for the Advancement of Sustainability in Higher Education (AASHE). I want to understand the connection between Green Chemistry and the broader topic of sustainability, and how sustainability is incorporated into curricula.

I will apply Green Chemistry principles to the existing experiments in CHEM 162, 201, 211, and 213. First, the experiments will be evaluated for the amount and type of chemical waste currently generated. Next, the experiments will be evaluated for ways to reduce chemical waste. Additionally, I will consider and test alternate experiments which teach the same chemical concepts using a more "green chemistry" approach. The specific Green Chemistry principles used to evaluate the laboratory experiments are:

a. Prevent waste
b. Less hazardous synthesis
c. Design benign chemicals

d. (Utilize) benign solvents and auxiliaries
e. Catalytic vs. stoichiometric reactions
f. Inherently benign chemistry for accident prevention

I will draft revisions for the laboratory manuals for CHEM 162, 201, 211, 213 to include the concepts of Green Chemistry. This will include introducing the general principles of Green Chemistry and how they have been applied to each experiment included in the course. The laboratory manuals are written in-house by Department faculty.

V. Statement of potential value of your project to the university, to your professional growth, and to your particular field of study or discipline

I have been interested in the field of Green Chemistry for many years. This project would allow me to explore the resources of the Green Chemistry Institute of the American Chemical Society to become better versed and up-to-date with the field of Green Chemistry. This project will also give me the opportunity to make professional contacts with faculty incorporating Green Chemistry into their curricula at other institutions.

The great value to the university is that this project will incorporate Green Chemistry principles into four chemistry laboratory courses. This will give the chemistry department four courses which directly address sustainability. In turn, this will increase the number of courses that address sustainability campus-wide.

VI. Statement of expected outcomes of your project. (Describe the outcomes and relationship, if any, of any previous sabbatical projects to the current one.)

This sabbatical project will incorporate the principles of Green Chemistry to the introductory laboratory courses in the Chemistry and Biochemistry department. This will:

- incorporate the principles of Green Chemistry and chemical waste reduction/treatment into the laboratory courses CHEM 162, 201, 211, and 213.
- produce new instructional materials for CHEM 162, 201, 211, and 213.
- analyze and potentially reduce the amount and type of chemical waste generated by the 100 and 200 level chemistry laboratory courses.
- improve chemical safety in laboratory courses.
- expose over 1100 students/year to the principles of Green Chemistry and sustainability.
- inspire science students to apply Green Chemistry principles to “save the environment” in their research and future jobs.

Department Sabbatical Leave Committee Appraisal:

Recommend: Yes _____ No _____

Departmental Sabbatical Leave Committee Signatures:

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Reviewed By Dean or Administrative Officer _____

Reviewed By Provost _____

Mary A. Eberhardt

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EDUCATION

University of Pittsburgh, Pittsburgh, PA September 1990-May 1995, ABD
Clarkson University, Potsdam, NY September 1986- May 1990, B.S. Chemistry, Concentration in Technical Writing

EXPERIENCE

Central Connecticut State University June 2013 – present

Science Technical Specialist, Department of Chemistry and Biochemistry
Responsible for maintaining the department's laboratories and support facilities. Responsible for maintaining an appropriate inventory of supplies and ensuring proper maintenance of equipment. Maintains the chemical database for all stored chemicals and interacts with the Environmental Health and Safety department for the proper disposal of chemical waste. Assists the Chairperson with the hiring, training, and staffing of student assistants.

Adjunct Faculty Spring 2015-present
Teach CHEM 162 "General Chemistry Laboratory" and CHEM 201 "Foundations of Analytical Chemistry Laboratory". Taught an FYE section of CHEM 162 in Fall 2017. Taught SEST 481 "MCAT Review" in Spring 2016 and 2018.

Glastonbury High School, Glastonbury, CT August 2007- June 2013

Science Teacher Full-time teaching position, teaching AP Chemistry, honors level Chemistry, standard level Chemistry, and Chemistry in the Community classes.

Central Connecticut State University, New Britain CT.

College Science Partnership Series Coordinator & Instructor
Sept. 2002-May 2007 Teach freshman level chemistry laboratory experiments at CCSU to students from Bulkeley High School Health Professions Academy. The CSPS involves six on-campus laboratory experiments during the academic year. Focus on proper laboratory technique and the connection between classroom learning and hands-on experimentation.

Biotechnology Institute University Assistant September 2002-April 2004
Administrated a newly formed Biotechnology Institute at the University. Prepared and submitted a proposal to form the Institute composed of faculty from the Chemistry and Biological Sciences departments. Organized Fall and Spring Biotechnology Forums to

showcase faculty and student research at CCSU. Conducted a fundraising campaign for the Institute, including an alumni phonathon and soliciting donations from Biotech companies.

