General Engineering Fall 2022
Creative Inquiry Project List

Creative Inquiry (CI) is the imaginative combination of engaged learning, cross-disciplinary interactions and undergraduate research that is unique to Clemson University. Team-based investigations are led by faculty mentors and typically span a year or more. Students take on problems that spring from their own curiosity, from a professor's challenge or from the pressing needs of the world around them. These invaluable experiences produce exceptional graduates.

The following list of CI projects in the College of Engineering, Computing, and Applied Sciences (CECAS) has been compiled for Fall 2022 General Engineering (GE) students. All projects on this list are appropriate for freshmen and new transfers. This list is comprised of several projects that are two or more semesters, meaning it can be continued once you have transitioned to your engineering major. Other projects may only last one or two semesters. Many of these CI projects are interdisciplinary and provide exposure to multiple fields of engineering (e.g., civil engineering, environmental engineering, electrical engineering, etc.).

Projects #1 – 12 (pgs. 2-5) are open to any GE student. Projects #13 – 15 (pg. 6) are only available to students in the Residents in Science and Engineering (RISE) Program. Projects with a "TBA" time, mean the faculty will work with students to decide on a meeting time. Information for each of the CI projects is presented as follows:

Project # | Title **Project Course Information**

Primary Faculty (*Faculty Dept./Program*)	Duration of Project-Credits	Project Meeting Day and Time
Description of CI Project		

During orientation registration for Fall 2022 classes, interested students should register for the CI holding section (ENGR 1900-999, 1 credit hour). Engineering students are asked to submit their top three CI project choices via a Google Form that will be sent to their Clemson email address after their orientation session.

Please note: Students who register for the CI holding section MUST submit their project choices by 4 PM the day after their orientation session to remain enrolled in the ENGR 1900-999 holding section. Students who register for the holding section and do not submit their CI project choices via the Google Form will be dropped from the holding section. Students will be notified of their project placement via email. Please allow up to 7 business days for your class to update on your schedule.

Questions, please contact Ms. Brandi Elliott, GE Special Projects Coordinator, at bwe@clemson.edu.

CI Projects for General Engineering Students

Project 1 | Oyster Reef Restoration **BE 4990 – 003**

Dr. Caye Drapcho (*Biosystems Engineering*)	2 Semesters- 1 credit	Thursdays, 5:00 - 6:30 pm
Globally, 85% of the world's oyster reefs have been depleted due to over harvesting and/or poor water quality. Our team seeks solutions to restore oyster reefs through design of structures for oyster spat attachment.		

Project 2 | Incentivizing Litter Storage & Collection **ENGR 1900-819**

Dr. Todd Schweisinger *(Mechanical Engineering)*	2 + Semesters – 1 credit	Days: TBA
Widespread litter, comprised in large measure of plastic bags, plastic beverage containers, paper, and assorted refuse, vexes large parts of the world, particularly under-developed regions where there is no centralized trash and garbage collection. A practical means of involving the local population in collecting and transporting accumulated litter to central collection points and establishing incentives for participation is a potential solution. An important component of such an approach is thought to be the development of a practical process to enable single individuals to compact litter into small, manageable units, for which they could be compensated on a piece-by-piece basis. Students will collaborate in teams to design, build, test, and evaluate methods to compact litter, and they will need to consider the possible socio-economic and cultural aspects affecting the effectiveness.		

Project 3 | Clemson Engineers for Developing Communities **ECAS 1900 – 101**

David Vaughn (*College of Engineering, Computing, & Applied Sciences-Engagement*)	2+ Semesters – 1 credit	Fridays, 3:30 – 4:30 pm
This course is also designated as a Global Challenges course for the Clemson Crossings curriculum. You will be learning and completing assignments in ways that fulfill the student learning outcomes of the Global Challenges area of the common undergraduate curriculum. Clemson Engineers for Developing Communities (CEDC) is a translational research course in which teams of students from across campus work together on long-term projects to address global challenges that benefit the Central Plateau of Haiti, Guatemala, Colombia, and South Carolina, while looking through the lens of the United Nations Sustainable Development Goals (UN SDGs). Project work centers on infrastructure, economic development, health, and educational needs of our community partners. In this initial course, you will learn professional development, followership, leadership, critical thinking, project management, cross-cultural awareness, Teamwork, ethical judgement / responsibility are integral elements for project success, and the companion courses will teach project management and leadership.		

