The Biostatistics Graduate Program at Boston University (MS/PhD)

Program Handbook
2023-2024

Boston University Graduate School of Arts & Sciences

Boston University School of Public Health

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Mission Statements

The mission of the Graduate School of Arts & Sciences (GRS) is the advancement of knowledge through research and scholarship, and the preparation of future researchers, scholars, college and university teachers, and other professionals.

The mission of the Boston University School of Public Health is to improve the health of local, national and international populations, particularly the disadvantaged, underserved and vulnerable, through excellence and innovation in education, research and service.

The mission of the Department of Biostatistics:

- To teach students the proper conduct of research studies through rigorous study design and appropriate descriptive and analytic methods that enable valid, interpretable conclusions to be drawn
- To collaborate in research projects to ensure that studies are properly designed, appropriately analyzed, and suitably interpreted
- To develop and evaluate new methods of biostatistical analysis and strategies for study design

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Section 1

Introduction to the Biostatistics Graduate Program

OVERVIEW

Today biostatisticians play a critical role in studies of risk factors for disease, in assessing safety and efficacy of new therapies in clinical trials, and in the evaluation of patient outcomes. The results of these studies have public health and policy implications. From discussions with investigators about fine-tuning research questions to developing appropriate study designs, planning and implementing proper statistical analyses, and writing up the results, biostatisticians are involved in all aspects of research investigations. The goals of the faculty of the Department of Biostatistics are to participate actively in innovative research, to advance medical and statistical science, and to teach and work closely with students so that they may acquire the knowledge to pursue productive careers in medical and public health research and academia at the highest levels.

Students may pursue graduate study in biostatistics through the Biostatistics Graduate Program, jointly administered by the Department of Biostatistics of the School of Public Health and the Department of Mathematics and Statistics of the Graduate School of Arts and Sciences. The program offers students the opportunity to not only gain expertise in mathematical statistics, but also to specialize in the epidemiologic, medical, and bioscientific applications of statistics. Students are required to take courses in both the Department of Mathematics and Statistics and the Department of Biostatistics. The program offers a Master of Science (MS) in Biostatistics and a Doctor of Philosophy (PhD) in Biostatistics. Students pursue the PhD degree on a full-time basis and can choose to pursue the MS degree on either a full- or part-time basis, although they must complete their programs within a specified period of time as required by the Graduate School of Arts & Sciences.

Students who complete these programs will gain knowledge of probability, statistical inference and hypothesis testing, the design and conduct of experimental and epidemiological studies, statistical computation, and data analysis. Research interests of the Biostatistics department faculty include multivariate modeling, survival analysis, medical statistics, clinical trials methodology, statistical genetics, robust statistics, methods for the analysis of correlated data (longitudinal, spatial) data, estimation theory, and the design of experiments. Further information can be obtained from the directors of the program.

Section

2   Admission Requirements

APPLICATION FOR ADMISSION

The application deadline for the Biostatistics Program for Fall admission is **December 1** of the prior year for PhD applicants and **May 1** for MS applicants. We do not offer spring admission. All applications for admission are to be completed online through the Graduate School of Arts and Sciences (GRS). Please review all of the application instructions carefully, including the Frequently Asked Questions.

Department-specific admissions questions should be directed to biostat@bu.edu. Questions about the general admissions process should be directed to the Graduate School, grs@bu.edu.

Frequently Asked Questions for the Graduate School of Arts and Sciences are available here:

MS: https://www.bu.edu/cas/admissions/ma-ms/frequently-asked-questions/

PhD: https://www.bu.edu/cas/admissions/phd-mfa/apply/frequently-asked-questions/testing-requirements/

APPLICATION REQUIREMENTS

- GRS online application
- Official transcripts in English from all colleges and universities attended
- 1–2 page personal statement
- Three letters of recommendation
- Official report of TOEFL or IELTS scores for applicants whose native language is not English (see International Students below)
- Previous Coursework Document

PROGRAM PRE-REQUISITES

- At least the equivalent of a Bachelor's degree; no specific undergraduate major is required
- One year of calculus including multivariate calculus
- One formal course in linear algebra (with a minimum of four BU equivalent credits)

Applicants who have not met the pre-requisites will not be considered for admission.

INTERNATIONAL STUDENTS

Students from abroad must submit official English translations of all academic records. We do not require transcripts or evaluations from WES.

Official transcripts must be in English and sent directly from the college/university attended. Students must also submit results of the Test of English as a Foreign Language (TOEFL), with minimum score requirements of 550 for the paper-based test. GRS policy requires that applicants meet the minimum requirements *of each section* on the internet-based test:
   Reading—21
   Listening—21
   Speaking—21
   Writing—21

As an alternative to the TOEFL, the International English Language Testing System (IELTS) is also accepted as proof of English proficiency. The band score of 7.0 or higher is required for admission to the Graduate School of Arts & Sciences. We are accepting the results from the online Duolingo test and the TOEFL iBT Special Home Edition for the Fall 2023 admissions cycle.

Applicants who do not meet the minimum requirements of English proficiency are not eligible for admission. This requirement is waived for students who are citizens or permanent residents of English-speaking countries or students who expect to receive, an undergraduate or graduate degree from a college or university where the official language of instruction is English. If your transcript does not state that the language of instruction is English, then supporting documentation must be uploaded with the application.

Specific policies for admissions for international students can be found on the GRS website:
For prospective MS students: https://www.bu.edu/cas/admissions/ma-ms/international-students/
For prospective PhD students: https://www.bu.edu/cas/admissions/phd-mfa/international-students/

Section 3

MS Degree Requirements

OVERVIEW OF THE MS DEGREE

The Master of Science in Biostatistics program is aimed primarily at students with the equivalent of a Bachelor's degree who wish to pursue advanced study in the theory and methods of biostatistics. The program prepares students to function as collaborators on research projects in academia, industry or government, and prepares students for doctoral programs in biostatistics or other quantitative areas of health research.

MS LEARNING OUTCOMES

A candidate for a Master of Science degree in Biostatistics is expected to demonstrate mastery of knowledge in biostatistics by

- Demonstrating mastery at a Master's level of biostatistical theory and application through high achievement in course work and on written comprehensive examinations.
- Demonstrating commitment to advancing the values of scholarship by keeping abreast of current advances within biostatistics and showing commitment to personal professional development through engagement in professional societies and publication.
- Conducting scholarly work in a professional and ethical manner guided by the principles of the profession.