University of Connecticut Health Center, Farmington, CT**.**

Jumpstart Program Instructor September 2005-June 2007

The Jumpstart Program is a Saturday academy for college bound students, mostly from the Hartford Public schools. As the chemistry instructor, duties include designing and teaching classroom lessons to complement and enhance their weekday classroom experience in chemistry. Employ novel teaching materials to re-inforce basic principles of chemistry. Develop engaging chemistry experiments appropriate for the students.

Great Explorations Instructor January 2005-June 2007

Present a series of four chemistry experiments in an after school science program for middle school students at Kennelly, Naylor and Bellizzi schools.

University of Connecticut, Storrs, CT. Summer 2003-2006

College Enrichment Program Instructor

Teach a six week Introduction to Organic Chemistry course for upcoming college sophomores who are pursuing a medical career. Maintain an interactive classroom environment to ensure that all students comprehend the subject. Taught accompanying Organic Laboratory for three summer sessions.

American Aerogel Corporation, Middletown, CT January 2001-January 2002

Consultant Worked with small chemical firm in product development and test method development. Also directed patent application process for the company, coordinating patent-related work with external attorneys and analytical laboratories.

The Princeton Review, Westport, CT January 2000- May 2007

Master Trainer and Instructor Teach a 10 week MCAT review course for students applying to medical school. Specialized in teaching Verbal Reasoning, Essay writing, General Chemistry, Organic Chemistry and Physics. Certified Master Trainer : conduct classes to train and evaluate new instructors for the MCAT review course.

Blackhawk College, Moline, IL January -May 1999

Adjunct Faculty, *Natural Sciences Dept.* Taught Introductory Chemistry, including the laboratory class.

Lord Corporation, Erie, PA January 1995–December 1998

Sept. 1997-Dec. 1998	Product Development Scientist: Developed aqueous and solvent-borne rubber-to-metal adhesives for automotive applications. Responsible for coordinating all aspects of new products from development stage through scale-up and customer trials. Supervised lab technicians.
Jan. 1995-Aug. 1997	Analytical Services Research Scientist: Applied surface chemistry techniques to investigate bond failures (ESCA/XPS, ISS, mass spectroscopy, SEM/EDX, microscopy). Worked with internal and external customers to characterize rubber-to-metal bonding. Developed and maintained departmental Intranet site.

PROFESSIONAL ACTIVITIES

American Chemical Society, Connecticut Valley Chapter member.
American Chemical Society, Chemical Education Division member.
Toastmasters International, Competent Toastmaster.

PUBLICATIONS

"Reduced V/Al_2O_3 Catalysts: Determining the Oxidation States from XPS by Factor Analysis and Curve Fitting" M.A. Eberhardt, A. Proctor, M. Houalla, D.M. Hercules. *Journal of Catalysis* 162, 368 (1996).

"Measurement of Surface Coverage of V/Al_2O_3 Catalysts by IR, CO_2 Chemisorption and ISS" M.A. Eberhardt, A. Proctor, M. Houalla, D.M. Hercules. *Fresenius' Journal of Analytical Chemistry* 350, 570 (1994).

"Chemisorption of CO_2 on Alumina Supported Catalysts" F.M. Mulcahy, K.D. Kozminski, J.M Slike, F. Ciccone, S.J. Scierka, M.A. Eberhardt, D.M. Hercules. *Journal of Catalysis* 139, 688 (1993).

"ISS and XPS Study of the Surface Coverage of V/Al_2O_3 Catalysts" M.A. Eberhardt, M. Houalla, D.M. Hercules. *Surface and Interface Analysis* 20, 766 (1993).

"A Multitechnique Surface Analytical Study of a Segmented Block Copolymer Poly(ether urethane) Modified through H_2O radio Frequency glow Discharge" T.G. Vargo, D.J. Hook, J.A. Gardella, M.A. Eberhardt, A.E. Meyer, R.E. Baier. *Journal of Polymer Science: Part A: Polymer Chemistry* 29, 535 (1991).

"A Surface Spectroscopic and Wettability Study of a Segmented Block Copolymer Poly(ether Urethane)" T.G. Vargo, D.J. Hook, J.A. Gardella, M.A. Eberhardt, A.E. Meyer, R.E. Baier. *Applied Spectroscopy* 45, 448 (1991).

