

GRADUATE STUDENT HANDBOOK

This handbook is designed to be used in conjunction with the [Graduate Division's Graduate Handbook](#) for detailed requirements, policies and procedures specific to the University and the Department of Statistics & Applied Probability.

This handbook has been prepared as carefully as possible. Please notify the Graduate Program Assistant if any information is unclear or missing.

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GRADUATE STUDENT ADVISING

The Faculty Graduate Advisor

The Graduate Advisor is a faculty member who is appointed each year to advise the students regarding their academic programs and progress. All graduate students must consult with the department's Faculty Graduate Advisor about their program of study. The graduate advisor is familiar with all of the department's graduate courses and is qualified to advise students on how to achieve their long-term academic goals. Students should see the graduate advisor whenever:

- a) A problem arises affecting their academic work
- b) There is a change in their study plan or degree objective
- c) They wish to submit a petition to the Graduate Division.

In addition, students must meet with the graduate advisor before the end of spring quarter. During these meetings the graduate advisor will review the students' past academic record and help plan their work for the upcoming year. Ph.D. students who already have a dissertation advisor should prepare a study plan with their dissertation advisor, and keep the Graduate Advisor fully informed.

Faculty Graduate Committee

There is a Graduate Committee consisting of several faculty members, who will, in consultation with other faculty, make decisions on petitions, financial aid, area requirements and other matters concerning individual graduate students.

The Graduate Program Assistant (Staff Graduate Advisor)

For matters of an administrative nature, students should see the department's Graduate Program Assistant. The Graduate Program Assistant is a staff member who handles the administrative duties of the graduate program, including student records, admissions, textbooks, cubicles, website, etc. The Graduate Program Assistant is a good resource for departmental and UC-wide policy and can act as a liaison with the Graduate Division.

The Thesis/Dissertation Advisor

It is each student's responsibility to obtain the early consent of a faculty member to serve as their thesis/dissertation advisor (also called committee chair). This advisor directs the student's research and supervises their progress. As soon as Ph.D. students, or M.A. students writing a thesis, are ready to start their research, they should ask a faculty member to be their committee chair/advisor. It takes a long time for students to become familiar with a professor's emphasis and approach in research, therefore serious consideration to this decision should be given. An advisor may, because of the particular sub-field, have additional course requirements. Although it is a serious matter, students may add or remove committee members. All committee changes must be approved by the department chair and by the Dean of the Graduate Division. Students should therefore thoroughly consider the decision.

Students should maintain frequent and regular contact with their advisor, regardless of their progress. Continuous personal contact allows a professor to know students' backgrounds, interests, creative abilities, technical skills, strengths and weaknesses. Without this detailed knowledge, it is difficult for faculty to give appropriate direction for research. For this reason, it is important that students maximize their professional contacts with as many members of the faculty as possible.

FINANCIAL SUPPORT

The Department of Statistics and Applied Probability provides financial support for some graduate students. If funding is offered, usually this offer of support will be made when a student is admitted into the program. All Ph.D. applicants are considered for funding during the application process.

Those Ph.D. students who are offered support with admission to the department will receive some combination of teaching assistantships, research assistantships, scholarships, and fellowships. These offers are contingent on students being registered and in good academic standing. Good academic standing is defined as maintaining a cumulative grade point average of 3.0 or higher, and remaining within the department's normative time schedule. Students who do not remain in good standing may be placed on academic probation and have their funding revoked. For more information, please see the section entitled "Academic Performance Standards."

There are sometimes resources available in our department (typically in the form of teaching assistantships) for MA/MS students who have shown promise in the program and who are eligible for such employment per university rules. However, such funding decisions for MA/MS students are only made for one-quarter at a time, and only if the department has needs beyond those filled by eligible Ph.D. students who remain in good standing. Decisions are made depending on specific department needs and individual skills.

The holder of a teaching assistantship is expected to demonstrate the basic skills and abilities needed to teach mathematics and statistics. All TA's must pass one quarter of PSTAT 501 *Teaching Assistant Training*, usually before or within their first quarter of teaching in the department. Additional TA appointments are contingent in part on satisfactory teaching performance as measured by student evaluations and faculty feedback. Only in exceptional circumstances and with Graduate Division approval, will students be hired as teaching assistants for more than 15 quarters, and no student may be a TA for more than 18 quarters in their career in the UC system. Teaching Assistants should consult the *Statistics Department TA Handbook* (<http://www.pstat.ucsb.edu/projects/leadtraining/depttahandbook.htm>).