CI Projects for General Engineering Students

Project 4 | Development of Makerspace SOPs **ENGR 1900-219**

Dr. Todd Schweisinger and Kelsey Sheaffer *(Mechanical Engineering)*	2 + Semesters – 1 credit	Days: TBA
The Clemson University Makerspace regularly purchases new equipment to introduce it to the Clemson making community for research, courses, and personal projects. Training for users is offered for all equipment to any Clemson student, faculty, or staff. The ultimate goal of this CI project will be to create training for the new equipment that can be conducted safely with as little employee input as possible, and to revise and update training on existing equipment to improve effectiveness. The students will first learn to use the machines to develop their ability and skills, and to explore the capabilities and limitations of the equipment.		

Project 5 | Microfluidics and Lab-on-a-Chip **ENGR 1900-031**

Dr. Xiangchun Xuan *(Mechanical Engineering)*	1 + Semester – 1 credit	Days: TBA
In this Creative Inquiry project, we explore the use of electric, magnetic or flow field for the transport and control of biological and synthetic particles in engineered microchannels with lab-on-a-chip applications to chemistry and biomedicine for point of care technology.		

Project 6 | The Clemson Concrete Canoe Team (3CT) **CE 1990 – 020**

TBA (*Civil Engineering*)	2 Semesters – 1 credit	Days: TBA
3CT is a student-lead team that designs, builds, markets, and races a concrete canoe each year at regional and national competitions. Students learn and apply classroom knowledge and concepts to a real-world project, including project management, concrete mix design and materials, structural analysis/design, naval architecture, public relations, product performance/evaluation, sustainability, mentoring, and communication skills (oral and written). Instructor consent is required.		

CI Projects for General Engineering Students

Project 7 | Martian and Lunar Regolith Simulants **CE 1990 – 123**

Dr. Qiushi Chen (*Civil Engineering*)	1 + Semesters	TBA
Efficient in-situ resource utilization is a critical component of NASA's current and future Mars and Lunar exploration missions. In this CI project, the team aims to explore innovative, energy-efficient and sustainable processes to transform in situ Martian and Lunar resources into construction materials for functional building blocks.		

Project 8 | Deep Learning & Big Data **ECE 1990-018**

Dr. Melissa Smith (*Electrical & Computer Engineering*)	2+ Semesters – 1-3 credits	Days: TBA
Machine Learning is a field which is becoming increasingly useful in a wide variety of domains due to the accumulation of large amounts of raw data ("big data") and the availability of high-performance computing (HPC) systems which can process this data. These domains include image processing, natural language processing, autonomous driving, gene set analysis, molecular structure classification, and many others. The goal of this Creative Inquiry is to equip students with the various skills required to apply machine learning techniques to real-world problems, which includes data-related issues such as how to select and load a dataset, software-related issues such as how to implement a machine learning pipeline from basic components, and hardware-related issues such as how to best take advantage of GPUs and other high-performance computing resources. Students will gain hands-on experience with machine learning / big data by working on a real-world problem of their choice.		

Project 9 | Future Engineers **ECE 1990– 013**

Dr. Melissa Smith (*Electrical & Computer Engineering*)	2 + Semesters- 1-3 credits	Days: TBA
The Future Engineers CI is a service/outreach program that takes STEAM activities to Clemson and Six Mile Elementary schools one afternoon per week for 6 weeks. Approximately 20 4th and 5th graders from each school are selected to participate each semester and the students are different each semester.		

CI Projects for General Engineering Students

Project 10 | Drinking Water Quality **EES 4900 – 011**

Dr. David Ladner *(Environmental Engineering & Earth Sciences)*	1 Semester – 1 credit	Tuesday, 3:30 – 4:30 pm
Students will do field sampling, laboratory measurement, and/or data analysis to evaluate drinking water and source water quality. This includes measuring pH, temperature, conductivity, E-coli presence, alkalinity, nitrate, and other parameters. A goal is to create an organization where citizens can send in their private well water for analysis.		

