Course Number and Title: EGN 4912 Engineering Undergraduate Research

Catalog Description:
The primary purpose of this course is to provide the student an opportunity for firsthand, supervised research. "Research" is defined as mentored, but self-directed, work that enables individual students or a small group of students to explore an issue of interest to them and to communicate the results to others. Projects may involve inquiry, design, investigation, scholarship, discovery, or application, depending on the topic, and the student is aware of how her or his project fits into and contributes to solving the larger problem to which it belongs. The student will usually assist a faculty member with a research project by helping to prepare the study and contributing in a meaningful way in meeting the objectives of the study. The student may work with a graduate student who is performing research supervised by a research faculty member.

Credit Hours: 0-3
0 Credit Hours: Students can enroll in this course at 0 credit hours. This situation would be preferred by students who are approaching a maximum number of credit hours toward their degree or who are unable to cover the cost of tuition for these credits. Students registering for 0 credit hours should carefully discuss with their faculty advisor the time expectations for completion of the requirements of the class, and these expectations should be clearly articulated on the Engineering Undergraduate Research Form.

1-3 Credit Hours: Students are expected to devote an equivalent of three hours a week of actual work in this class for each credit in which they are enrolled. Students can enroll in a total of 12 credit hours of this course during their undergraduate study at UF. Students should check with their department on the impact of excess surcharges and whether the credits will count toward their degree. Students should carefully discuss with their faculty advisor the time expectations for completion of the requirements of the class, and these expectations should be clearly articulated in the Engineering Undergraduate Research Form.

Pre-requisites and Co-requisites: None; however your project may have specific pre-requisites that your research advisor should identify before you enroll in this class.

Instructor Information: See Faculty Mentor Confirmation Form

Graduate or Post-doctoral Student Research Mentor (s): See Faculty Mentor Confirmation Form

Course Website: https://www.eng.ufl.edu/graduate/about-us/undergraduate-research/
The engineering department or faculty mentor may have an additional website specific to the content of your undergraduate research project.

Course Objectives: After completion of this course, the student will have learned

- To search the literature
- To take proper safety precautions in the laboratory, if relevant, to the project
- To properly keep an accurate record of research performed

- How to approach a research problem and develop a methodology
- How to write a research report
- To work in a team environment, if relevant to the project
- How to conduct herself/himself responsibly, safely, and ethically in research

The student will have fully participated in the research process with a desirable outcome of a final written report that synthesizes data collected or gathered and ideally an oral presentation.

Textbooks/Required Materials:
There is no required text in this course. If appropriate to the project, students are required to purchase a laboratory notebook and are encouraged to consult with their research advisor for recommendations on the style of notebook to use. Students should also consult in advance with their research advisor on the necessity of owning a calculator, laptop computer, etc. in order to perform their project tasks.

Recommended Reading:
Responsible Conduct of Research, National Science Foundation
http://www.nsf.gov/bfa/dias/policy/rcr.jsp

On Being a Scientist: Responsible Conduct in Research, 2nd Edition, National Academy Press, 1995 ***(free)***
http://www.nap.edu/readingroom/books/obas

Avoiding Plagiarism Guide, George A. Smathers Marston Science Library
http://www.uflib.ufl.edu/msl/subjects/images/plagiarism_26_guidelines.pdf

The Craft of Scientific Writing, 3rd Edition, by Michael Alley (1996), Springer-Verlag, NY, NY.

The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid, by Michael Alley (2002), Springer-Verlag, NY, NY.

Attendance Policy:
Students conducting undergraduate research are expected to exercise a significant degree of autonomy in their work, completing research tasks with relatively little direct oversight from their research advisor. Nevertheless, the student should dedicate a minimum number of hours on their project that is consistent with the total credit hours sought for the experience. Besides the minimum expectations outlined in the Assessment section of this syllabus, the faculty advisor may also have additional expectations for participation, including attendance at group meetings, individual meetings, etc.