				Progress Report for Climate Action Plan April 2017				
Subject	Course #	Title	Topic course (Y/N)	Description	Classification	Offered	Justification	Cross-listed courses
ART	465	Studio Topics	Y (Social Practice/Environmental Art)	Selected topics in studio art, announced each semester. Students may not take this course for credit under the same topic more than once.	SC	S17	considers the role of art/artists in affecting societal views/behavior toward the environment; aims to introduce an understanding of contemporary climate issues	ART 565
ART	565	Advanced Studies in Art	Y (Social Practice/Environmental Art)	Selected topics in studio art and/or art education announced each semester. Maximum credits in one studio area and/or art education is 12. Students may not take ART 565 for credit under the same art education topic more than once.	SC	S17	considers the role of art/artists in affecting societal views/behavior toward the environment; aims to introduce an understanding of contemporary climate issues	ART 465
BIO	107	Plants and Civilization	N	Plant growth and reproduction, and the economic and social importance of plants. No credit given toward biology majors or minors. Two lectures and one two-hour lab per week. Study area IV.	CTIS	F15, F17	instructor stated via email that, in this class, "I show graphs that clearly show global warming, and I talk about how one can decrease one's carbon footprint."	
BIO	111	Introductory Biology	N	Humans and the biological world, with emphasis on structure and function of the human organism, including topics on disease, heredity and evolution. Cannot be used to meet requirements for major or minor in biology. Three lectures per week. No credit given to those with credit for [BMS 111]. CSUS Common Course.	CTIS	F15, W16, S16, SU16, F16, W17, S17, SU17, F17	one instructor stated via email that their iterations included a unit on climate change; another's syllabus includes lectures on climate change, ecosystems, and human impacts on both	
BIO	121	General Biology I	N	Structural and physiological organization of cells involved in growth and inheritance of living organisms is discussed. Consideration of growth of flowering plants and comparisons of levels of specialization reached among major groups within the plant kingdom. Lecture topics are paralleled in laboratory, where living, prepared and preserved materials are used for study and dissection. Three lectures and one three-hour	CTIS	F15, S16, SU16, F16, S17, SU17, F17	instructor stated via email that, in this class, "I show graphs that clearly show global warming, and I talk about how one can decrease one's carbon footprint."	
BIO	132	Introductory Ecology	N	Introductory course that introduces students to ecological processes structuring the biosphere and our impacts on it. Emphasis will be placed on current local and global environmental issues and ways of making human lifestyles sustainable. Three lectures per week. Cannot be used to meet requirements for major or minor in Biology.	CTIS	W16, SU16, W17, SU17	suggested by biology professor; sustainability referenced in course description	
BIO	133	Laboratory in Introductory Ecology	N	Introductory biology laboratory course in field ecology to accompany, or follow, BIO 132. One three-hour laboratory or field trip per week. Cannot be used to meet requirements for major or minor in Biology.	CTIS	SU17	suggested by biology professor	
BIO	230	Natural History	N	Consideration of local wild species and their natural history traits, habitats, range, and evolutionary history. Two hours of lecture and one two-hour outdoor laboratory meeting per week.	CTIS	F15, S17, F17	suggested by biology professor	
BIO	327	Vascular Plants	N	Phylogenetic relationships, life cycles, distribution and economic significance of vascular plants. Emphasis is placed on the seed plants. Three lectures and one three-hour laboratory per week. No credit given to those with credit for BIO 227.	CTIS	S16, S17	instructor stated via email that, in this class, "I show graphs that clearly show global warming, and I talk about how one can decrease one's carbon footprint."	
BIO	405	Ecology	N	Distribution and abundance of different typesof organisms and the physical, chemical, and biological features and interactions that determine survival, growth, and reproduction in changing environments. Ecological theory and quantitative analyses included in lecture and laboratory. Three hours of lecture and one three-hour laboratory per week.	CTIS	F15, F16, F17	suggested by biology professor	
BIO	436	Environmental Resources and Management	N	Analysis of the interactions of human population-resource depletion-pollution at local to global scales from an environmental management/protection perspective. Emphasis upon better understanding the impacts of over-population and methods for control, significance and loss of biodiversity, aquatic pollution, and global climate change.	SC	S17	description states an emphasis on climate change	
BIO	490	Topics in Biology	Y (Wildlife Ecology and Management)	For advanced undergraduates. Selected studies in the biological sciences. Lectures, seminars, discussions, independent readings, reports and laboratory work appropriate for the topic will be utilized. Four credit hour offerings will include one three-hour laboratory per week. May be repeated with different topics.	CTIS	S17	suggested by biology professor	BIO 540
BIO	540	Topics in Advanced Biology	Y (Wildlife Ecology and Management)	Selected topics in the biological sciences. Lectures, seminars, discussions, independent readings, reports, and laboratory work as appropriate for the topic will be utilized. Four credit hour offerings will include one three-hour laboratory per week. May be repeated with different topics.	CTIS	S17	suggested by biology professor	BIO 490