MS DEGREE REQUIREMENTS

The Graduate School or Arts & Sciences requires students pursuing a Master of Science in Biostatistics to:

- Complete the 32-credit curriculum
- Fulfill the Residency Requirement
- Fulfill the Grade Requirement
- Pass both the Theory and Applied Biostatistics Qualifying Examinations
- Complete the MS degree within 3 years of matriculation to the program

MS CURRICULUM

Students in the MS program must complete a total of 32 credits as follows:

Course #	Course Title	When offered***	Prerequisites
Six Core Courses, required (24 credits):			
CAS/MET MA581	Probability	Fall/Spring/Summer	
CAS/MET MA582	Mathematical Statistics	Fall/Spring/Summer	MA 581
SPH EP770	Concepts and Methods in Epidemiology	Fall/Spring	
SPH BS755[!] or CAS MA575	Linear Models	Fall Spring	MA581
SPH BS805 or SPH BS806	Intermediate Statistical Computing & Applied Regression Multivariable Analysis for Biostatisticians	Fall/Spring/ Summer Fall	
SPH BS852	Statistical Methods in Epidemiology	Fall/Spring	BS 805 or BS 806
Elective Courses (8 credits):			
CAS MA576	Generalized Linear Models	Spring	MA 575
CAS MA578	Bayesian Statistics	Spring	MA 581
CAS MA583	Introduction to Stochastic Processes	Spring	MA 581
CAS MA585	Time Series Modeling and Forecasting	Spring	MA 581
CAS MA588	Nonparametric Statistics	Spring	MA 582
CAS MA589	Computational Statistics	Fall	MA 581
CAS MA592^{+}	Introduction to Causal Inference	Fall (every other year)	MA 575
GRS MA685	Advanced Topics in Applied Statistical Analysis	Fall	
GRS MA751[#]	Statistical Machine Learning	Spring	MA 575, MA 581

GRS MA781*	Estimation Theory	Fall	MA 581, MA 582
GRS MA782*	Hypothesis Testing	Spring	MA 781
GRS MA861*	Seminar: Applied Mathematics		
GRS MA881*	Seminar: Statistics		
GRS MA882	Seminar: Statistics (Limit 4 credits)	Fall/Spring	
CAS CS542#	Machine Learning	Fall, Spring, Summer	
SPH BS722	Design and Conduct of Clinical Trials	Fall/Spring	Prior coursework in both epidemiology and biostatistics
SPH BS728	Public Health Surveillance, a Methods Based Approach (2 cr)	Fall	
SPH BS775	Applications of Statistical Methods in Clinical Research	Alt Springs (even years)	
SPH BS807+	Applied Causal Inference in Health Research	Alt Fall (even years)	
SPH BS810	Meta-analysis for Public Health and Medical Research	Fall	
SPH BS820	Logistic Regression/Survival Analysis	Spring	
SPH BS821	Categorical Data Analysis	Fall	
SPH BS825	Advanced Infectious Disease Epidemiology (2 credits)	Fall	
SPH BS831	Genomics Data Mining and Statistics (2 credits)	Spring	
SPH BS845	Applied Statistical Modeling & Programming in R	Fall	
SPH BS849	Bayesian Modeling for Biomedical Research & Public Health (2 credits)	Spring	
SPH BS851	Applied Statistics in Clinical Trials I	Fall/Spring	
Elective Courses (8 credits; *continued*):			
SPH BS853	Generalized Linear Models with Applications	Spring	BS 805 or BS 806
SPH BS854	Bayesian Methods in Clinical Trials	Alt Falls (odd years)	BS 851

SPH BS856	Adaptive Designs for Clinical Trials	Alt Springs (odd years)	BS 851
SPH BS857	Analysis of Correlated Data	Spring	BS 805
SPH BS858	Statistical Genetics I	Fall	
SPH BS859	Applied Genetic Analysis	Spring	
SPH BS860	Statistical Genetics II	Alt Springs (even years)	BS 858 or BS 859
SPH BS861	Applied Statistics in Clinical Trials II	Spring	BS 851
SPH BS901**	Directed Study in Biostatistics	TBD	
SPH BS902**	Directed Research in Biostatistics	TBD	
SPH EP854*	Advanced Epidemiology	Fall	

! BS755 and MA575 are the same cross-listed course. Biostatistics students should register using BS755 when it is available (usually in the Fall term) and MA575 otherwise

* Must obtain permission from academic advisor and/or instructor to take this course as an elective.

Only one of these two courses may count as an elective

+ Only one of these two courses may count as an elective

** A maximum of 4 credits is allowed across these two courses.

*** **Important note:** Please see the BU Course Search Database and the course listings on the BU Bulletin for full course descriptions. Course semester offerings are subject to change; for the most up-to-date course offering information, please see the University Class Schedule on the StudentLink.

MS PROGRAM REQUIREMENTS AND POLICIES

Residency Requirements: Students must be registered in both the semester in which the last degree requirements are completed and in the preceding semester. For example, if a student plans to complete their degree requirements in the Spring of 2024, they must be registered in both Spring 2024 and Fall 2023.

Grade Requirements: Students must earn a grade of B- or better in all courses applied to the degree. Students must meet all the requirements of the Graduate School of Arts & Sciences Satisfactory Progress and Good Academic Standing.

Satisfactory progress: The Graduate School of Arts & Sciences minimum standard for Satisfactory Academic Progress requires that students maintain a Cumulative Grade Point Average of 3.0 or higher. Failing to maintain a 3.0 GPA may affect eligibility for federal financial aid.

Good academic standing: Students must meet the requirements of the Graduate School of Arts and Sciences for Good Academic Standing. Students may have no more than two failing (less than B-) or W grades and meet all milestones of the program in

order to meet the time limits of the program. Failure to remain in good academic standing can result in dismissal from the program.

SPH PH700 Foundations of Public Health

All MS and PhD Biostatistics students must complete the zero-credit, self-paced, online course **SPH PH700** *Foundations of Public Health*. PH700 is an online [Blackboard](#) course that consists of 17 self-paced modules, which cover foundational knowledge in public health that prepare students to fully engage in their program of study. PH700 fulfills criteria for foundational public health knowledge, as required of all graduate students by SPH's accrediting body, the Council on Education for Public Health ([CEPH](#)).

Qualifying Examinations

The MS candidate must satisfactorily pass two comprehensive written [examinations](#) upon completion of coursework. These will require proficiency in the material covered in the six core courses.