Project 11 | Advanced Manufacturing by Ultrafast Lasers **ME 2900– 037**

Dr. Xin Zhao *(Mechanical Engineering)*	1 + Semesters – 1 credit	Days: TBA
Due to the significant advances of lasers, laser-based manufacturing and material processing have been widely used in many industry sectors, including energy, automotive, electronics, bioengineering, medicine, aerospace/aeronautics, etc. Ultrafast lasers are one of the most advanced laser machines which offer extremely high laser intensity, short pulse duration, and introduce ultrafast phenomena during laser-matter interaction. It is an ideal tool for high precision manufacturing processes of materials which are difficult to be processed by traditional methods. This project aims to understand the fundamentals of ultrafast lasers and laser-matter interaction, and explore its applications in micromachining, material strengthening, and multi-functional surface processing. This project includes hands-on participation to learn the state-of-the-art ultrafast laser and use it for micro-manufacturing, material strengthening, and multi-functional surface processing. The project length is expected to be 2 semesters.		

Project 12 | Preparation for UG Research Experience **ECAS 1990- 401**

Dr. Kennedy, Dr. Alper, Ms. Allard (*Electrical & Computer Engineering*)	1 Semester – 1 credit	Monday, 9:05 – 9:55 am
Research is the development of knowledge that is not just new to you, but new to your discipline. This course will help you understand what research is, is not and how to participate. It is open to all students who have not conducted research previously and would like some guidance prior to applying for an experience through a Creative Inquiry team, a National Science Foundation Research Experience for Undergraduates (REU) program, or any one of many ways to participate in research as a Clemson undergraduate. This will be a 1 credit course where students prepare for applying to a research group and gain the skills needed to conduct research. The course will be split into the following topics: (1) What is research? (2) Undergraduate research opportunities and how to apply to them (3) Skills and best practices for conducting research (4) STEM degrees and graduate programs. The course will be limited to 30 students.		

RISE CI Projects

The following projects are restricted to students who are participating in the Residents in Science and Engineering (RISE) program.

Project 13 | Design for All Abilities **ENGR 1900 – 020**

Professor Matt Miller (*General Engineering*)	1 Semester – 1 credit	Asynchronous On-line

There are many individuals with physical and/or cognitive disabilities in the world, but their needs are often overlooked in the design of everyday things. This project will guide students through research on principles of universal design, identification of a project with a local impact, and development of prototype solutions to improve the accessibility and utility of the Clemson campus. Students will participate in activities that allow them to gain first-hand experience with some of the challenges individuals with disabilities face on a daily basis. This experience will enable students to empathize with people different from themselves, providing a unique design perspective and ability to think outside the box when developing solutions to meet the needs of a wide range of stakeholders.

Project 14 | Filament Recycling **ENGR 1900 – 028**

Dr. Will Martin (*General Engineering*)	2+ Semesters – 1 credit	Days: Friday, 12:20

3D printing is one the fastest growing and most innovative of the manufacturing industries. However, a large portion of material used to 3D print invariably gets used as support material, failed prints, and other wastes. This unused plastic often gets discarded, with an average of 10%-20% of the total material used thrown away. The renewable spools CI will be heading industry grade recycling of filament to provide to campus resources and eventually the community with recycled spools of filament to reduce waste.

Project 15| Green Roofs, Rainwater Cisterns, and Urban Agriculture **ENGR 1900 – 024**

Dr. Will Martin (*General Engineering*)	2 + Semesters – 1 credit	Days: Friday, 3:35

This project is exploring the possible synergy between utilizing green roofs, rainwater cisterns, and roof top agriculture. Green roofs have many benefits, but their impact on reducing stormwater runoff quantity from larger design storms is limited. Including a cistern can be a way to improve this, a cistern by itself is not a reasonable approach if there is no use for the stored water. Urban agriculture is the link that we will use to couple these two BMPs as the stored water can be used to irrigate the plants in the green roof, which expands the types of plants which can be grown to crops which can be harvested and produce a source of revenue as well as a source of locally produced food.