BMS	316	Microbiology	N	Genetics and metabolism of bacteria, focusing on microorganisms that affect human health and the environment. Discussion areas include biochemistry, molecular genetics, immunology, infectious diseases, and environmental microbiology. Laboratory exercises deal with bacterial growth and control, diagnostic identification, bacterial genetics, and the roles of bacteria in humans and the world. [Three hours] of lecture and one, three-	CTIS	F15, S16, F16, S17, SU17, F17	it does not appear that sustainability is an integral component of all iterations of this course, but one instructor stated that their examples include vaccination/antibiotic cost and distribution, as well as the varying needs in developed vs. developing countries, and that there is also a project that involves addresses soils contaminated by gasoline; this course is included here in part
CEN	200	Introduction to Community and Civic Engagement	?	Introduction to the skills, knowledge, and theory for students to solve problems in their own communities, and develop a sense of self and collective efficacy. Emphasis on civic agency, interpersonal, leadership and advocacy skills, critical analysis appreciation for diversity and an enhanced understanding of community issues and challenges. Required for Community Engagement minors.	SC	F15, S16, S17, F17	addresses environmental and social justice, including issues relating to climate change and water security
CEN	201	Practicum in Community and Civic Engagement	?	This one-credit course is the community-engagement component of the CEN 200 class, and provides the platform for the students, working in groups, to carry out a community-based project.	SC	S16, S17, F17	taught with CEN 200 (SC course)
CJ	510	Law, Criminal Justice, and Issues of Inequality	N	Law as a means of controlling behavior, including history and philosophy of American law, the interrelationship between law and other social institutions, and the effects of law and criminal justice policies on the preservation and promotion of inequalities based on social class, race, gender, and ethnic identity. Courses required as special condition for admission to the program must be completed or taken concurrently.	CTIS	S16, S17	discusses issues of social justice
CM	155	Construction Documents	N	Examination of the role of the construction project administrator. Emphasis on interpretation of construction documents and administration of project-related documents and reports associated with the construction process.	CTIS	F15, S16, F16, S17, F17	course objectives include "Recognize basic sustainable construction concepts and LEED checklist"; instructor recommended CTIS
CM	535	Sustainable Buildings	N	Sustainable design and construction goals, processes, and strategies with a focus on larger commercial and institutional buildings. Designing and constructing sustainable buildings not only benefits the environment, it also makes good business sense.	SC	F15, F17	"sustainable" in course title; covers sustainable design and building, which is a field providing environmental and economic benefit; professor recommended SC
COMM	451	Environmental Communication	N	Knowledge, attitude, and behavior-change strategies related to environmental and natural resource conservation issues. Coercive, incentive based, and communication-based change strategies will be contrasted. Additional written work will be required for graduate students.	SC	W16, SU17	considers environmental education, marketing, justice, advocacy, and issues in different countries (in more recent years seems to be study abroad course)
EDEL	315	Principles of Learning: Elementary Education	N	Examination of principles pertinent to teaching and learning. Emphasizes the use of educational theory and research findings applicable to classroom practices, learning communities, and learners' developmental levels. 30 hours of certification specific field experience required. In Elementary Education, taken concurrently with SPED 315 and RDG 315. CT law requires [fingerprinting] and a criminal background check for the filed	CTIS	F15, S16, F16, S17, F17	includes promotion of equality/understanding of cultural and other differences
EDEL	322	Effective Elementary Teaching I	N	Emphasis on use of standards, development and alignment of objectives, daily and long-range lesson plans, instructional strategies, assessment strategies and reflection on practice. Students develop and implement lessons. 45 hours of certification specific field experience required. CT law requires fingerprintng and a criminal background check for the field experiences in this class. Fingerprinting must be completed prior to the	CTIS	F15, S16, F16, S17, F17	includes eco-justice and assignment promoting connection between studeats and other people/the environment
EDF	415	Educational Foundations	N	Social and moral contexts of schooling, purposes of education in American society, contemporary educational policy, politics of the policy-making process and the role of teachers as leaders. Not for credit in graduate degree programs. CT law requires fingerprinting and a criminal background check for the field experiences in this class. Fingerprinting must be completed prior to the beginning of class.	CTIS	F15, S16, SU16, F16, S17, SU17, F17	instructor stated via email that sustainability concepts are included
EDF	516	School and Society	N	Presentation and analysis of factors, institutions, and events relating to school's role in society. Sociocultural analysis and interpretation of historic development, as well as contemporary influences affecting dynamic role of school in American life today.	CTIS	F15, S16, SU16, F16, S17, SU17	instructor stated via email that sustainability concepts are included
EDF	524	Foundations of Contemporary Theories of Curriculum	N	Study of the social, psychological, and philosophical influences that shape the curriculum and a range of curriculum positions in the United States and in other countries.	CTIS	F15, F16	instructor stated via email that sustainability concepts are included
EDF	535	Special Topics in Educational Foundations	Y (Sustainability Education)	Inquiry into special topics in educational foundations. Examples include school violence, gender and education, multicultural education, national standards, and testing.	SC	W16, SU17	topic states sustainability focus
EDF	538	The Politics of Education	N	Introduction to the politics of education and the making of educational policy within our society's political system. Topics include: school governance and the decision-making process, problems of policy-making in bureaucracy, intergovernmental rivalries of local, state, and Federal authority, legal and extra-legal influences, ideological conflict, and the struggle for change and reform in school institutions.	CTIS	F15, S16	instructor stated via email that sustainability concepts are included
EDTE	210	Education & Teacher Leadership in Diverse Learning Communities	N	Exploration of teaching, diversity, and the roles teachers play as leaders in diverse educational learning communities. Inquiry-based approach includes participant-observation, case analysis, examination of beliefs and research on learning and teaching. Field experience required. Taken concurrently with EDT 210. Due to field experience in this class, proof of fingerprinting is required prior to the beginning of class.	SC	F15, S16, F16, S17, F17	includes eco-justice and globalization as issues, as well as fossil fuels, anthropocentrism, and agricultural/food industry practices