The MS Biostatistics Theory Qualifying Examination is given in the spring semester and is administered by the Math department. Candidates must satisfactorily answer four questions based on material covered in MA581 and MA582. The MS Biostatistics Applied Qualifying Examination is given in December and in April each year. Candidates must satisfactorily answer a total of four questions based on material covered in MA575, BS805/BS806, and BS852 with at least one question from each of the three course areas.

Students can use one single reference sheet (printer size [8.5in x 11in] or smaller, handwritten or typed) in the Applied examination. A reference sheet is not allowed in the Theory examination. The reference sheet will be collected at the end of the exam.

Students are strongly urged to meet with their advisors to discuss preparation for the Qualifying Examinations. Students are allowed two attempts to pass a Qualifying Exam. The Biostatistics Qualifying Exam Committee will evaluate requests by students to take an exam for the third time on a case-by-case basis.

Important Note: For May graduates only, diplomas will be available at the commencement ceremonies. Otherwise, approximately one month following the date of graduation and depending on a student's preference, the diploma is either available for pick-up from the Diploma Office at the Office of the University Registrar, 881 Commonwealth Avenue, or it will be mailed to the address specified on the Diploma Dispersal form that is submitted with the Diploma Application.

Policies
All students must adhere to all Boston University Graduate School of Arts & Sciences [academic policies](#); and the University's [Administrative Policies](#). Note that this information [may change](#) at any time.

Responsible Conduct of Research (RCR)

The Biostatistics department strongly recommends that MS students complete at least step one of the University's Responsible Conduct of Research training. RCR consists of two steps:

- **Step 1:** Complete CITI RCR Training, which consists of self-guided online modules and quizzes, offered through the Collaborative Institutional Training Initiative (CITI) Program.
- **Step 2:** Complete Advanced RCR 1 credit course (see information in the Biostatistics PhD RCR requirement section)

MS GRADUATION

Please review the detailed graduation timeline and procedures on the GRS Dissertation and Graduation Procedures webpage. Note that several steps, including the Intent to Graduate form, must be taken well in advance of the intended graduation date. It is the student's responsibility to keep track of all graduation procedures.

Master of Science in Biostatistics students are eligible and invited to participate in both the GRS and SPH Commencement ceremonies. Many students choose to participate in only the SPH ceremony. Students must register in advance for each Commencement ceremony in which they plan to participate. Information and instructions about Commencement will be sent directly from SPH and GRS. It is the student's responsibility to keep track of all Commencement ceremony procedures.

Section 4

PhD Degree Requirements

OVERVIEW OF THE PHD DEGREE

The PhD program in Biostatistics is geared toward the graduate student who seeks a career as an academic, industrial, or governmental biostatistician. The Program meets the needs of the professional who wishes to achieve a high graduate degree specialized in statistical theory and methods for biomedical or clinical research applications. Students who complete the PhD program will gain knowledge in probability, statistical inference and hypothesis testing, the design and conduct of experimental and observational studies, statistical computation, and data analysis. Research interests of the program faculty include estimation and hypothesis testing theory, multivariate analysis, survival analysis, clinical trials methodology, statistical genetics and genomics, disease surveillance, robust statistics, longitudinal data analysis, time series, regression modeling for correlated data, causal inference, and the design of experiments.

PHD LEARNING OUTCOMES

A candidate for a Doctor of Philosophy degree in Biostatistics is expected to demonstrate mastery of knowledge in biostatistics and to synthesize and create new knowledge, making an original and substantial contribution to the field in a timely fashion by:

- Demonstrating mastery at a doctoral level of biostatistical theory and application through high achievement in course work and on written comprehensive examinations.
- Making an independent, original, and substantial contribution to the field of biostatistics, assessed through an oral defense of the dissertation work.
- Demonstrating commitment to advancing the values of scholarship by keeping abreast of current advances in the field of biostatistics and showing commitment to personal professional development through engagement in professional societies and publication.
- Conducting scholarly work in a professional and ethical manner guided by the principles of the profession.

PHD DEGREE REQUIREMENTS

The Graduate School of Arts & Sciences requires all students pursuing a Doctor of Philosophy in Biostatistics to:

- Complete the 64-credit program (students with a relevant prior MS/MA may transfer up to 32 credits)
- Fulfill the Residency Requirement
- Fulfill the Grade Requirement
- Pass both Qualifying Examinations

- Attend seminars and presentations as described below.
- Complete a dissertation that conforms to program and Graduate School requirements (outlined below)
- Pass the Final Oral Defense Examination
- Fulfill the teaching requirement by working as a Biostatistics TA for at least 1 semester
- Complete the PhD degree within 7 years of matriculation to the program
- Submit at least on paper based on dissertation work for publication

Additionally, students in Dissertation Phase are required to:

- Present the status of their dissertation research once per year
- Meet with their full dissertation committee at least twice per year
- Submit dissertation progress reports twice per year

Review all GRS requirements for doctoral students, including those for Good Academic Standing and Satisfactory Academic Progress here.

PHD CURRICULUM

The intent of the curriculum is to provide a firm foundation in biostatistics and mastery of a broad range of applied techniques. Students in the PhD program entering with only a bachelor's degree must complete a total of 64 credits.

Students entering the PhD program with MS degrees may be accepted into an eight-course (32 credits) post-Master's PhD program. However, they may be required to take additional co-requisites if there are any gaps in their background. For post-Master's PhD students, the core courses required will be determined at the start of their program by the Co-Directors. The remaining courses must come from the list of Biostatistics (either BS or MA) or Elective courses.

Students may take up to four credits of coursework not listed below if it is related to their thesis and approved by their advisor. A written justification of the course selection must be sent by the advisor to the Program Directors. This must be submitted at least one month prior to the start of the semester.

