COVER SHEET

Research Track: Mechanical Engineering Curriculum

The Mechanical Engineering Department Research Track is designed for exceptional students to pursue a faculty mentored research experience for 2 consecutive semesters at 0.5 cu per semester. Participation for one summer is required, contingent on a successful MUSE faculty student application. The student will receive a maximum of 1 cu that are applicable to one elective in Group C (only). A 0.5 CU cannot count for an elective.

1) The earliest entrance into the track is in sophomore year during the fall. The latest application into the track is in junior year during the spring.

2) Students are required to have at least a 3.65 GPA. Enrollment in the track is also contingent upon faculty interest and availability to take students as research assistants (students in the track). Enrollment in the research track is subject to department approval. Faculty are not obligated to participate in the program. The ranking of students applying for the track is based on the quality of student application as determined by the faculty advisor. Students are limited to 0.5 course units per semester.

3) Students in the track still have to take the capstone Senior Project sequence, which must include design. The Senior Project sequence must not be used to make progress toward the overall research project.

4) For students, the full sequence of the program is:
    1. Recommend participation in MUSE or UG research experience (like REUs) prior to beginning research track.
    2. Junior/Senior fall: 0.5 CU on research
    3. Junior/Senior spring: 0.5 CU on research

5) The total 1 CU of research can be applied to the student's 1 Group C technical elective requirements toward the degree.

6) Students in the track need to commit and engage into an Independent Research Contract. Students, along with the faculty, are required to develop a detailed research plan for the program of study that is to be submitted to the department chair.

7) Students taking 0.5 CU of research must conduct research for a minimum of 6 hours per week. As part of their grade, in addition to the weekly research, the student is required to conduct a literature/background review, produce a research report at the end of each semester, and present a poster during Student Achievement or Alternative Poster Type Session, and present research to the department, school, or engineering class. Faculty will provide workspace for the student with support of the SOE Dean's office.

8) A successful research program is one that culminates in the publication (by the student and the faculty) of at least one paper in an industry recognized refereed journal or professional

conference (not an undergraduate student paper competition or TCNJ journal). This does not imply that a paper has been fully published, but the faculty must feel confident that enough research work has taken place leading to a journal publication with recognition given to the student and their work. At a minimum, in the final semester of the program, the student will submit a portfolio that includes:

a. Research thesis in the form of a journal manuscript
b. Each semester's work plan and progress report
c. A report delineating dissemination activities (MUSE poster, conference posters or presentations), outcomes achieved, statement of importance of the research track to career goals and current career plans

9) The faculty and the student(s) each have the option to seek MUSE, School Support, or External support during the summer. Students must maintain a 'B' grade in their research track courses to remain enrolled in the track. Students may elect to drop out of the research track option at any time, but will be required to complete any remaining electives/units required for graduation. Students are allowed to switch faculty members, with faculty permission.

Application Process:

Applications are submitted one semester prior to the start of the research activity.

I. Cover page that includes:
Project title:
Student name:
Adviser name (with signature):
State which semesters are being applied for:
Statement on the use of human or animal subjects. Approval must be obtained prior to enrollment in the first research course (typically the enrollment period for the fall of the junior year):

II. Project Description (2 pages):
1. Background
2. Significance
3. Objectives
4. References

III. Facilities and equipment needs (1/2-page maximum)

IV. Expected safety training required to complete the research (1/2-page maximum)

V. Curriculum plan for junior and senior year

VI. (Not required, but encouraged) Agreement to apply to MUSE and participate if the application is awarded.

VII. Include the Student MUSE application

Deliverables by students in research track per semester/year:

After admission to the research track, students are expected to deliver the following documents:

I. Detailed project proposal (5 pages, double spaced, 1-inch margins)

Due either

1) at the end of the MUSE program if the student participates as a rising junior/senior; or
2) one semester prior to the start of the research activity.

a. Specific Aims (1 page)

i. State concisely the goals of the proposed research and summarize the expected outcome(s), including the impact that the results of the proposed research will exert on the research field(s) involved.

ii. List succinctly the specific objectives of the research proposed, e.g., to test a stated hypothesis, create a novel design, solve a specific problem, address a critical barrier to progress in the field, or develop new technology. The engineering concepts and approaches must be clearly delineated.