ENGR	150	Introduction to Engineering	N	Introduction to engineering problem-solving techniques unique to areas of the technical world, including chemical, civil, construction, nuclear, manufacturing, mechanical, and electrical disciplines. Problem solving is presented in both English and International (SI) Units.	CTIS	F15, S16, F16, S17, F17	one instructor's syllabus included 4 scheduled lectures on energy & renewable energy, and the other's scheduled a trip to a climate change-themed art display; one instructor mentioned via email that climate change was included in example problem(s), and the other mentioned via email that references to sustainability issues are made throughout the semester	
GEOG	110	Introduction to Geography	N	Basic patterns of physical environment and relationship of human patterns to them are explained. CSUS Common Course.	CTIS	F15, W16, S16, SU16, F16, W17, S17, SU17, F17	topics include weather/climate, economics, politics, land and energy resources, human impacts on the environment, and ecosystems; one professor also mentioned that their iteration of the course "include[s] sustainability-related topics" in more than half of the lectures	
GEOG	241	Introduction to Planning	N	Introduction to the principles and practice of planning at various spatial scales - regional, metropolitan, urban, and neighborhood.	CTIS	F15, S16, F16, S17, F17	includes a lecture devoted to sustainability, and instructor stated that concepts are integrated throughout the semester	
GEOG	266	Introduction to Remote Sensing	N	Lecture, exercises and a discussion of the basics of remote sensing including characteristics of remote sensors and remote sensing applications in academic disciplines and professional industries. Emphasis is placed on image acquisition and data colection in the electromagnetic spectrum and data set manipulations. Remote sensing imagery will be interpreted using a variety of tools.	CTIS	F15, F16, S17, F17	includes applications in forestry, agriculture, plant pathology, wetlands inventorying, land use change, and environment analysis	
GEOG	374	Climatology	N	Earth's climate with an emphasis on the physical processes and dynamics of the atmosphere. Topics include regional, urban and historical climatologies, atmospheric pollution, and climate change. Some class time will be devoted to practical exercises.	CTIS	F15, F17	description states climate change as a topic	
GEOG	439	Urban Geography	N	Form, function, and evolution of urban settlements with reference to attributes of place. Emphasis is also placed on internal structure and regional relationships of cities. Provides a methodological basis for thought involving the planning process, including preservation planning and systems analysis. Personal on-site study of a current urban problem within the state is expected.	CTIS	S16, S17	aims to promote sustainable practices	GEOG 518
GEOG	441	Community & Regional Planning	N	Philosophies, theories, and principles involed in planning of regions and urban areas.	CTIS	F15, F16	principles of sustainability were used to assess student development of a project; instructor mentioned via email that sustainability concepts are included throughout	GEOG 518
GEOG	475	Energy Resources and Climate Change	N	Seminar on geographical bases of energy resources and global climate change. Emphasis on the geographical, physical, environmental, economic, and social impacts of energy resource development and use and their effects on global climate regions and sustainability.	SC	F15, S17	cross-listed with SUST course	SUST 475
GEOG	483	Topics in Planning	Y (Transportation Planning)	Selected topics in planning. May be repeated with different topics for a maximum of 6 credits.	CTIS	S17	aims to ensure students understand effects at the social, economic, and environmental levels; sustainability and climate change are each listed specifically as topics in different lectures; instructor mentioned via email that sustainability concepts are included throughout	GEOG 518