Course #	Course Title	When offered***	Prerequisites
Nine Core Courses, required (36 credits):			
CAS/MET MA581	Probability	Fall/Spring/Summer	
CAS/MET MA582	Mathematical Statistics	Fall/Spring/Summer	MA 581
SPH EP770	Concepts and Methods in Epidemiology	Fall/Spring	
SPH BS755[!] or CAS MA575	Linear Models	Fall Spring	MA581
SPH BS805 OR SPH BS806	Intermediate Statistical Computing & Applied Regression OR Multivariable Analysis for Biostatisticians	Fall/Spring/Summer Fall	
SPH BS853 OR CAS MA576	Generalized Linear Models with Applications Generalized Linear Models	Spring Spring	BS 805 or BS 806
SPH BS857	Analysis of Correlated Data	Spring	BS 805 or BS 806
GRS MA781	Estimation Theory	Fall	MA 581, MA 582
GRS MA782	Hypothesis Testing	Spring	MA 781
1. At least 12 credits from the following Biostatistics courses:			
SPH BS722	Design and Conduct of Clinical Trials	Fall/Spring	Prior coursework in both epidemiology and biostatistics
SPH BS728	Public Health Surveillance, a Methods Based Approach (2 credits)	Fall	
SPH BS775	Applications of Statistical Methods in Clinical Research	Alt Springs (even years)	

SPH BS807***	Applied Causal Inference in Health Research	Alt Fall (even years)	
SPH BS810	Meta-analysis for Public Health and Medical Research	Fall	
SPH BS820	Logistic Regression/Survival Analysis	Spring	
SPH BS821	Categorical Data Analysis	Fall	
SPH BS825	Advanced Methods in Infectious Disease Epidemiology (2 credits)	Fall	
SPH BS831	Genomics Data Mining and Statistics (2 credits)	Spring	
SPH BS845	Applied Statistical Modeling and Programming in R	Fall	
SPH BS849	Bayesian Modeling for Biomedical Research and Public Health (2 credits)	Spring	
SPH BS851	Applied Statistics in Clinical Trials I	Fall/Spring	
SPH BS852	Statistical Methods in Epidemiology	Fall/Spring/Summer	
SPH BS854	Bayesian Methods in Clinical Trials	Alt Falls (odd years)	BS 851
SPH BS856	Adaptive Design for Clinical Trials	Alt Springs (even years)	BS 851
SPH BS858	Statistical Genetics I	Fall	
SPH BS859	Applied Genetic Analysis	Spring	
SPH BS860	Statistical Genetics II	Alt Springs (even years)	BS 858 or BS 859
SPH BS861	Applied Statistics in Clinical Trials II	Spring	BS 851
2. The remaining courses may be selected from the above series of courses or from the following Elective Courses (12 credits):			
CAS MA511	Introduction to Analysis I	Fall	
CAS MA512	Introduction to Analysis II	Spring	MA 511
CAS MA555	Numerical Analysis I	Spring	
CAS MA556	Numerical Analysis II	Fall	MA 555

CAS MA568	Statistical Analysis of Point Process Data	Fall	MA 213, MA 214
CAS MA578	Bayesian Statistics	Spring	MA 581
CAS MA583	Introduction to Stochastic Practices	Spring	MA 581
CAS MA585	Time Series Modeling and Forecasting	Spring	MA 581
CAS MA588	Nonparametric Statistics	Spring	MA 582
CAS MA589	Computational Statistics	Fall	MA 581
CAS MA592***	Introduction to Causal Inference	Alt Fall (odd years)	MA 575
CAS MA685	Advanced Topics in Statistics	Fall/Spring	
GRS MA703	Statistical Analysis of Network Data	Sometimes Fall, sometimes Spring; alternating years	MA 575
GRS MA711	Real Analysis	Fall	MA 512
GRS MA750	Nonparametric and Semiparametric Data Modeling	Fall	MA 575, MA 581
GRS MA751*	Statistical Machine Learning	Spring	MA 575, MA 581
GRS MA777	Multiscale Methods for Stochastic Processes and Differential Equations	Fall	MA 581, MA 583
GRS MA779	Probability Theory I	Fall	MA 511
GRS MA780	Probability Theory II	Spring	MA 711
GRS MA882	Seminar: Statistics	Spring	
CAS CS542*	Machine Learning	Fall, Spring, Summer	
SPH BS901**	Directed Study in Biostatistics	TBD	
SPH BS902**	Directed Research in Biostatistics	TBD	
SPH EP854‡	Advanced Epidemiology	Fall	EP 770
SPH EP855‡	Advanced Epidemiology Seminar: Issues in Study Design	Spring	EP 854

! BS755 and MA575 are the same cross-listed course. Biostatistics students should register using BS755 when it is available (usually in the Fall term) and MA575 otherwise

* Only one of these two courses may be taken as an elective.
** Limit of 4 credits among the two. Post-Bachelor's PhD students may petition Co-Directors to allow more than 4 credits.
*** Only one of these two courses may be taken as an elective.
‡ Only one of these two courses may count as an elective.

*** **Important note:** Please see the BU Course Search Database and the course listings on the BU Bulletin for full course descriptions. Course semester offerings are subject to change; for the most up-to-date course offering information, please see the University Class Schedule on the Student Link.

Specialization Areas

Students in the PhD program may also select one of three areas of specialization by completing at least three courses from those listed within a specific area as part of their electives:

Analysis of Observational Studies	
SPH EP854	Advanced Epidemiology
SPH BS820	Logistic Regression/Survival Analysis
SPH BS852	Statistical Methods in Epidemiology
SPH BS810	Meta-analysis for Public Health and Medical Research
Clinical Trials	
SPH BS722	Design and Conduct of Clinical Trials
SPH BS810	Meta-analysis for Public Health and Medical Research
SPH BS851	Applied Statistics in Clinical Trials I
SPH BS854	Bayesian Methods in Clinical Trials
SPH BS856	Adaptive Designs for Clinical Trials
SPH BS861	Applied Statistics in Clinical Trials II
Statistical Genetics	
SPH BS831	Genomics Data Mining and Statistics
SPH BS858	Statistical Genetics I
SPH BS859	Applied Genetic Analysis
SPH BS860	Statistical Genetics II

PHD ADVISING SYSTEM

Academic Advisor. Upon entry into the Biostatistics Program, each student will be appointed an Academic Advisor from the Biostatistics faculty. This person will act as the student's primary academic advisor and a general point of contact within the department until the student identifies a dissertation advisor.

RA or TG Advisor. In addition to the academic advisor, each doctoral student will be assigned either a Research Assistantship (RA) advisor or a Training Grant (TG) advisor at the start of the program. This advisor will oversee the assistantship or training grant placement for the upcoming year. Students should work with their RA/TG advisor in addition to the academic advisor when finalizing a course schedule, in case there are classes that would be particularly relevant to the Assistantship or Training Grant that the RA/TG advisor recommends. Policies relevant to RAships can be found in the RA handbook.

