



Research Petition Policy for the Combined Bachelor's and Master's Degrees (BS/MS) program for the School of Biomedical Engineering, Science and Health Systems

This report establishes the policy to petition for the Research Option of the combined bachelor's and master's (BS/MS) degrees program for the School of Biomedical Engineering, Science and Health Systems (The School) at Drexel University effective September 24, 2007. The policy outlines the process to pursue the dual BS/MS degrees with a research master's thesis. The guidelines presented in this document serve as a supplement to The School's Combined Bachelor's and Master's Degrees (BS/MS) program as the basis for this policy.

Research Option Petition Requirements

Students that are accepted to the BS/MS program in the School of Biomedical Engineering, Science and Health Systems are automatically placed in the Advanced Courses Option that does not require the completion of a research thesis. In order to pursue a research thesis for the Master of Science degree, the BS/MS student must petition the School for permission to participate in the Research Option of the BS/MS program. The Research Option admissions requirements are:

- A.** The student must be admitted to either the Biomedical Engineering BS/MS program or the BS/MS program in another engineering discipline at Drexel University (*only the Research Option is open to students pursuing a BME master's degree combined with an undergraduate engineering degree that is not biomedical engineering*).
- B.** The student must have a cumulative GPA of at least 3.2 for entry. The student must maintain a cumulative GPA of 3.0 to maintain eligibility.
- C.** The student must submit a petition no later than the start of the third week of the junior year summer term (*missing this deadline limits the student to the Advanced Courses Option*).
 - a.** The petition must include:
 - i.** a plan of study for both undergraduate and graduate courses approved by an academic advisor and the supervising research advisor,
 - ii.** a summary research plan incorporating an outline of an ABET-qualified design component for the master's thesis approved by a research advisor and an academic advisor,
 - iii.** a completed BS/MS research petition transmittal form.
 - b.** If a petition is not submitted or is not accepted, the BME student will be designated as continuing in the Advanced Courses option, and is expected to complete the Senior Design course sequence.
- D.** The petition to participate in the Research Option of the Biomedical Engineering BS/MS program will be given final approval by the School of Biomedical Engineering, Science and Health Systems.

- E. The School of Biomedical Engineering has no jurisdiction over master's degrees awarded in other academic units. Therefore, Biomedical Engineering BS/MS students who choose to pursue the MS degree in an academic unit other than Biomedical Engineering are required to complete the Senior Design sequence in BME to ensure that the requirements of a major design experience are met.
- F. BS/MS Research Option participants may fulfill the MS thesis requirement with a peer-reviewed journal publication as detailed in the BS/MS policy. However, note that this option is primarily intended for exigent circumstances and is not the recommended pathway to complete the MS thesis requirement. The peer-reviewed journal article will be reviewed for an ABET-qualified design component for a final approval of the degree award.
- G. **BS/MS Research Option participants must note that pursuing the MS thesis for completion of the MS degree without completing the Senior Design course sequence means that both their BS and MS degrees are contingent on the completion of the MS thesis.** In other words, the student must ensure the completion of both degrees to get a degree at all.

Petition Instructions

The petition to participate in the BS/MS Research Option encompasses three components: a) a revised plan of study, b) a summary research plan and c) a completed transmittal sheet that are used in determining the status of the petition. Each component must be satisfactorily completed before the submission can be reviewed.

- a. **Revised Plan of Study** - The petition must include a revised course plan for both undergraduate and graduate courses approved by the research advisor and the academic advisor. The course plan will essentially be a term by term schedule of the courses to meet the appropriate curriculum requirements for both BS and MS degrees.
- b. **Summary Research Plan** – The research plan should at a minimum summarize the objectives, the methods, and the schedule of the proposed research. ***The research plan must also incorporate an ABET-qualified design component*** for the master's thesis (see details below).
- c. **Completed BS/MS Research Petition Transmittal Sheet** – The official petition transmittal sheet should accompany each petition package. The form requires signature approval from the student, the supervising research advisor, and the academic advisor.

Details of the Summary Research Plan

Each petition must include a written plan that summarizes the proposed effort to complete the thesis research. The research plan should not exceed 12 pages of text body (not including references and appendices). As a guideline the research plan should include the following:

1. A **title page** including:
 - a. The proposed thesis title
 - b. Student name
 - c. Student's Undergraduate Program
 - d. Supervising research advisor name, institutional affiliation and location
 - e. Date

2. A **table of contents**.

3. A list of **specific aims (1-2 pages)**. The proposed research should have approximately three specific aims (objectives) that it intends to achieve. Each aim should be clearly stated and should represent a deliverable entity without the inclusion of multiple sub-aims.

4. **Introduction/Background (1-3 pages)**. The research plan should summarize the context of the intended research. The introduction/background examines the previous work and the state-of-the-art of the investigational issues.

5. An explanation of **methods and materials (1-3 pages)**. The research plan should detail a scheme for conducting the research. That scheme should detail the processes, supplies, equipment and facilities to be used.