GSCI	100	Search in Geological Sciences	Y (Climate Change)	Examination of various topics, contemporary issues and problems in Geological Sciences. Three hours of lecture per week. Cannot be used to meet requirements for majors or minors in Geological Sciences. No credit given to students having take[n] GSCI 100 or GSCI 101 with the same topic. Course may be repeated one time with a different topic. This course is equivalent to ESCI 100 and credit will not be earned if this course has been	SC	W15, F15	topic is climate change, its causes, its impacts, and its solutions	
GSCI	100	Search in Geological Sciences	Y (Natural Hazards)	Examination of various topics, contemporary issues and problems in Geological Sciences. Three hours of lecture per week. Cannot be used to meet requirements for majors or minors in Geological Sciences. No credit given to students having take[n] GSCI 100 or GSCI 101 with the same topic. Course may be repeated one time with a different topic. This course is equivalent to ESCI 100 and credit will not be earned if this course has been	SC	W15, SU16, W17, SU17	includes a module (4 lessons) on hazards related to climate change	
GSCI	121	The Dynamic Earth	N	Basic concepts of geology and the dynamic processes operating on and within the earth and how those processes can impact humans. Topics include formation of rocks, erosion and landscape evolution, plate tectonics, an interpretation of earth processes from geological data. Volcanic, earthquake, flooding, coastal erosion and landslide hazards and glaciation are also covered. No credit given to students with credit for GSCI 131. This	CTIS	F15, S16, F16, S17, F17	includes lectures on water and energy resources, climate, and sea levels, including (but not focusing primarily on) human impacts	
GSCI	125	The Dynamic Earth Laboratory	N	Laboratory investigations into geology and the dynamic processes operating on and within the earth and how those processes can impact humans. Topics include minerals and rocks, erosion and landscape evolution, plate tectonics, and interpretation of earth processes from geological data. Volcanic, earthquake, flooding, coastal erosion and landslide hazards and glaciation. No credit given to students with credit for GSCI 135.	CTIS	F15, S16, F16, S17, F17	includes a lab on glaciers and climate change, as well as labs on pollution, coastal hazards, and water quality	
GSCI	131	Environmental Geoscience	N	Investigation of Earth environmental systems including streams, lakes, estuaries, coastal, groundwater, and the physical ocean, as well as the impact of humans on those environments. Topics will also include material and energy resources, waste disposal, and climate change. No credit given to students with credit for GSCI 121. This course is equivalent to ESCI 131 and credit will not be earned if this course has been previously	SC	F15, S16, SU16, F16, S17, SU17, F17	lecture topics include humans and the geologic environment, pollution, global climate change, and energy resources; aims to introduce means of addressing environmental issues	
GSCI	135	Environmental Geoscience Laboratory	N	Laboratory investigations of Earth environmental systems including streams, lakes, estuaries, coastal, groundwater, and the physical ocean, as well as the impact of humans on those environments. Topics will also include material and energy resources, [waste] disposal, and climate change. No credit given to students with credit for GSCI 125. This course is equivalent to ESCI 135 and credit will not be given if this course has been	SC	F15, S16, F16, S17, F17	includes labs on renewable and nonrenewable energy resources, pollution, and global climate change	