The policies for allowable absences and make-up work follow the university attendance policies: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Assessment:
70% *Degree to which students meet expectations.* Expectations are to be established by the research advisor and student a minimum of one semester in advance of the

student's enrollment in the research course. The agreed-upon expectations will be reflected on the Undergraduate Research Form signed by both the student and research advisor prior to the student's enrollment in the class. The following is a minimum set of expectations for every student enrolled in this class for credit: i.) perform a background literature search and review, ii.) develop a project plan, iii.) perform experimental work or applied experimental work, iv.) write and present a research report. All four of these minimum expectations as well as additional expectations (e.g., attendance at departmental and/or College research seminars, participation in research group meetings, etc.) are to be clearly established and articulated to the student by the research advisor prior to commencement of the research project.

20% *Quality of the final report and oral presentation.* The faculty advisor will provide clear expectations of the desired format, content, and deadlines of the final report. The faculty advisors will grade the final report.

10% *Attendance.*

You will receive a final grade of satisfactory (S) or unsatisfactory (U) in this course. That is, you will not receive a letter grade. A grade of S will be assigned if you achieve at least 70% of the available points by the end of the semester. For more information on grades and grading policies, please visit:
https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

In order to provide the students a measure of performance mid-semester, the faculty advisor is expected to complete a mid-term evaluation of the student, accompanied by recommendations for improvement for the remainder of the term. The mid-term evaluation of the student should be accompanied by a one-on-one meeting between the faculty advisor and the student.

Absences and Make-up Work:
Requirements for attendance as clearly established and articulated by the research advisor are consistent with university policies that can be found at the following web site:
https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Honesty Policy:
All students registered at the University of Florida have agreed to comply with the following statement: "I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University." In addition, on all work submitted for credit the following pledge is either required or implied: "On my honor I have neither given nor received unauthorized aid in doing this assignment."

Because of the self-guided nature of the research endeavor, the research student must take measures to ensure that she or he follows the highest ethical behavior, especially regarding collecting, recording, and reporting of data. If you have any question regarding ethical conduct in your research, first consult your research advisor.

If you witness any instances of academic dishonesty in this class, please notify the instructor or contact the Student Honor Court (392-1631) or Cheating Hotline (392-6999). For additional information on Academic Honesty, please refer to the University of Florida Academic Honesty Guidelines at:
https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/

Accommodation for Students with Disabilities:
Students who will require an accommodation for a disability must contact the Dean of Students Office of Disability Resources in Peabody 202 (phone: 352-392-1261). Please see the University of Florida Disability Resources website for more information at:
https://www.dso.ufl.edu/drc

In keeping with UF policy, the student, not the instructor, is responsible for arranging accommodations when needed. Once notification is complete, the Office of Disability Resources will work with the instructor to accommodate the student.

Registration
1) Once you have received confirmation from the faculty mentor that you are selected for an undergraduate research position then then print a copy of the EGN 4912 Syllabus and Registration Form.

2) Complete and sign the Student Registration Form, meet with faculty member to complete and sign the Faculty Mentor Registration Form, make 2 additional copies, keep one and leave one with your faculty mentor.

3) Take the original signed Registration Forms to the appropriate academic advisor in your major department for registration for EGN 4912 with the appropriate department section number. If you are an Exploratory Engineering student or Non-Engineering students then take the signed registrations forms to the department where your faculty mentor resides for your undergraduate research project. The advisor will keep this original form for departmental records.

More information
Students doing research with faculty on the UF campus should not be volunteers because of liability and accountability concerns.

EGN4912 is strictly for students participating in research with a faculty member in the Herbert Wertheim College of Engineering.

Responsibilities of the Undergraduate Student:

1. Seek out a faculty advisor and work with her/him in completing the application form prior to enrolling in EGN 4912.
2. Understand the faculty advisor's expectations of your work (specific research tasks, deliverables, timeline, etc.) on the project.
3. Work actively doing research and participating in other related activities for about 3 hours each week for every credit hour enrolled in the course.
4. Keep clear accurate records of your work.
5. Understand how to conduct research in a responsible and ethical manner. Follow the UF Honor Code at all times.
6. Follow all safety protocols and ask questions about safety protocols before performing any procedure about which you are unsure.
7. Ask for assistance when you need it.
8. Keep your faculty research advisor and/or mentor informed of your results.
9. If required, learn to work on a team while also pursuing independent research on your project.
10. Write and submit a research report following the guidelines and expectations of your faculty advisor and/or mentor.
11. Present your research findings in an oral presentation.
12. Strive to go beyond the minimum expectations of preparing a literature review and project plan, performing the research, and writing a final report. Seek out opportunities for oral presentations at a conference, writing and submitting a journal paper of your work, etc.