Dissertation Advisor. Each PhD student will identify one or more research advisors within 6 months of entering dissertation phase. Students are encouraged to identify their research advisors early in the program, based upon published research, academic advising, teaching, working group affiliation, or other criteria relevant to the student's research interests. Dissertation advisors are selected by mutual agreement between the student and advisor. Once identified, the student should notify the Academic Program Administrator of their dissertation advisor and this person should be clearly listed on all dissertation progress updates. The primary dissertation advisor may be a faculty member from outside the Biostatistics Department if approved by GRS; in this case, the second reader on the dissertation committee must be a Biostatistics faculty member.

PHD PROGRAM REQUIREMENTS AND POLICIES

Residency Requirements: The minimum residency requirement is the equivalent of 2 consecutive regular semesters of full-time graduate study at Boston University. Students who have completed their course requirements must register each subsequent semester for BS980 Continuing Study/Dissertation Seminar until they have completed all requirements for the degree. Upon written petition and appropriate cause, students will be allowed up to 2 semesters of leave of absence.

Students must be registered in both the semester in which the last degree requirements are completed and in the preceding semester. For example, if a student plans to complete their degree requirements in Spring of 2024, they must be registered in both Spring 2024 and Fall 2023. If a student plans to defend in Summer 2024, they must be registered in Spring 2024 and Summer 2024. Any student who plans to defend in early fall should meet with GRS Records to discuss their plans.

A full explanation of GRS residency requirements can be found [here](#).

Grade Requirements: Students must earn a grade of B- or better in all courses applied to the degree. GRS policy is that students must maintain satisfactory academic progress, which includes maintain a [GPA of 3.0](#).

Teaching Requirements: Students must complete the teaching requirement before defending their dissertation. Students complete the teaching requirement by working as a Teaching Assistant or Co-Instructor for a 3 or 4 credit Biostatistics course (or related course, as long as the Academic Program Administrator is informed) for at least one semester.

[Seminar and Presentation Attendance Requirement](#):

1. **Seminars**: All PhD students must attend at least 4 qualifying seminars per semester (fall and spring). Eligible events include: Biostatistics Lunchtime Seminar Series, Statistical Genetics Seminar Series, working group meetings, Biostatistics Student Association (BSA) and Boston University Student Chapter of the American Statistical Association (BUSCASA) seminars, Department of Mathematics and Statistics seminars, and biostatistics-related seminars of the Boston University Clinical and Translational Science Institute (CTSI). A sample of upcoming events that count towards this requirement will be included in the departmental newsletter throughout the academic year.

2. **Presentations**: Doctoral students must also attend doctoral student dissertation presentation sessions each semester (fall and spring). Both the regularly scheduled [dissertation research presentation sessions](#) and dissertation defenses can be used to fulfill this requirement. **Students in coursework phase** must attend at least one doctoral student presentation session each semester (fall and spring). **Students in dissertation phase** must attend at least three doctoral student presentation sessions each semester (fall and spring), not including their own presentation session.

3. **L. Adrienne Cupples Award**. All doctoral students are required to attend the L. Adrienne Cupples Award presentation and associated student meeting in the spring semester.

The Academic Program Administrator will track compliance with these requirements, which are also reviewed by the Graduate Education Committee. Students who do not attend the required number of events each semester will be required to make a special presentation in the spring.

[Responsible Conduct of Research (RCR) Requirement](#)

The Biostatistics department requires all doctoral students to complete the University's Responsible Conduct of Research training. The University will email students information about the training and a link to the online training modules. RCR consists of two steps:

- **Step 1: Complete CITI RCR Training**, *which consists of self-guided online modules and quizzes, offered through the Collaborative Institutional Training Initiative (CITI) Program.*
- **Step 2: Complete Advanced RCR (Live) discussion workshops.** *These four workshops, offered every semester, incorporate faculty mentor-led group discussions around the practical and ethical questions surrounding authorship, conflicts of interest, collaborative science, social responsibilities, research misconduct, mentor/mentee relationships, data acquisition and management, and peer review*
  Note: As of Fall 2023 BU has switched to a 1-credit, non-tuition-bearing course ENG EK800 format for the advanced RCR training, offered through the College of Engineering. This ten-week course meets weekly for 50-minute sessions and fulfills the new National Science Foundation requirements, as well as the existing NIH requirements. In Fall 2023 the course is taught by Sarah Hokanson and meets on Wednesdays from 4-4:50pm in the Kenmore Classroom Building (KCB), room 101. This course must be completed within two years of requirement notification. Training must be done every four years and at each new career stage.

SPH PH700 Foundations of Public Health

All MS and PhD Biostatistics students must complete the zero-credit, self-paced, online course **SPH PH700** *Foundations of Public Health*. PH700 is an online Blackboard course that consists of 17 self-paced modules, which cover foundational knowledge in public health that prepare students to fully engage in their program of study. PH700 fulfills criteria for foundational public health knowledge, as required of all graduate students by SPH's accrediting body, the Council on Education for Public Health (CEPH).

Awarding the MS Degree to Doctoral Students
Students accepted to the doctoral program without a prior MS or MA degree, can be awarded the MS in biostatistics degree upon completion of the requirements of the MS degree and have passed their PhD qualifying exams. If a student wishes to be awarded an MS degree, they must complete the Master's Intent to Graduate form with GRS.

Qualifying Examinations

The doctoral candidate must satisfactorily pass two comprehensive written examinations upon completion of coursework. These will require proficiency in material covered in the nine core courses. Students can use one reference sheet (printer size [8.5in x 11in] or smaller, handwritten or typed) for both examinations. The reference sheet will be collected at the end of the exam.

The Statistical Theory Qualifying Examination is given each year in the fall semester. Candidates must answer a total of four of six questions based on material covered in MA781 and MA782. The PhD Applied Statistics Qualifying Examination is given each year in December and in April. Candidates must satisfactorily answer five questions based on material covered in BS853/MA576, MA575, BS805/BS806, BS857, and BS852, with at least one question from each. Students entering in Fall 2022 or after must

answer one question from each of the four required courses MA575, BS805 or BS806, BS853, and BS857, plus one additional question.

Students are strongly urged to meet with their advisors to discuss preparation for the Qualifying Examinations. Students are allowed two attempts to pass a Qualifying Exam. The Biostatistics Qualifying Exam Committee will evaluate requests by students to take an exam for the third time on a case-by-case basis.