HIST	510	Seminar in Public History	N	Exploration of development, methodologies, and employment opportunities of the field public history [sic]."	CTIS	F15, F16, F17	Public History & Environmental Sustainability, Public History & Civic Engagement, and Public History & Economic Development are listed as concept areas of study and class groups are assigned projects focusing on one such concept; a required book is "Cultural Heritage and the Challenge of Sustainability"	
HIST	511	Topics in Public History	Y (Historic Preservation and Resource Planning)	Topical knowledge and hands-on experiences in the practice of public history in fields such as oral history, museums, archives, and historical editing. May be repeated with different topics for a total of 9 credits.	CTIS	S16, F17	one week covers explicitly includes sustainability as a topic; S16 participation in sustainable building conference (GESAC?)	
HON	120	Science & Society I	Y (Invasive Species)	Satisfies non-laboratory requirement of Study Area IV. Selected topics from the natural sciences and their relation to society.	SC	S17	lectures include human introduction of species, climate change, biodiversity, and pathogens	
IS	570	Modern World Issues	N	Analysis of current global issues, with primary focus on power, institutions and sustainability concerns. Consideration of resources and environment challenges, sociocultural tensions, socioeconomic trends, international security, and the impacts of technological innovation.	SC	F15, F16, F17	description states an emphasis on "sustainability concerns"	
JRN	418	Studies in Journalism	Y (Health & Science Journalism)	Selected topics in journalism. Students may take this course under different topics for a maximum of 6 credits. No credit will be given to students who previously have earned 6 credits for ENG 418.	CTIS	S16	readings on global warming, fracking, water crisis, chemical pollution; syllabus cites effects of climate change as contributing to the subject's importance	a professional
ME	458	Heating, Ventilating and Air Conditioning Systems Design	N	Analysis and design of heating, ventilating, air conditioning and refrigerating systems (HVAC) for buildings and industrial applications, including equipment and component selection. Energy-efficient concepts and controls will be emphasized.	CTIS	S16, S17	an intended learning outcome is to align HVAC applications with sustainability efforts	
MKT	321	International Marketing	N	An analysis of the techniques, procedures, and strategies used by multinational firms. Potential problems are explored. Methods and sources of data for determining products to sell and countries in which to sell them are studied.	CTIS	F15, S16, F16, S17, F17	a course goal is to understand how different politics, economic environments, and cultures affect marketing; suggested "current events" topics for class discussion include inequality, globalization, and sustainability of export growth model for nations; instructor stated via email that "You cannot function in International Marketing without having an understanding of how the World [sic]	
NRSE	485	Professional Values and Role Development	N	Analysis of current social, political and ethical healthcare issues. Concepts relevant to ethical and professional behaviors will be incorporated.	CTIS	S16, S17	includes topics such as unequal access to healthcare globally, cultural diversity, and other contemporary issues, including legislation being proposed/enacted that relates to those issues	
PHIL	240	Ethical Problems in Business	N	Critical examination (both practical and theoretical) of contemporary moral problems in business such as ethical investment, questionable foreign payments, disclosure, dumping, mergers, job discrimination, whistle-blowing, and big and small business responsibilities and regulations.	CTIS	S16, F17	course texts and questions for class consideration include the role of environmental and consumer protection legislation in business, as well as the ethics of marketing/manipulating people, including those in poverty	
PHIL	241	Environmental Ethics	N	Critical examination of ethical problems concerning how people treat the land, air, plants, and animals.	SC	F16	discusses human attitudes toward and creation of policies regarding issues/topics such as ecology/environment, energy resources, and agriculture	
PHIL	242	Ethical Problems in Technology	N	Critical examination (both practical and theoretical) of contemporary moral problems in technology, ranging from modern farming and manufacturing technologies to recombinant DNA, nuclear, modern surgical and computer technologies.	SC	S17	topics for consideration include human and ecological impacts of different technologies; solutions for consideration include different energy policies and agricultural practices	
PHIL	243	Philosophy of Bioethics	N	Overview of prominent ethical theories utilized in bioethics. Research articles and case studies will be used to examine various bioethical topics, including (but not limited to): nanoethics, neuroethics, environmental ethics, medical ethics, and research ethics.	CTIS	S17	includes lecture "Bioethics and the Environment" and reading "Our Rights and Obligations to Future Generations for the Environment"; objectives include ability to recognize ethical problems in biomedicine and science	
PS	235	International Relations	N	Introduction to study of international relations, including international politics, international law and morality, international organization, international conflict and cooperations and the foreign policies of the major powers.	CTIS	F15, F16, F17	includes a section covering global climate change and resources	
PSY	125	Environment & Behavior	N	Effects of built and natural environment on human behavior, cognition, and emotion.	SC	F15, S16, F16, S17, F17	syllabi reviewed from both instructors included consideration of how environment influences "human behavior and wellbeing" and how human environmental behaviors are shaped and can be changed; one professor suggested CTIS, but seems more like SC based on textbook and lecture topics	
PSY	241	Introduction to Health Psychology	N	Examination of how psychological processes impact health, both positively and negatively. Topics include health-related behaviors, stress, coping, and management of chronic illness such as cancer, diabetes, heart disease, and HIV/AIDS.	CTIS	F15, S16, F16, S17, F17	instructor stated in email that issues of environmental health and social equality/well-being are included	