6. An outline of an **ABET-qualified design component (1-3 pages)**. Each research plan must contain a design component outline that describes how the student will achieve some experiential practice with technical design. Each member of the MS thesis, faculty examining committee will apply a *Technical Design Rubric* (see below) to the written account of the design component in the BS/MS student's thesis. A **minimum average score of 1.8** (on a scale of 0 to 3) of the examiners' scores must be achieved to satisfactorily complete the design component. The thesis should identifiably incorporate aspects of the following ABET-qualified design elements which will be graded by the thesis committee using the *Technical Design Rubric* :
 - a. Identification of the problem
 - b. Background research of the problem
 - c. Clearly stated objectives of the *technical* design
 - d. A comparative analysis of alternative solutions
 - e. Development of a plan to achieve the design (including a block/system diagram)
 - f. Design project scheduling
 - g. Execution of the plan
 - h. Verification of the design effectiveness
 - i. Modification of the design for optimization
 - j. Technical level of the project

7. A **task schedule (1 page)**. The proposed research plan should layout a schedule for the completion of the specific aims. Thoughtful attention should be given to this schedule which must coincide with course planning.
8. **Formatting**. The following specifications are the recommended print formatting:
 - a. Text style and size – 10 or 12 point font (Arial, Helvetica or Times New Roman)
 - b. 1.5 line spacing
 - c. 1 inch left margin and a 0.5 inch right margin
 - d. references in APA format
 - e. limit appendices to five pages maximum

BIOMED – Technical Design Rubric

| | 3 - Excellent | 2 – Good | 1 - Adequate | 0 - Inadequate |
|--|---|--|---|--|
| Identification of the problem Score: | The problem has been shown (not just stated) to exist with supporting factual evidence. | A problem statement has been stated. | The problem statement has weak support. | Problem has not been stated clearly and lacks any supporting evidence. |
| Research and information gathering Score: | Existing solutions to the problem, including their good and bad points, have been stated. | Existing solutions have been stated. Additional discussion may be warranted in places. | A complete review of existing solutions and research related to this problem is not presented. | Connection between references and what is written is not clear. Little investigation has been done. |
| Definition of the project Score: | <ul style="list-style-type: none"> • There are clear expectations of the specific outputs or deliverables for the project. • A set of measurable performance requirements has been created. | <ul style="list-style-type: none"> • Expectations have been stated. • Some objectives may not be measurable. | <ul style="list-style-type: none"> • Expectations have been stated. • Most objectives are not measurable. | <ul style="list-style-type: none"> • Expectations are not clear. • Expectations are not measurable. |
| Development of a plan Score: | <ul style="list-style-type: none"> • A system block diagram has been developed to assist the team in solving the design. • All blocks have been broken down to a manageable level. | <ul style="list-style-type: none"> • A system block diagram has been developed to assist the team in solving the design. • Not all blocks have been broken down to a manageable level. | <ul style="list-style-type: none"> • A system block diagram has not been fully developed. • A few blocks have been broken down. | <ul style="list-style-type: none"> • A system block diagram has not been fully developed. • The problem has not been divided into manageable tasks and blocks. |
| Execution of the plan Score: | All major points of the project were completed. | Most major project points were accomplished | Few of the major project points were accomplished. | None of the major project points were accomplished. |
| Verification of the design Score: | The prototype has been tested against the performance requirements listed in the definition of the project. | The prototype has not been fully developed or tested. | Little verification of design was accomplished. | No verification of design was accomplished. |
| Project Scheduling Score: | A plan stating the cost, completion date, and required resources has been presented. Gantt charts and a budget spreadsheet have been generated. | Some aspects of the plan have not been fully developed. | Few aspects of the plan have been developed. | Lack of planning is evident. |
| Technical level of project Score: | A significant portion of this project involves technical information outside the scope of the undergraduate curriculum. | Several technical aspects were new to the students and required research. | This project contains some research but mostly involves technical information taught at the junior and senior levels. | This project did not challenge the students to perform much research, as it relied mainly on information taught within the curriculum. |

Total Score: _____**Average Score (Total/8):** _____**Date:** _____**BS/MS Student Name:** _____**Thesis Reviewer Name:** _____

BS/MS Research Petition Transmittal Sheet

This form represents the transmittal information for a petition to participate in the Research Option of the BS/MS program in the School of Biomedical Engineering, Science and Health Systems. This form must accompany the requisite **Revised Plan of Study** and **Summary Research Plan** that complete the petition. The student must obtain the approval of a Supervising Research Advisor by signature below and submit the petition to the School of Biomedical Engineering main office before the start of the third week of the summer term in the Junior year. An academic advisor will review the petition and notify the student of the petition's disposition.

Petition Submission Date: _____

Student Name: _____ ID# _____

Student Email: _____

Undergraduate Major: _____

Graduate Major: _____

Grade Point Average: _____ Concentration Area: _____

Student Signature: _____

Supervising Research Advisor Approval

I have read the *Research Petition Policy for the Combined Bachelor's and Master's Degrees (BS/MS) program*. I have also reviewed and agree with the named student's Revised Course Plan and the Summary Research Plan, and thereby, consent to supervise the master's thesis research of the named student.

Research Advisor Name: _____ Date: _____

Location: _____

Email: _____ Phone#: _____

Research Advisor Signature: _____

Academic Advisor Approval

I have reviewed the named student's petition to participate in the Research Option of the BS/MS program and found that:

_____ the petition complies with the specifications to warrant a successful master's thesis research experience, and I **ACCEPT** the petition. The student will be registered in the Research Option.

_____ the petition does not comply with the specifications to warrant a successful master's thesis research experience, and I **DO NOT ACCEPT** the petition. See the attached comments for details of this decision. The student is eligible to remain in the Advanced Courses Option.

Academic Advisor Name: _____ Date: _____

Academic Advisor Signature: _____