Access to Department
All Biostatistics doctoral students will have after-hours access to the Biostatistics Department on the 3rd floor of the Crosstown building, to use the student workstations outside of normal business hours.

Policies
All students must adhere to all Boston University Graduate School of Arts & Sciences academic policies; and the University's Policies. Note that this information may change at any time.

Fellowships
PhD students are eligible to apply for external fellowships, such as the F31 fellowship from the NIH. The department is very supportive of these fellowships as they provide valuable training and opportunities for students. Successful candidates typically apply once they are completing coursework, have done preliminary research on a dissertation topic, and have identified a strong and experienced mentoring team.

To ensure adequate departmental support of the application, students who intend to apply for a fellowship are required to notify the program co-directors and their RA supervisor, if applicable, of their intent to apply at least three months prior to the application deadline in order to receive approval to apply. The applicant must supply information on the proposed research topic, faculty supervisors, and timeline for submission of the application. Students with successful applications will work with the program directors to ensure a smooth transition from their current funding source upon funding of the fellowship.

PhD Student Parental Leave
All full-time or certified full-time PhD students in good academic standing are entitled to 60 days of paid parental leave for the birth or adoption of a child. This provides continuation of the student's stipend during the period of accommodation. This leave must end no later than the final day of the semester immediately following the semester in which the child is born/adopted. During this period the student is excused from course requirements, and any requirements outside of coursework such as qualifying exams must be rescheduled. If the student is serving or was to serve in a teaching role or as an RA on a funded project during the period of accommodation, then they will be relieved of any duties directly related to the course or project during that period of accommodation.

The student must inform their department chair or program director at least 30 days prior to the start of the semester in which the leave will occur, and submit the Notification of Childbirth and Adoption Accommodation form to grsaid@bu.edu.

Please see [Boston University's Childbirth and Adoption Accommodations for PhD Students](#) for further details.

PhD Students & Outside Summer Internships
PhD students who wish to do an outside internship over the summer must complete the following steps:

1. Discuss the internship with all advisors, including the RA advisor and dissertation advisor (if the student has not yet identified a dissertation advisor, this would be the academic advisor).
   * The internship should be relevant to dissertation research &/or dissertation preparation.
   * International students must demonstrate that the internship is integral to their dissertation; see step 4 below.

2. Obtain the RA advisor's approval to pause RA work for the duration of the internship.

3. Complete the Biostatistics Summer Internship Proposal Form.
   * Obtain signatures from both: 1) the RA or TG advisor, and 2) the dissertation advisor (if applicable).
   * Submit the form to the academic Academic Program Administrator for the Biostatistics PhD Co-Directors to review and approve.

4. **International Students:** Work with BU's International Students and Scholars Office (ISSO) to obtain [Curricular Practical Training (CPT)](#) authorization.
   * The CPT authorization application process involves the student completing a form and obtaining an approval letter from their dissertation advisor (the letter must be signed by both the dissertation advisor and one of the Biostats PhD Co-Directors).
   * The paperwork must demonstrate that the internship is directly related to the student's dissertation work and that it is a unique opportunity which cannot be accomplished using BU facilities.
   * The dissertation advisor certifies that they will monitor the student's off-campus research.
   * If the student is still in the coursework phase and does not have a dissertation advisor yet, the student can work with their academic advisor or RA advisor, to establish the connection between the outside summer internship and the student's course of study and prospective dissertation topic.

Dissertation Requirements

Dissertation Phase: Students enter dissertation phase after completing all of their required coursework and passing both Qualifying Exams. Students in dissertation phase may officially audit one class per semester during the academic year (i.e., not including Summer Term). This course must be related to the dissertation research or be considered as background or preparation for the dissertation research or topic. More information on the GRS Auditing Courses Policy is available [here](#).

Students in dissertation phase are required to fulfill additional requirements as outlined below.

Dissertation: The PhD dissertation provides students with the opportunity to design, conduct, and report on independent, original research in biostatistics. The dissertation consists of original research in the development of statistical methodology for biomedical or epidemiologic applications. The dissertation must be an original contribution to the body of knowledge in biostatistics. It is expected that the dissertation content will address a relevant question in statistical methodology and will pose a new approach, extend an existing approach, or provide novel application of an existing method. Dissertations will often utilize simulation, but simulation studies without methodological development or a theoretical component are not sufficient. Additionally, simulations are not required and use of real data sets in combination with theoretical work may suffice.

Transition towards the Dissertation Phase: Upon successful completion of the Qualifying Examinations and required coursework, doctoral students select dissertation advisors who will guide them through their dissertation research. Prior to meeting the requirements to officially enter the dissertation phase, students may begin doing proto-research with a potential dissertation advisor. This would include limited work to identify and begin developing a research topic for the dissertation. This must be done with the guidance of the student's academic advisor, to ensure that this work does not detract from successfully completing coursework and passing the qualifying exams.

Dissertation format: The dissertation must meet all formatting requirements specified by GRS. Within these requirements, two approaches to the dissertation are allowed. The first is a single body of work comprehensively addressing one problem. The second format consists of two or three problems in a single area of research. For either format, the content of the dissertation should be at least equal to the content of three journal articles. The format of the dissertation (single body of work versus multiple related problems) should be agreed upon by consensus of the student, the primary reader and the committee members.

Dissertation Proposal and Prospectus: Each doctoral student will work with a primary dissertation advisor and committee to develop a dissertation proposal. This proposal describes the dissertation project that the student intends to work on and should have the following sections: 1) introduction (with literature review); 2) basic outline of the problems the dissertation will address, and 3) (optional) preliminary results. It is expected that the student will develop this document with guidance from their dissertation committee. This document is not binding, since it is recognized that the scope and content of the dissertation can change. The purpose of this document is to ensure that the student is making appropriate progress to defining a dissertation problem and working closely with their committee.

If adequately developed, this document may be used as the prospectus required by GRS (GRS Prospectus instructions available here). Otherwise, this document should be treated as a preliminary version of the prospectus to be submitted at a later date. The Prospectus approval form must be submitted to GRS **at least six months prior to the dissertation defense**. When the prospectus has been approved by the student's dissertation committee, the student should submit the form and prospectus to the program directors and Academic Program Administrator for approval and signature, and then submit the signed form to GRS with a cc: to the Academic Program Administrator.