PSY	430	Intergroup Relations	N	Open to students with junior or higher standing. Focuses on the impact of social categorization on human psychology. Examines the motivational, cognitive, and socio-structural factors that contribute to diverse perspectives and social relations within a national context. Topics may include stereotyping, prejudice, gender issues, race relations, and multiculturalism.	CTIS	F15, S16, F16, S17, F17	schedule includes understanding of diversity issues and means of addressing issues of inequality (i.e. prejudice)	
PSY	541	Health Psychology	N	Examination of health-related behaviors, stress, risk factors and methods to improve well-being. Mind-body aspects of chronic illness, addiction, and immune system disorders are discussed.	CTIS	F15, F16, F17	instructor stated in email that issues of environmental health and social equality/well-being are included	
PSY	542	Psychology of Stress	N	Seminar on the biological, emotional, behavioral and cognitive effects of stress. Critical examination of stress theories and research methodology. Focus on factors that modify the relationship between stress and health outcomes (e.g., social support, optimism).	CTIS	S17	instructor stated in email that issues of environmental health and social equality/well-being are included	
SUST	140	Introduction to Sustainability	N	Introduction to the basic principles, theories, methods, and applications of sustainability.	SC	S16	subject is "Sustainability"	
SUST	275	Sustainable Soils & Vegetation	N	An analysis of major soil groups, soil properties, associated vegetation, and a critical review of human activities that impact the natural state of soils and vegetation. An overview of sustainable practices that can address human impacts on soils and vegetation.	SC	S17	subject is "Sustainability"	GEOG 275
SUST	475	Sustainable Energy & Climate Change	N	Seminar on social, economic, and environmental dynamics of renewable and nonrenewable energy resources and their impacts on global climate change.	SC	S17	subject is "Sustainability"	GEOG 475
SUST	500	Social, Political, and Ethical Dimensions of Global Sustainability	N	Study of the complex interrelationships between natural, social, and political systems. An interdisciplinary examination of principles, practices, and policymaking that underlie global sustainability including environmental impact on intergenerational equity, public health, social and economic justice, gender equity, education, human rights, and democracy.	SC	S16, F17	subject is "Sustainability"	
SUST	501	Contemporary Challenges in Environmental Sustainability	N	Review of the principles of sustainability. Interdisciplinary discussion of current global environmental challenges and potential sustainable solutions. Topics to be covered include population growth, climate change, water scarcity and pollution, persistent toxics, fossil fuels, and alternative energy resources.	SC	F16	subject is "Sustainability"	
SUST	502	Science for Sustainability	N	Interdisciplinary course provides core science background necessary for understanding current environmental problems in sustainability. Emphasizes interrelationships of natural global systems and focuses on global biogeochemical cycles (water, carbon, nitrogen, sulfur), atmospheric chemistry, terrestrial and aquatic ecosystems, biological diversity, and effects of toxics.	SC	S16, S17	subject is "Sustainability"	
SW	100	Exploration in Social Work	N	For students with a strong desire to help people and facilitate social change to determine if they wish to pursue a career in social work. Students will be introduced to the full range of client and practice settings in the global context. Limited to students with 45 credits or less or permission of the instructor.	CTIS	F15, F16, S16, S17, F17	syllabus states that department mission is, in part, for students to "advance human rights and social and economic justice"; this, in addition to understanding issues of and means of addressing environmental justice, are stated as expected learning outcomes for the course	
SW	227	Human Behavior and the Social Environment I	N	Examination of individuals, families, and communities, taking an ecological perspective of the life span; various cultural, economic, and ethnic factors that influence lives; application of social work values and how these relate to developmental tasks in a socio-political environment. Field work required. Pre-Social work majors only.	CTIS	F15, S16, F16, S17, F17	syllabus states that department mission is, in part, for students to "advance human rights and social and economic justice"; course volunteer/field work experience intended to advance understanding of social, economic, and environmental justice issues	
SW	478	Current Topics in Social Work	Y (Social Work Practice with Lesbian, Gay, Bisexual, and Transgender (LGBT) Populations)	Analysis and evaluation of special topics in the general field of social work. Topics will vary from year to year. If topics vary, may be taken more than once.	CTIS	S16	syllabus states that department mission is, in part, for students to "advance human rights and social and economic justice"; anticipated learning outcomes include understanding of social, economic, and environmental justice issues	
TM	310	Environment, Health and Safety (EH&S)	N	Overview of environment, health and safety issues including: improving employee health and safety, reducing hazards, hazardous waste and air emissions, and reducing the environmental impact of the production facility. Emphasis on sustainability, OSHA, EPA, and ISO 14000 standards and regulations.	SC	F15, S16, F16, S17, SU17, F17	description states an emphasis on sustainability	