All prospective TAs whose native language is not English are required to pass the TA Language Evaluation in order to be certified for sole classroom teaching responsibility. For more information regarding this evaluation, please consult the *Graduate Handbook* on the Graduate Division's website. (<http://www.graddiv.ucsb.edu/handbook/>) and the EMS web site (<http://www.ems.ucsb.edu/graduate/ta-info>).

There are external fellowships and funding opportunities that all students are encouraged to seek out. The Office of Financial Aid has applications for loans, grants, and work study employment (<http://www.finaid.ucsb.edu/>). International students can obtain applications for the Presidents Work Study Program from the Office of International Students (<http://www.oiss.ucsb.edu/>). The Graduate Division website has information on more sources of funding (<http://www.graddiv.ucsb.edu/financial/>). The Statistics and Applied Probability Department website also has information on other sources of funding specific to graduate students in statistics & probability (<http://www.pstat.ucsb.edu/graduate%20program/Scholarships.htm>).

All U.S Citizens and Permanent residents are required to submit a FAFSA (Free Application for Federal Student Aid) every year. The FAFSA is due at the beginning of March each year.

AREA REQUIREMENTS

In order to ensure breadth in the course of study, the Department of Statistics and Applied Probability has set up area requirements in the disciplines of applied statistics, mathematical statistics, and probability. Students may also choose to satisfy a pure mathematics area requirement offered by the Department of Mathematics. The area requirements vary for each degree, specialization, and optional Ph.D. emphasis. Consult with the Graduate Advisor or your committee chair as to which of these area requirements are appropriate for your proposed field of study, research, and degree objective. Each area requirement consists of two parts:

- a) **Completion of the Designated One-Year Graduate Sequence** with a minimum grade of "B" or better in each class. Courses taken S/U will not satisfy this requirement
- b) **A Qualifying Examination** on both undergraduate and graduate material. The qualifying examination is offered once a year, generally in spring or summer. The examination is designed to test whether students have adequate knowledge of relevant material. Each student has up to **two** attempts for each qualifying exam, and must successfully pass the requisite number of exams within **three** years of entering the department.

A detailed description of each of the four area requirements follows:

1. *Mathematical Statistics Area Requirements:*

Courses:

- *PSTAT 207 A-B-C: Statistical Theory*

Qualifying Examination:

- The examination for the mathematical statistics area requirement will be based on the topics that are usually covered in PSTAT 120 A-B-C, and PSTAT 207 A-B-C
These topics include:
 - Univariate and multivariate distribution theory: important special distributions including the Binomial, Poisson, Hypergeometric, Negative Binomial, Normal, Gamma and Beta, sampling distributions including chi-square, t and F, and order statistics. Exponential family. Moment generating function and its uses.
 - Sufficiency: factorization criterion, and minimal and complete sufficient statistics.
 - Estimation: maximum likelihood and method of moments, uniformly minimum variance unbiased estimators, Cramér-Rao inequality, Rao-Blackwell theorem, consistency, and asymptotic normality.
 - Hypothesis testing: Neyman-Pearson lemma, power functions, most powerful and uniformly most powerful tests. General likelihood ratio tests and their asymptotic properties and asymptotic equivalents.

- Confidence intervals and prediction intervals.
- Nonparametric tests for one-sample, two-sample, and independence problems: chi-square tests for goodness of fit and contingency tables.
- Least squares principle: linear and non-linear regression and inferences based on them.
- Bayesian inference for estimation and hypothesis testing.
- Basic decision theory for estimation and hypothesis testing.

Reference Material (Mathematical Statistics)

- Casella and Berger, *Statistical Inference*, 2nd edition
- Bickel & Doksum, *Mathematical Statistics*, Vol. 1
- Ross, *A First Course in Probability*
- Cox and Hinkley, *Theoretical Statistics*
- Rao, *Linear Statistical Inference and its Applications*
- Lehmann, *Theory of Point Estimation*, Springer, also *Testing Statistical Hypotheses*
- Rohatgi, & Saleh,, *An Introduction to Probability and Statistics*, 2nd Edition

2) Probability and Stochastic Processes Area Requirements:

Courses:

- PSTAT 213 A-B-C: *Introduction to Probability Theory and Stochastic Processes*

Qualifying Examination:

- The examination for the probability area requirement will be based on the following list of topics, which are generally covered in PSTAT 120A, PSTAT 160 A-B, PSTAT 210, and PSTAT 213A-B-C

These topics include:

- Generating Functions
- Discrete time Markov Chains: Major examples – random walk and branching processes. Chapman-Kolmogorov equations, classification of states, decomposition of the state space, invariant measures and stationary distributions, limit theorems, time reversibility.
- Continuous time Markov Chains: Major examples – Poisson process, birth-death processes. Backward and forward equations, generator, limiting behavior.
- Convergence of r.v.s.: Different types of convergence; ch. F., convergence in distribution, continuity theorem, LLN and CLT, some discussion of infinitely divisible and stable distributions, a.s. convergence and lemma Borel-Cantelli, convergence in probability, m.s./ Skorohod's representation theorem, strong LLN; uniform integrability and L^1 convergence.
- Conditional Expectation, also with Hilbert spaces for L^2 variables.
- Martingales: Properties and examples, Doob and Doob-Meyer decomposition, martingale convergence theorems, stopping items, optional sampling, optional stopping theorems and applications, maximal inequalities.
- Brownian motion: Brownian Motion as the scaling limit of a random walk, martingale and Markov properties, quadratic variation and Levy characterization. Stochastic integral, Ito formula, applications to related processes including Ornstein-Uhlenbeck process and Geometric Brownian motion.

References for Probability and Stochastic Processes:

- Grimmett & Stirzaker, *Probability and Random Processes*
- Durrett, *Probability: Theory and Example*
- Resnick, *Adventures in Stochastic Processes*
- Resnick, *A Probability Path*
- Billingsley, *Probability and Measure*
- Breiman, *Probability*
- Jacod & Protter, *Probability Essentials*

3) Applied Statistics Area Requirements:

Courses:

- PSTAT 220 A-B-C: *Advanced Statistical Methods*

Qualifying Examination:

- The examination for the applied statistics area requirement will be based on the following topics, which are generally covered by PSTAT 122, PSTAT 126, and PSTAT 220 A-B-C:
 - Data summary exploratory data analysis, linear models and analysis of variance, regression and correlation, experimental design, generalized linear models including logistic regression and log linear models for contingency tables, applications of regression methods in practical research, and multivariate methods. Additional topics as announced by Qualifying Examination committee.

References for Applied Statistics include:

- Box, Hunter and Hunter, *Statistics for Experimenters*
- Cochran and Cox, *Experimental Design*
- Draper and Smith, *Applied Regression Analysis*
- McCullagh and Nelder, *Generalized Linear Models*. (2nd ed.)
- Johnson and Wichern, *Applied Multivariate Statistical Analysis*.
- Rao, *Advanced Statistical Methods in Biometric Research*
- Venables and Ripley, *Modern Applied Statistics with S*. (4th ed.)
- Yandell, *Practical Data Analysis for Designed Experiments*
- Neter, Wasserman & Kutner, *Applied Linear Regression Models*
- Faraway, *Linear Models with R*, 2nd Edition
- Faraway, *Extending the Linear Model with R*
- Seber and Lee, *Linear Regression Analysis*
- Montgomery, *Design and Analysis of Experiments*

4. Pure Mathematics Area Requirements:

Courses:

- MATH 201 A-B-C: *Real Analysis*
- MATH 202 A-B-C: *Complex Analysis*

Qualifying Examination:

- The Pure Mathematics qualifying examination is based on material found in the UCSB undergraduate courses MATH 118 A-B-C and MATH 122 A-B, and the UCSB graduate courses MATH 201 A-B-C and MATH 202 A-B-C. This exam is administered by the Mathematics Department, and students planning to take this qualifying examination should contact the Mathematics Department to enquire about any changes in the format of this examination or topics.
- The examination consists of two parts;
 1. Topics in Real Analysis (The real number system, topology of \mathbb{R}^n , continuity, differentiability, Riemann integration, sequences and series, convergence processes including uniform convergence, functions of several variables, and introductions to metric spaces and to measure and integration).
 2. Topics in Complex Analysis (Complex numbers and functions, Cauchy integral theorem and Cauchy's integral formula and consequences, Residue calculus, elementary conformal maps, power series and Laurent series, elementary properties of analytical continuation, zeros and singularities of analytic functions).

Reference Material (Real Analysis)

- Rudin, *Principles of Mathematical Analysis*, 3rd ed. (covers all topics and more). The exam excludes 7.28-7.33, 8.15-8.22, and all of Chapter 10. From Chapter 6 the exam will cover only ordinary Riemann integration, not the more general Riemann-Stieltjes integral.
- Andrew Browder, *Mathematical Analysis* (Chapters 1-10).
- Robert Strichartz, *The Way of Analysis* (excluding Chapters 11, 12 and 15).