GRS has limited specific guidance for the format and content of the dissertation prospectus. The dissertation prospectus, generally a formal paper <u>not exceeding 20 double-spaced (or 10 single-spaced) pages of 12-point font</u>, should be completed before the more extensive phase of dissertation research is undertaken. The readers, the Director of Graduate Studies/Program Director must approve the final draft.

In addition, the following are recommendations for the dissertation prospectus for biostatistics. This document should have a well-developed background and literature review for the dissertation projects. Methods and results for the first project can be included in the prospectus. The document should outline the scope of the dissertation and the projects that the student will complete, as agreed upon by the dissertation committee.

Dissertation Progress: Doctoral students in the dissertation phase of the program are required to meet with their dissertation committee at least twice per year. It is beneficial to have at least three committee members in attendance at each meeting, particularly as the dissertation nears completion. Progress on the dissertation will be closely monitored by the committee and co-directors through progress update forms submitted in October and May each year. Any student who fails to meet with their committee and submit the dissertation progress update on time will be prevented from registering for the subsequent semester until the progress update has been submitted. See detailed timeline at the end of this document.

Doctoral Dissertation Presentations: Presentations of doctoral student dissertation research in progress will be held regularly throughout the fall and spring semesters. Students in dissertation phase must (a) present the status of their dissertation work to students and faculty at least once per year and (b) attend at least 3 other doctoral dissertation presentation sessions or dissertation defenses per semester (fall and spring). **There are no exceptions.** Failure to comply may lead to a delayed graduation.

Prepare a scholarly manuscript for publication. All doctoral students are required to have submitted at least one first-author paper based on their dissertation to a peer-reviewed journal for publication prior to the dissertation defense. The article must conform to the requirements of a specific statistical or otherwise appropriate journal. The dissertation committee must confirm that this submission has occurred prior to the defense being scheduled.

Final Oral Defense Examination: Each doctoral candidate will present an oral defense of the dissertation before a four-member (or more) doctoral committee.

Time Limits: The PhD program must be completed within seven years after the first registration for doctoral study. All doctoral students are expected to adhere to Biostatistics Program guidelines regarding the following milestones in their programs of study toward degree completion:

- Successfully complete all core courses no later than 3 years after matriculation.
- Pass at least one (Theoretical or Applied) Biostatistics Qualifying Examination no later than 3 years after matriculation.
- Pass both Qualifying Exams no later than 4 years after matriculation.

- Establish the members of the dissertation committee no later than 6 months after passing the final qualifying exam and completing required coursework.

PHD GRADUATION

Please review the detailed graduation timeline and procedures on the GRS Dissertation and Graduation Procedures webpage. Note that several steps, including the Intent to Graduate form, must be taken well in advance of the intended graduation date. It is the student's responsibility to keep track of all graduation procedures.

Doctoral students in Biostatistics are eligible and invited to participate in both the GRS and SPH Commencement ceremonies. Many students choose to participate in only the SPH ceremony. Students must register in advance for each Commencement ceremony in which they plan to participate. Information and instructions about Commencement will be sent directly from SPH and GRS. It is the student's responsibility to keep track of all Commencement ceremony procedures.

Section 5

Administrative Timeline & Progress to Degree

TIMELINE TO DOCTORAL DEGREE

Students are responsible for monitoring the progress of their program with the help of their academic advisor. The following are steps students should take to completing their PhD Dissertation. Students should direct questions to the one of the Co-Directors

Years 1-4	Complete coursework Sit for Qualifying Exams o Applied Qualifying Exam offered in April and December. o Theory Qualifying Exam offered in Fall.
Dissertation Phase *(after completing all coursework and qualifying exams)*	Identify dissertation advisor, topic, and timeline to completion within 6 months of entering dissertation phase. Identify full committee within the first year of dissertation phase. o A Committee consists of at least four members. At least two members must be Biostatistics Program faculty members. The primary reader may be someone from outside of the Program. If any committee member does not have a BU faculty appointment, the student must file a Special Service Appointment form with the Graduate School of Arts and Sciences. Complete the dissertation proposal by the end of the third year or within one year of entering dissertation phase. Once the full committee has been selected, meet with the full committee at least twice per year throughout the remainder of dissertation phase. Fulfill doctoral dissertation presentation requirements o Present dissertation research at least once per year. The abstract and summary should be sent to Kathy Lunetta (klunetta@bu.edu) at least one week before the presentation.

	Attend at least 3 doctoral student dissertation presentations per semester (fall and spring)
7-9 months prior to defense	Prepare Dissertation Prospectus and submit to committee for feedback and approval. Submit approved prospectus and signed Dissertation Prospectus Approval Form to Academic Program Administrator at least 6 months prior to defense. Review dissertation formatting requirements and sample pages.
4-5 months prior to graduation	Submit Intent to Graduate form to GRS. If a student started in a 64 credit degree program and wishes to be awarded an MS degree and have not yet requested the degree, they must also complete the Master's Intent to Graduate form.
3 months prior to defense	First draft of dissertation should be submitted to readers. Schedule an Appointment at GRS to review format of dissertation.
1 month prior to defense	Submit one article based on the dissertation to a peer-reviewed journal for consideration of publication and be listed as first author. The dissertation advisor must sign off on fulfillment of this requirement. Submit dissertation abstract to committee for approval. Schedule individual meetings with members of the committee to discuss the content and presentation of material in the dissertation.

3 weeks prior to defense	Submit Schedule of Final Oral Examination with Abstract Approval to Academic Program Administrator. Submit draft of dissertation to Academic Program Administrator. You will be notified if the format is approved or if any changes are required by GRS. Provide a final copy of dissertation to each member of the committee. Select a Chair from the members of your Committee and notify GRS of the name of the Chair. The Chair must be a member of the Biostatistics program faculty (Math or Biostatistics Department). Appropriate paperwork will be sent to Chair in advance of the defense.
Day of defense	Prepare and bring appropriate signature pages according to GRS specifications for the defense. Present dissertation using PowerPoint or similar electronic presentation.
After defense	Submit final approved dissertation electronically to the ETD Administrator and make an appointment with GRS Records to submit required materials in person. Submit a final electronic copy of the dissertation to the Co-Directors of the Program. Complete an exit interview form and meeting with one of the Co-Directors within one month of program completion.

Section

6

Professional and Career Development

The Graduate Program in Biostatistics in the Graduate School of Arts and Sciences offers a seminar series on topics relating to professional development and career planning for both Master and Doctoral degree students. Topics of discussion and activities include how to negotiate salaries and resources, ethical and professional issues in biostatistical practice, how to present the key concepts and results of one's work on a dissertation or research project, planning one's career path, the review of curricula vitae/resumes, and the conduct of mock job interviews.