Responsibilities of the Faculty Mentor, Graduate Student/Post-Doctoral Mentor(s):

1. Determine the appropriate number of credit hours to be assigned to the project. Approve and sign the application form to enable the student to register for 0-3 credit hours.
2. Clearly define your expectations of the student's participation on the project (specific tasks, deliverables, timeline, etc.).
3. Provide support and supervision of the student (either directly or by referring her/him to someone else, e.g., graduate student or postdoctoral mentor).
4. Meet regularly with the student to review her/his progress and to provide guidance in moving forward in her/his project.
5. Arrange for <u>all</u> safety training that is appropriate for the student to ensure her/his safety in your laboratory.
6. Help the student understand the broader context in which her/his research project fits and understand the basis for methods and procedures used.
7. Encouraged to provide a mid-semester evaluation of the student's performance, accompanied by recommendations for improving performance for the remainder of the semester.
8. Provide feedback and establish deadlines on the student's Literature review, Project plan and Final report
9. Assign the student's final grade.
10. Encourage the student to go beyond the minimum expectations of preparing a literature review and project plan, performing the research, and writing a final report.

Student Registration Form

(to be completed by undergraduate student)

Student Full Name: Joseph Hill

UFID Number: 3305-7097 **Cell Phone:** (727) 492-7320

Gatorlink Email Address: joseph.hill@ufl.edu

Major: Mechanical Engineering

Level/College: Bachelors, HWCOE

Expected Bachelor's Graduation Date: Spring 2024

Project Title: Force-Torque Sensor Based Initial Position Calibration of a Six-DoF Articulated Robot Arm

Faculty Mentor: Dr. Mike Griffis

Semester/Year of Enrollment: Summer 2023 **Credit Hours (0-3):** 3

Brief Description of the Research Project/Expectations:

The goal of the project is to use the positional error of the robot in a kinematics equation to alter the initial homing angles and increase the positional accuracy over any surface. The current homing sequence of the articulated 6-DoF arm is a significant
source of positional error because the sequence does not have any external calibration, and all arm movements are derived from the starting conditions.

The proposed calibration method is to place a stiff rod on a three-axis force-torque sensor and mount the sensor on the robot's end plate. When the robot translates the rod over a well defined surface, the robot's real pose is compared to where the robot believes it is. This error is used in a kinematics equation compensate the actual starting position of the arm.

I have prepared the research description above in consultation with my research advisor. I have read the responsibilities of the student included on the syllabus and agree to undertake these responsibilities.

Student's Signature: Joseph Hill **Date:** 2022-02-18

Faculty Mentor Registration Form

(to be completed by the faculty mentor)

Faculty Name: _____

Gatorlink Email Address: _____

College and Department: _____

Office Address: _____

Office Phone: _____

Graduate Student/Post-Doctoral Mentor(s) Information (if applicable):

Name: _____

Gatorlink Email Address: _____

College and Department: _____

Office Address: _____

Office Phone: _____

Will the student's project and or research involve:

1) Export-controlled research? ___Yes ___No
2) An infectious agent or clinical samples? ___Yes ___No
3) Methods/procedures requiring specific safety training? ___Yes ___No

If yes, describe specific training that the student will receive prior to performing these activities.

What are your expectations for the student's attendance in this project (e.g., estimated hours/week in your laboratory, in seminars, group meetings, etc.)?

I approve of the research description and credit hours submitted by the student applicant. I have read the responsibilities of the research advisor (see next page) and agree to undertake these responsibilities.

Faculty Mentor Signature:_____ Date:_____

I have read the responsibilities of the research advisor (see next page) and agree to undertake these responsibilities.

Student/Post Doc Signature:_____ Date:_____