Reference Material (Complex Analysis)

- Brown & Churchill, *Complex Variables and Applications*, 6th ed. (Sections 1-80 cover these topics)
- Spiegel, *Complex Variables*, Schaum's Outline Series (covers all topics)
- Knopp and Konrad, *Problem Book in the Theory of Functions*, Vol. 1 & 2 (an old book, but still an excellent source for problems).

MASTER OF ARTS DEGREE PROGRAM

Admission

A candidate for admission to the Master of Arts in Statistics program at UCSB must:

- Fulfill the academic requirements for graduate study (see the section on Admissions, page 13);
- Have had undergraduate course work equivalent to:
 1. *PSTAT 120 A-B-C: Probability & Statistics*
 2. *Math 108A-B: Linear Algebra*
 3. *CS 10: Basic Computer Science*
 4. It is also desirable for students to have undergraduate work in an area in which Mathematics and/or Statistics is applied.

Students who have not satisfied all these requirements can be admitted, but they may be asked to take supplementary undergraduate courses which will not count towards the 42 unit course requirement given below. In particular, students who do not have credit for PSTAT 120 A-B-C or an equivalent course, must take PSTAT 120 A-B-C, since it is a prerequisite for the required graduate courses in the program.

Current UCSB graduate students who want to add the **MA** in Statistics and Applied Probability program must petition using the Change of Degree Status Petition, which can be found on the Graduate Division's website at: <http://www.graddiv.ucsb.edu/academic/forms-petitions>. Students interested in adding the MA should contact the Faculty Graduate Advisor before petitioning to express their interest and discuss coursework that may be advisable before petitioning.

Current UCSB MA students who want to apply to the **Ph.D.** in Statistics and Applied Probability program must use the Online Graduate Application located at www.graddiv.ucsb.edu/eapp. Current graduate students may only apply during the regular application cycle for the department. A complete online application and all supporting documents must be submitted by the deadline in order to be considered for admission and fellowship support. MA students interested in adding the Ph.D. should contact the Faculty Graduate Advisor before applying via the online application to express their interest and discuss coursework or qualifying exams that may be advisable before applying.

Requirements for the Degree

The department offers a Master's Degree in Statistics with a required specialization in either Mathematical Statistics or Applied Statistics. The specific requirements for each specialization are listed below. In both of these programs, the candidate must complete at least 42 units, 24 of which must be graduate courses in the 200 series. The remaining 18 units may be selected from upper-division or graduate courses in statistics, or in appropriate related fields with the prior approval of the Graduate Advisor. A maximum of 6 units of Directed Reading and Research (596) may be counted towards the degree. All required courses must be completed with a letter grade of "B" or better. The student's cumulative GPA must remain above a minimum of 3.0. Note also that PSTAT 500, 501, 502, 510, 109, 120ABC and 133 ABC do not count towards the MA degree requirement.

The Mathematical Statistics Track

The candidate must complete 42 units of approved upper-division or graduate work, including any two of the three basic graduate course sequences in probability and statistics:

- *PSTAT 207 A-B-C: Statistical Theory*
- *PSTAT 213 A-B-C: Introduction to Probability Theory & Stochastic Processes*
- *PSTAT 220 A-B-C: Advanced Statistical Methods*

Mathematical Statistics students may follow either of two plans; Plan I (Thesis Option) or Plan II (Examination Option).

Plan I - Thesis Option. In addition to the course requirements outlined above, students must pass a comprehensive examination corresponding to one of the statistics area requirements, prepare an acceptable thesis under the supervision of a faculty member, and defend it before their Master's Thesis Committee. Before the end of their second quarter, Plan I students should form and nominate their thesis committee. This committee should consist of a minimum of three members, at least two of whom must be ladder faculty from the Statistics and Applied Probability Department. The committee will be formally nominated by the Department Chair and approved by the Graduate Dean. While it should be nominated early in the student's graduate career, it will, in no case, be finalized later than the beginning of the final quarter of work.

Plan II - Examination Option. In addition to the course requirements outlined above, students must pass two qualifying examinations corresponding to two of the statistics area requirements.

The Applied Statistics Track

The Applied Statistics track will be oriented toward practical real-life problems and will be mathematically less demanding than the Mathematical Statistics track. It will aim at teaching data analytic procedures and their applications to statistical problems. In keeping with this goal, students will be required to become competent at statistical computing and participate actively in the consulting projects that arise in the Statistical Laboratory. This degree will prepare students for careers in government and industry as well as for quantitative research in other scientific disciplines of major interest.