b. Research Strategy

i. Significance

1. Explain the importance of the problem that the proposed project addresses.
2. Explain how the proposed project will improve scientific knowledge, technical capability, and/or in one or more broad fields.
3. Describe how the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field will be changed if the proposed aims are achieved.

ii. Innovation

1. Explain how the project challenges and seeks to shift current research or clinical practice paradigms.
2. Describe any novel theoretical concepts, approaches or methodologies, instrumentation or interventions to be developed or used, and any advantage over existing methodologies, instrumentation, or interventions.
3. Explain any refinements, improvements, or new applications of theoretical concepts, approaches or methodologies, instrumentation, or interventions.

iii. Approach

1. Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project
2. Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims.
3. If the project is in the early stages of development, describe any strategy to establish feasibility, and address the management of any high-risk aspects of the proposed work.
4. Point out any procedures, situations, or materials that may be hazardous to personnel and precautions to be exercised.

5. Provide a timeline of activities for the duration of participation in the program (2 semesters). The timeline and activities should be appropriate to the level of effort for 0.5 CUs allowed each semester.

II. Progress report

Due by the final exam week of the relevant semester or earlier at the discretion of the supervising faculty.

Summarize the specific aims of the previous project period and the importance of the findings, and emphasize the progress made toward their achievement. Explain any significant changes to the specific aims and any new directions including changes to the specific aims and any new directions. A list of publications, patents, and other printed materials should be included in the Progress Report Publication List attachment; do not include that information here.

a. Results to date
b. Changes to original proposal
c. Specific outcomes achieved such as presentations, papers, abstracts
d. Plan of activities for the upcoming semester
e. Updated timeline

III. Research thesis
Due in week 12 of the final semester.

The details of the content, format, length, etc., will depend on the faculty mentors determination of the appropriate journal for the completed work.

IV. Oral Presentation of thesis
Complete no later than the final week of the final semester

MEC 497– MENTORED RESEARCH

(Fall/Spring XXXX)

Instructor: **xxx**
Office: **xxx**
E-mail: **xxxx**
Prereq: Department permission based on a successful application to research track. A minimum GPA of 3.65 is required**.**
Text: Peer reviewed literature and past research reports germane to subject matter. Supplemental materials provided as needed.
Catalog:

This course is for the pursuit of an original mechanical engineering research project under the direction of a supervising professor. Students must be accepted to the research track and may enroll for 0.5 CU upto 2 consecutive semesters. A final paper in the form of a manuscript and an oral presentation to faculty and students of the department is required for 1.0 CU of mentored research completed. The paper must be archived by the Department of Mechanical Engineering, and shall follow a format appropriate to a national or international research journal and/or peer reviewed conference as defined by the supervising professor.

The expected time commitment is 6 hours per week (0.5 cu). Only a full 1.0 CU of completed mentored research can be used to replace one Group C technical elective course; 0.5 CUs cannot be applied to technical electives.

Research Track Learning Outcomes:

The Program Outcomes listed below are expected of all graduates of the Mechanical Engineering and Engineering Science/Mechanical Engineering Specialization Program. Mechanical Engineering and Engineering Science/Mechanical Engineering Specialization graduates will have:

Course Requirements:

Dependent on research topic developed with supervising professor.

Grading Procedures

The faculty mentor has discretion on the grading criteria, but must include the following components:

Semester 1: Research proposal (first semester only), progress report for that semester, summary of intermittent reports;

Final paper and presentation (completion of semester).

Organization and Expectations of the Course:

At the discretion of the supervising facility.

Program Outcomes:

The Program Outcomes listed below are expected of all graduates of the Mechanical Engineering and Engineering Science/Mechanical Engineering Specialization Program. This specialized class focus will vary on the outcomes, but will address (at a minimum) those outcomes in bold.