In addition, the Boston University Center for Career Development offers a wide range of workshops, seminars, and trainings that are open to graduate students from all programs and are available from the student's first day in a program through graduation and beyond (http://www.bu.edu/careers/connect).

The University's Office of Career Planning and Professional Development for Doctoral Students (https://www.bu.edu/grad/cd-pd/phd/) provides focused resources for doctoral students that help guide students in creating and refining their Individual Development Plans (IDPs). BU additionally offers several programs to provide dissertation writing support (https://www.bu.edu/erc/grad/gws/

As a joint sponsor of the Graduate Program in Biostatistics, the Career and Practicum Office of the School of Public Health (https://www.bu.edu/sph/careers) also provides support for our Master and Doctoral degree students and is a major connecting point for organizations in health care and biomedical research seeking to hire graduates from our Programs.

As a long-standing and successful program at Boston University that integrates education and research between the Graduate School of Arts and Sciences and the School of Public Health, the Biostatistics Graduate Program supports its students in planning for careers in industry and government as well as in academia.

Section

7

Course Descriptions

BIOSTATISTICS COURSE DESCRIPTIONS

Comprehensive and up to date course descriptions can be found on: https://www.bu.edu/phpbin/course-search/index.php.

Section 8

Biostatistics Program Faculty

The Department of Biostatistics faculty is committed to the roles of teacher and mentor both inside and outside of the classroom. Their research brings depth and a real-life context to the classroom. The department's faculty has analyzed the multigenerational risk factors that contribute to heart disease, which led to a predictive tool for physicians to determine treatment strategies for patients with cardiovascular disease. In partnership with other academic institutions, members of the department have isolated and identified key factors that contribute to higher incidences of breast cancer and other diseases in African-American women. In addition, the department has designed and implemented an important comparative study that pinpoints risk factors for Alzheimer's disease. Members of the department are also actively engaged in clinical trials and methods for public health surveillance, designed to improve clinical treatments and aid the public health delivery system to identify disease hotspots.

Faculty bios for primary, secondary, and adjunct Biostatistics faculty can be found here and information about faculty research can be found on the Research section of our website.

The Mathematics and Statistics Faculty listing is here.

Biostatistics MS Degree Audit Sheet (32 credits)

I. MS Degree Required Courses: Six courses (24 credits)	Semester Completed	Grade Earned	Credits Earned
CAS MA 575 Linear Models			
CAS/ MET MA581 Probability			
CAS/ MET MA582 Mathematical Statistics			
SPH EP770 Concepts and Methods in Epidemiology			
SPH BS805 Intermediate Statistical Computing & Applied Regression or SPH BS806 Multivariable Analysis for Biostatisticians			
SPH BS852 Statistical Methods in Epidemiology			
II. MS Degree Electives: Any two (8 credits)	Semester Completed	Grade Earned	Credits Earned
CAS MA: 576, 583, 585, 588, 589, 592 GRS MA: 685, 751#, 781*, 782*, 861*, 881*, 882 CAS CS: 542#			
SPH BS: 722, 728, 775, 807, 810, 820, 821, 825, 831, 845, 849, 851, 853, 854, 856, 857, 858, 859, 860, 861, 901**, 902**			
SPH EP 854*			
# Only one of these two courses may count as an elective. * Must obtain permission from academic advisor to take this elective. ** Limit of 4 credits among the two.			

III. Qualifying Exams	Date of Completion	Grade Earned
Applied Qualifying Exam		
Theory Qualifying Exam		

MS Requirements Checklist:

□ Credits total: 32 MS graduate credits or approved transfer courses.

□ Grade of B- or better in all courses applied to the MS

□ Any course waivers or transfer credit approved

□ All incomplete classes completed, and grades posted

□ Submitted graduation application to GRS (2-3 months prior to commencement)

Biostatistics PhD Degree Audit Sheet

I. Post- BA PhD Required Courses: Nine courses (36 credits)	**Semester Completed**	**Grade Earned**	**Credits Earned**
CAS MA 575 Linear Models			
CAS/ MET MA581 Probability			
CAS/ MET MA582 Mathematical Statistics			
SPH EP770 Concepts and Methods in Epidemiology			
SPH BS805 Intermediate Statistical Computing & Applied Regression or SPH BS806 Multivariable Analysis for Biostatisticians			
SPH BS853 Generalized Linear Models with Applications or CAS MA 576 Generalized Linear Models			
SPH BS857 Analysis of Correlated Data			
GRS MA781 Estimation Theory			
GRS MA782 Hypothesis Testing			
II. PhD Biostatistics Electives: At least 12 credits of the following Biostatistics Courses:	**Semester Completed**	**Grade Earned**	**Credits Earned**
SPH BS: 722, 728, 775, 807, 810, 820, 821, 825, 831, 845, 849, 851, 852, 854, 856, 858, 859, 860, 861			
III. PhD Additional Elective Courses: The remaining courses may be selected from the above series of courses or from the following Elective Courses. One elective may be in the biological sciences# (12 credits):	**Semester Completed**	**Grade Earned**	**Credits Earned**
CAS MA:511, 512, 555, 556, 576, 578, 583, 585, 588, 589, 592, 685; GRS MA: 703, 711, 750, 751*, 779, 780, 882 ; CAS CS: 542* SPH EP: 854‡, 855‡ SPH BS: 901**, 902**			

* Only one of these two courses may be taken as an elective

‡ Only one of these two courses may count as an elective.

** Limit of 4 credits among the two. Post-Bachelor's PhD students may petition Co-Directors to allow more than 4 credits.

#Given the large number of biology courses, a comprehensive list is not provided here. Please contact the Program Co-Directors to seek permission for a specific course in the biological sciences.

IV. Qualifying Exams	**Date of Completion**	**Grade Earned**
Applied Qualifying Exam		
Theory Qualifying Exam		

PhD Requirements Checklist:
□ Total of 32-64 PhD graduate credits or approved transfer courses
□ Grade of B- or better in all courses applied to the PhD
□ All course waivers or transfer credit approved
□ All incomplete classes completed, and grades posted
□ Attended and presented at Doctoral Student Presentation Seminars
□ Submitted graduation application to GRS (2-3 months prior to commencement)