The candidate must complete 42 units of upper-division or graduate work approved by the Graduate Advisor in Statistics. At least 24 of these units must be at the graduate level. The 42 units must include:

PSTAT 220 A-B-C: Advanced Statistical Methods

PSTAT 122: Design and Analysis of Experiments

PSTAT 230: Seminar and Projects in Statistical Consulting

The remaining units of credit may be obtained by taking any upper-division/graduate courses from the Statistics and Applied Probability listings (excluding *PSTAT 109, 120 A-B-C, 133 A-B-C, 500, 501, 502, and 510*) or courses from other applied disciplines with approval of the graduate advisor.

To satisfy the area requirement in Applied Statistics, students must pass the Applied Statistics qualifying examination based on *PSTAT 120A-B-C, 122, 126, and 220A-B-C*. Students also must pass a specific data analysis project that the *PSTAT 230* instructor designates will fulfill the degree project requirement.

The requirements for the Applied Statistics track will be kept flexible so that joint programs of study with other departments and schools can be worked out to suit the individual student's needs. These individualized programs should form a coherent plan and are subject to the approval of the Statistics and Applied Probability Department faculty. Courses that have substantial overlap will not be allowed.

Normative Time and Time-to-Degree

Normally, a student will complete the M.A. Degree in three to six quarters. Two Years is the department's Normative Time. Under Graduate Council policy, students have a maximum of four years to complete their Master's Degree. This is the Time-to-Degree deadline. If the department feels that a student is not making timely progress toward their degree, the student may be placed on academic probation.

Degree Completion

Graduate students who expect to complete the requirements for the Master's degree by the end of a given quarter must notify the Graduate Program Assistant at the beginning of that quarter. When the requirements for the Master's degree are completed, the Graduate Program Assistant will notify the Graduate Division. The Graduate Division will award the degree. It normally takes a few weeks for the degree to appear on the student's transcript. The diploma will be mailed to the student's permanent address within 3-4 months of completing the degree. Be sure to have a permanent address recorded on GOLD for your diploma to be mailed; keeping in mind that it won't be mailed for a few months after your degree is awarded.

PH.D. DEGREE PROGRAM

Admission

A candidate for admission to the Ph.D. in Statistics and Applied Probability program at UCSB must:

- Fulfill the academic requirements for graduate study (see the section on Admissions, page 13);
- Have had undergraduate course work equivalent to:
 1. *PSTAT 120 A-B-C: Probability & Statistics*
 2. *Math 108A-B: Linear Algebra*
 3. *CS 10: Basic Computer Science*
 4. It is also desirable for students to have undergraduate work in an area in which Mathematics and/or Statistics is applied.

Students who have not satisfied all these requirements can be admitted, but they may be asked to take supplementary undergraduate courses which will not count towards the 72 unit course requirement given below. In particular, students who do not have credit for PSTAT 120 A-B-C or an equivalent course, must take PSTAT 120 A-B-C, since it is a prerequisite for the required graduate courses in the program.

Current UCSB MA students who want to apply to the **Ph.D.** in Statistics and Applied Probability program must use the Online Graduate Application located at www.graddiv.ucsb.edu/eapp. Current graduate students may only apply during the regular application cycle for the department. A complete online application and all supporting documents must be submitted by the deadline in order to be considered for admission and fellowship support. MA students interested in adding the Ph.D. should contact the Faculty Graduate Advisor before applying via the online application to express their interest and discuss coursework or qualifying exams that may be advisable before applying.

Course Requirements

Students must complete 72 units of PSTAT graduate courses or approved graduate courses from other departments. At least 60 of the 72 required units must be in PSTAT 200 level graduate courses (excluding PSTAT 263), and they must include:

- *PSTAT 207 A-B-C: Statistical Theory*
- *PSTAT 213 A-B-C: Introduction to Probability Theory and Stochastic Processes*
- *PSTAT 220 A-B-C: Advanced Statistical Methods*

Twelve of the 72 units can come from 500-level courses, excluding PSTAT 501. Each required course (PSTAT 207, 213, and 220 sequences) must be completed with a letter grade of at least "B" or better. Students must maintain above a minimum cumulative grade point average of 3.0.

Students who plan to petition to add any of the optional Ph.D. emphases in Financial Mathematics and Statistics, Bioengineering, or in Quantitative Methods in Social Sciences must, refer to these emphasis descriptions in this document, since optional Ph.D. emphasis requirements may differ from the above. These students also need to refer to their intended optional Ph.D. emphasis web pages and committees for any changes/updates in optional emphasis requirements, and for additional information not included in this document.

