Dual Degree Program in Applied and Industrial Mathematics and Biostatistics

Dual degrees in Biostatistics and Applied and Industrial Mathematics are offered by the College of Arts and Sciences and the School of Public Health and Information Sciences. Upon completion of the program, students will receive a Ph.D. in Applied and Industrial Mathematics and an M.S. in Biostatistics.

Application Procedure

To be admitted to the program, the student is required to apply to and be accepted by both the Department of Mathematics and the Department of Bioinformatics and Biostatistics. A student seeking admission into this program must submit letters to both the Department of Mathematics and the Department of Bioinformatics and Biostatistics stating the intent to take advantage of the dual degree program, as well as their choice of the thesis or non-thesis option for the M.S. in Biostatistics. Students must submit two (2) recent letters of recommendation with their letter of intent. Applicants will receive written notification stating whether their admission request has been approved or disapproved.

Degree Requirements

The required courses for the dual degree program consist of all non-overlapping core courses for the Ph.D. in Applied and Industrial Mathematics and the course requirements for the M.S. in Bioinformatics and Biostatistics.

Ph.D. in Applied and Industrial Mathematics

- **Core Courses (24 hours)**
  - Two sequences, each of 6 semester hours, chosen from
    - Real Analysis I-II, MATH 601-602
    - Algebra I-II, MATH 621-622
    - Combinatorics and Graph Theory I-II, MATH 681-682
  - Two sequences, each of 6 semester hours, chosen from
    - Mathematical Modeling I-II, MATH 635-636
    - Theory of Probability I-II, MATH 663-664[1]
    - Statistical Inference and Linear Statistical Modeling, MATH 667-668[1]
- **Area of Specialization (18 hours)[2]**
  - Application area courses chosen in consultation with a student's advisory committee. These courses can be outside of the Department of Mathematics.
- **Industrial Internship**
  - Each student, with prior approval of the Graduate Studies Director, has to complete an internship in an appropriate industrial or governmental setting, or have equivalent experience.
- **Other Requirements**
  - Students must pass 3 qualifying examinations, complete an approved computing project, and pass a candidacy examination as detailed in the catalog entry for the Ph.D. in Applied and Industrial Mathematics.
- **Dissertation (12-18 hours)**
  - A doctoral dissertation is required of each student.

- **Course Requirements (33 hours)**
  - Probability and Mathematical Statistics, PHST 661-662 or MATH 561-562 (6 hours)[1]
  - Biostatistical Methods I and II, PHST 680-681 (6 hours)[1]
  - Clinical Trials I and II, PHST 624-625 (4 hours)
  - Introduction to Statistical Computing, PHST 620 (3 hours)
  - Categorical Data Analysis, PHST 684 (3 hours)
  - Survival Analysis, PHST 683 (3 hours)
  - Electives (5 hours)
  - Public Health in the U.S., PHPH 523 (3 hours)[4]
- **Additional Requirements for Optional Thesis (6 hours)**
  - Thesis, PHST 666 (6 hours). To be completed in accordance with the guidelines written in the catalog entry for the M.S. in Bioinformatics and Biostatistics Degree.[3]

Footnotes:

1. The PHST 661-662/MATH 561-562 requirement is met if the student takes MATH 663 and MATH 667. The PHST 680-681 requirement is waived if the student takes MATH 667-668. Both requirements (PHST 661-662/MATH 561-562 and PHST 680-681) are waived **only if** the student completes both the MATH 663-664 and MATH 667-668 sequences.
2. Courses taken to satisfy the Biostatistics component of the dual degree program can be applied to the 18 semester hours of electives which are required for the Ph.D. in Applied and Industrial Mathematics.
3. Students electing to complete the optional master's thesis will not be permitted to enroll in the requisite thesis course (PHST 666) until at least 2 qualifying examinations toward the Ph.D. in Applied and Industrial Mathematics have been passed.
4. PHPH 523 fulfills an accreditation requirement that all graduates from the School of Public Health and Information Science receive foundational instruction in public health.

Credit Sharing

The maximum number of hours that simultaneously can be applied (i.e., double-counted) toward the M.S. in Biostatistics and the Ph.D. in Applied and Industrial Mathematics is 12. For example, if a student takes the MATH 663-664 and 667-668 sequences to fulfill the PHST 661-662 and PHST 680-681 sequences, then the allotment of 12 doubly counted hours will have been exhausted, and no courses toward the Biostatistics component of the dual degree can be counted toward the 18 elective hours required for the Ph.D. in Applied and Industrial Mathematics, nor Math courses counted toward the 5 elective credit hours required for the M.S. in Biostatistics. Courses to be double-counted other than those listed above in Footnote 1 must be approved by advisors in the Departments of Mathematics and Bioinformatics and Biostatistics.

Combined Industrial Internship and Master's Project or Master's Thesis

The Industrial Internship required by the Department of Mathematics and the Master's Thesis option <u>or</u> Practicum course (PHST 603) for the M.S. can be satisfied by a single internship and technical report which simultaneously satisfies the requirements for both degrees. Specifically, the internship must both

focus on biostatistics so that it satisfies the Practicum or Thesis, and contain advanced mathematical content, so that it satisfies the Industrial Internship. Likewise, the technical report must meet two requirements: it must satisfy the requirements for a Master's Thesis or Practicum report for the M.S. degree and it must be written at an advanced mathematical level expected Industrial Internship. Students should enroll in the Practicum (PHST 603) or Master's Thesis (PHST 666) courses during or shortly after completion of the Industrial Internship to take advantage of the combined Industrial Internship and Master's Project/Thesis.

Special Considerations

Students Having Previously Completed a Master's Degree in the Department of Mathematics

To preserve the spirit of a dual degree, such students need to complete 33 (Non-thesis option) or 39 (optional thesis) semester hours of courses as required for the M.S. in Biostatistics. Six (6) semester hours from the previous Master's degree coursework can be applied to this requirement. The remaining semester hours must be chosen from the list of approved electives not covered by core courses for the Department of Bioinformatics and Biostatistics, with preference given to courses in the Departments of Mathematics and Bioinformatics and Biostatistics. Combined Industrial Internship, Practicum and Master's Thesis cannot be replaced by a previous Master's thesis. This requirement must be satisfied as previously described, meeting the specifications of both departments.

Students Currently Enrolled in the Ph.D. in Applied and Industrial Mathematics Program

Students currently enrolled in the Ph.D. in Applied and Industrial Mathematics program will need to submit complete application materials to the Department of Bioinformatics and Biostatistics for admission to the M.S. component of the dual degree, as well as notify their advisor in the Department of Mathematics of the intention to enter the dual degree program. Letters of recommendation for admission to the M.S. program can be taken from the letters of recommendation written for admission to the Ph.D. program, provided they have been written recently enough to satisfy admissions requirements for the M.S. in Biostatistics.