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. **an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions**
7. **an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.**

Tentative Lecture Schedule:

WEEK	DATE	TOPIC	WORK DUE	MATERIALS (read/lookup)
1	XXX	Literature review, develop topic with supervising professor. Weekly Meeting		
2-11	XXX	Weekly meeting	Status	
12	XXX	Research Thesis		
	FINAL	Final Paper Due at the professor's discretion	Paper	

Selected TCNJ Policies

TCNJ's final examination policy is available on the web:
http://policies.tcnj.edu/policies/digest.php?docId=9396

Attendance:
Every student is expected to participate in each of his/her courses through regular attendance at lecture and laboratory sessions. It is further expected that every student will be present, on time, and prepared to participate when scheduled class sessions begin. At the first class meeting of a semester, instructors are expected to distribute in writing the attendance policies which apply to their courses. While attendance itself is not used as a criterion for academic evaluations, grading is frequently based on participation in class discussion, laboratory work, performance, studio practice, field experience, or other activities which may take place during class sessions. If these areas for evaluation make class attendance essential, the student may be penalized for failure to perform satisfactorily in the required activities. Students who must miss classes due to participation in a field trip, athletic event, or other official college function should arrange with their instructors for such class absences well in advance. The Office of Academic Affairs will verify, upon request, the dates of and participation in such college functions. In every instance, however, the student has the responsibility to initiate arrangements for make-up work.

Students are expected to attend class and complete assignments as scheduled, to avoid outside conflicts (if possible), and to enroll only in those classes that they can expect to attend on a

regular basis. Absences from class are handled between students and instructors. The instructor may require documentation to substantiate the reason for the absence. The instructor should provide make-up opportunities for student absences caused by illness, injury, death in the family, observance of religious holidays, and similarly compelling personal reasons including physical disabilities. For lengthy absences, make-up opportunities might not be feasible and are at the discretion of the instructor. The Office of Academic Affairs will notify the faculty of the dates of religious holidays on which large numbers of students are likely to be absent and are, therefore, unsuitable for the scheduling of examinations. Students have the responsibility of notifying the instructors in advance of expected absences. In cases of absence for a week or more, students are to notify their instructors immediately. If they are unable to do so they may contact the Office of Records and Registration. The Office of Records and Registration will notify the instructor of the student's absence. The notification is not an excuse but simply a service provided by the Office of Records and Registration. Notifications cannot be acted upon if received after an absence. In every instance the student has the responsibility to initiate arrangements for make-up work.

TCNJ's attendance policy is available on the web:
http://policies.tcnj.edu/policies/digest.php?docId=9134

Academic Integrity Policy:
Academic dishonesty is any attempt by the student to gain academic advantage through dishonest means, to submit, as his or her own, work which has not been done by him/her or to give improper aid to another student in the completion of an assignment. Such dishonesty would include, but is not limited to: submitting as his/her own a project, paper, report, test, or speech copied from, partially copied, or paraphrased from the work of another (whether the source is printed, under copyright, or in manuscript form). Credit must be given for words quoted or paraphrased. The rules apply to any academic dishonesty, whether the work is graded or ungraded, group or individual, written or oral.

TCNJ's academic integrity policy is available on the web:
http://policies.tcnj.edu/policies/digest.php?docId=7642

Americans with Disabilities Act (ADA) Policy
Any student who has a documented disability and is in need of academic accommodations should notify the professor of this course and contact the Office of Differing Abilities Services (609-771-2571). Accommodations are individualized and in accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992.

TCNJ's Americans with Disabilities Act (ADA) policy is available on the web:
http://policies.tcnj.edu/policies/digest.php?docId=8082
Disability Support Services:
http://differingabilities.pages.tcnj.edu/

A Statement Regarding the Use of the Fourth Hour.

The students are assigned to work in groups on one or more learning projects and the group work unfolds during the fourth hour, for which no classroom space is required, since students meet in the library or in their dorm rooms or dorm lounges, or other spaces at their convenience.

Diversity

Mechanical Engineering Department strives to create a learning environment for students that supports a diverse range of ideas, perspectives and experiences, and honors their identities (including race, gender, class, sexuality, religion, ability, etc.). To help accomplish this:

If you have a name and/or set of pronouns that differ from those that appear in your official TCNJ records, please let the faculty know.

If you feel like your performance in the class is being affected by your experiences outside of class, or if something was said in class (by anyone) that made you feel uncomfortable please don't hesitate to come and talk with the faculty. If you prefer to speak with someone outside of the course, here are some resources that may be helpful:

1.To request help if you are in crisis or if you are concerned about a friend

2. To report discrimination or harassment

3. To request counseling or psychological services