Area Requirements

Each Ph.D. student must complete two of the four area requirements. Each student may attempt each qualifying exam twice. Each student must pass two qualifying exams within three years after joining the department's graduate program.

Normative Time

The Department of Statistics and Applied Probability has a normative time of three years to advance to candidacy and five years to complete the Ph.D. degree. The expectation of the department is that students will follow this timeline:

First 2 years

- Core courses completed
- Qualifying Exams passed

By winter of the 3rd year

- Advanced to Candidacy

After 5 years

- Dissertation and degree finished

If the department feels that a student is not making timely progress toward their degree, the student may lose funding and/or be placed on academic monitoring or academic probation. Please see section entitled "Academic Performance Standards" in this document, and Graduate Division web pages for more information.

Students may only be funded via Teaching Assistantships for 5 years (15 quarters); before petitions to Graduate Division are required. The maximum that a student may TA per UCSB regulations is 18 quarters. With an exception we might fund into the 6th year, but this is not guaranteed.

Nomination of the Dissertation Committee

A student must formally nominate their dissertation committee before the preliminary oral examination and advancement to candidacy. This requires separate paperwork and approval.

Eligibility of service on dissertation committees is governed by Academic Senate Regulations and the Graduate Council. The rules are as follows;

- a) Committee must consist of a minimum of 3 UC ladder faculty
- b) Two, including the Chair, must be in home department
- c) Additional members are at the department's discretion
- d) If the student wants to nominate a non-ladder faculty member (such as a non SOE or PSOE lecturer, researcher, adjunct faculty, or visiting faculty) as the second or third member of their committee, an exception request must be made using the Ph.D. Form I or I-A. Consult the Graduate Handbook or the Graduate Program Assistant for further instructions.

When the student is ready to nominate the committee, the Ph.D. Form I should be used. The form can be found at the Graduate Division website or obtained from the Graduate Program Assistant. The Ph.D. Form I requires the student's proposed field of study, tentative dissertation title, committee member signatures, signature of the faculty graduate advisor, and the signature of the department chair. The Ph.D. Form I also includes the UCSB Graduate Student Conflict of Interest Form, which requires the signature of the Committee Chair and Departmental Chair. After the signatures have been obtained, the form is submitted to the Graduate Division. This form should be submitted to Graduate Division as early as possible before the preliminary oral examination.

Preliminary Oral Examination

Ph.D. students must take and pass the Preliminary Oral Examination given by the student's Doctoral Committee before advancing to candidacy. The purpose of this examination is to ensure that the student has gained extensive knowledge on advanced topics in the areas surrounding his/her proposed dissertation topic and engaged in sufficient preliminary reading and research on the topic. The candidate needs to convince his/her Doctoral Committee that he/she is capable of preparing an acceptable dissertation. The examination requires a satisfactory presentation by the student of his/her proposed research topic and the results of his/her preliminary reading and research on the topic.

Advancing to Candidacy

A student is eligible to advance to candidacy when he/she has finished the required coursework, passed the qualifying examinations, passed the preliminary oral examination, and is ready to begin working on the dissertation. A student is ready to work on their dissertation after they have acquired the necessary knowledge to conduct their research.

There are two sets of requirements the student has to meet before advancing to candidacy; requirements established by the Academic Senate, and requirements established by the Department of Statistics and Applied Probability.

1. Academic Senate Regulations:
 - a. Minimum 3.0 grade point average in all upper division and graduate classes completed since admission.
 - b. A transcript free of any "incomplete grades" or "no grades".
 - c. Registration for three consecutive quarters, and registration during the quarter the student will advance.
2. Department of Statistics & Applied Probability Requirements:
 - a. Completion of all the core courses required for their degree with a minimum letter grade of "B" in each course.
 - b. Completion of two qualifying exams at the Ph.D. level.
 - c. Completion of an oral examination given by the dissertation committee.

Steps for Advancement

1. Before the oral examination, ideally at the time of committee nomination, the student must see the Graduate Program Assistant to establish that he/she has met all of the requirements for advancement. The requirements will be recorded on a form created specifically for this, called the Degree Form. The student will also need to provide any needed information to the Graduate Program Assistant to complete the Ph.D. Form II.
2. Immediately prior to the oral exam, the committee chair will be given the Ph.D. Form II.
3. Once the student passes the oral exam, the committee members sign the Ph.D. Form II and give it to the Graduate Program Assistant, who will make a copy for the file and then give the original to the student to deliver to the Graduate Division.
4. Advancement to Candidacy requires a fee that is to be paid at the Cashier's Office before the student delivers the form to the Graduate Division. The fee can also be charged to the student's BARC Account. Proof of payment is required on the Ph.D. Form II.

Students who wish to petition to add the Financial Mathematics and Statistics (FMS) optional Ph.D. emphasis require prior approval from the FMS committee before their oral examination is scheduled.

Additional forms, in addition to Forms I and II need to be submitted to Graduate Division after paying an additional fee to formally add any optional Ph.D. emphasis (subject to emphasis committee approval). Please ask the Graduate Program Assistant and your Ph.D. committee chairperson for additional information.

The Dissertation

After advancing to candidacy, students complete their research, write their dissertation on a topic agreed upon with their Dissertation Advisor and their Doctoral Committee, and take any other appropriate courses.

Students complete the requirements for the Ph.D. by passing the oral dissertation defense to their Doctoral Committee, and by filing their dissertation with the Graduate Division. The candidate for the Ph.D. must make his/her dissertation available to all the members of the Ph.D. committee at least two weeks in advance of the date of the defense. An electronic copy must also be made available to the Graduate Program Assistant. Students must inform the Graduate Program Assistant that they will be defending their dissertation at least one month prior to the date of the defense. The dissertation defense is public, and will be announced to the department via email. For information on dissertation formatting and filing, please consult the Graduate Division.

Steps for Oral Dissertation Defense

1. Before the oral examination, the student must see the Graduate Program Assistant to give any needed information to the Graduate Program Assistant to complete the Ph.D. Form III. Immediately prior to the oral exam, the committee chair will be given the Ph.D. Form III.
2. Once the student passes the oral exam, the committee members sign the Ph.D. Form III and give it to the Graduate Program Assistant, who will make a copy for the file and then give the original to the student to deliver to the Graduate Division.
3. Filing the Ph.D. Form III requires a fee that is to be paid at the Cashier's Office before the student delivers the form to the Graduate Division. The fee can also be charged to the student's BARC Account. Proof of payment is required on the Ph.D. Form III.

OPTIONAL PH.D. EMPHASES

(Note: no formal emphasis is required within our Ph.D.— but optional emphases may benefit students researching particular areas):

The Department of Statistics & Applied Probability offers three optional Ph.D. emphases; one in Financial Mathematics and Statistics (FMS), one in Quantitative Methods in the Social Sciences (QMSS), and one in Bioengineering. The requirements for each emphasis are briefly outlined below.

Financial Mathematics and Statistics Emphasis

Students pursuing a Ph.D. may petition to add an emphasis in Financial Mathematics and Statistics. This emphasis formalizes the study of, and research in financial mathematics, which is a major growth area within the fields of statistics and applied probability. Students interested in mathematical finance benefit from the Center for Financial Mathematics and Actuarial Research (CFMAR).

If a student is interested in this emphasis, they should follow the plan listed below. The student needs to have completed the required courses and passed the qualifying exams before submitting the petition to add the emphasis, and should submit their petition to add the FMS emphasis before scheduling their advancement oral examination. The student needs to consult with the Graduate Program Assistant before petitioning to add the emphasis.

Students are required to accumulate 72 graduate units, of which 44 are required courses. A letter grade of “B” or better must be obtained in each required course.

Required Courses:

PSTAT 207 A-B-C: Statistical Theory
PSTAT 213 A-B-C: Introduction to Probability Theory and Stochastic Processes
PSTAT 223 A: Stochastic Calculus and Applications
PSTAT 223 B: Financial Modeling
PSTAT 223 C: Advanced Topics in Financial Modeling
MATH 201 A-B: Real Analysis

Electives:

PSTAT 220 A-B-C: Advanced Statistical Methods
PSTAT 221 A-B-C: Advanced Probability Theory
PSTAT 222 A-B-C: Advanced Stochastic Processes
PSTAT 262 FM: Seminars in Financial Mathematics and Statistics
ECON 210 A: Theory of Consumption and Production
ECON 210 B: Game Theory
ECON 210C: Markets and Incentives
ECON 235 A-B: Finance
PSTAT 274: Time Series **OR** *ECON 245 B: Economic Theory*
MATH 201C: Real Analysis
MATH 206 A: Matrix Analysis and Computation
MATH 206 B: Numerical Simulation
MATH 206 C: Numerical Solution of Partial Differential Equations—Finite Difference Methods
MATH 206 D: Numerical Solution of Partial Differential Equations—Finite Element Methods
MATH 228 A-B: Functional Analysis
MATH 246 A-B-C: Partial Differential Equations

Students must fulfill these two area requirements:

- Mathematical Statistics (*based on PSTAT 207 A-B-C*)
- Probability and Stochastic Processes (*based on PSTAT 213 A-B-C*)

The student's doctoral committee shall be appointed according to the same regulations governing other Ph.D. students in Statistics and Applied Probability and must be approved by the coordinating committee for the emphasis. The topics of dissertations must focus on an area of financial mathematics and statistics and be approved by the student's doctoral committee.

Quantitative Methods in the Social Sciences (QMSS) Emphasis

Students pursuing a Ph.D. may petition to add an interdisciplinary emphasis in quantitative methods in the social sciences (QMSS). The QMSS emphasis provides students the opportunity to do interdisciplinary research applying innovative statistical methods to the social sciences. In addition to all the regular PSTAT Ph.D. core area requirements and qualifying examination requirements, the QMSS emphasis requires at least two courses from outside of the statistics and applied probability department that deal with quantitative issues in the social sciences. A list of courses that may satisfy this requirement is available from the QMSS webpage (www.qmss.ucsb.edu), and the plan of study must receive the approval of the student's dissertation advisor. Students must also enroll in the QMSS colloquia for at least three quarters, and present their own original quantitative social science research to the colloquia at least once.

Students in this emphasis are expected to choose a dissertation topic that includes a strong interdisciplinary component and relates to current topics in the social sciences. The dissertation committee must include at least one core QMSS faculty member from outside the student's home department. (Note that according to the most recent Academic Senate requirements, the committee must include at least three UC ladder faculty members, two of whom must be members of the home department. One of the home department members must serve as chair or co-chair.)

After choosing a dissertation committee, students need to submit an application to add the emphasis to the QMSS Coordinating Committee which is available at www.qmss.ucsb.edu/joinqmss.html. If admitted to this QMSS emphasis, once all the requirements listed above or any updated requirements are completed, students should submit all records of courses, seminars, and research to the QMSS Coordinating Committee, which will certify to the Graduate Division that the requirements for the emphasis have been satisfied. The Graduate Division will verify completion of the emphasis and convey this information to the Registrar, which will in turn include the QMSS emphasis on the final transcript.

For more information about the QMSS emphasis, contact the department. Also refer to the QMSS web page at <http://www.qmss.ucsb.edu/> and the [QMSS Coordinating Committee, for any changes in the emphasis requirements.](#)

Bioengineering Emphasis

Students pursuing a Ph.D. may petition to add an interdisciplinary emphasis in Bioengineering, in addition to completing all the regular PSTAT Ph.D. core area requirements and qualifying examination requirements. For more information about the Bioengineering emphasis, contact the department. Also refer to the Center for Bioengineering web page at <http://bioengineering.ucsb.edu>

Required Courses (15 units):

ENGR 220A: Molecular Bioengineering

ENGR 220B: Cellular Bioengineering

ENGR 220C: Tissue and Systems Bioengineering

ENGR 225: Current Topics in Bioengineering (1 unit, required 3 times)

ENGR 230: Bioengineering Student Seminar (1 unit, required 3 times)

ACADEMIC PERFORMANCE STANDARDS

All UCSB graduate students must meet minimal academic standards in order to remain in good academic standing.

Coursework Performance Standards

- Maintain a cumulative GPA of 3.0 in a given quarter
- Establish a GPA by taking courses for a letter grade
- Complete coursework – the standard will not be met if a student has 12 or more units of incomplete (I), No Grade (NG), or No Record (NR)

Academic Progress and Normative Time Standards

- Students must finish the MA degree within two years
- Students must advance to doctoral candidacy within their third year after entering the department
- Students must finish the Ph.D. within five years

Performance Standard on Required Milestones or Exams

- (Ph.D. Students) Pass two qualifying exams within three years of entering the department

If the standards outlined above are not met, the student may be placed on departmental warning /monitoring status or on academic probation. A student on academic probation is not eligible to hold academic appointments (TAs or readerships), or to receive central fellowship support.

For more information, please see the [Graduate Student Handbook](#) available on the Graduate Division's website

ADMISSION INFORMATION

All applications are filled out and submitted online at UCSB'S Graduate Division online application located at: <http://www.graddiv.ucsb.edu/eapp/>

General Admissions Requirements

The Master's and Ph.D. degrees are open for application to those who hold a bachelor's degree in Statistics, Mathematics, or other related fields, and have an undergraduate GPA of 3.0 or above during their last two years of study. All applicants for admission to graduate status are required to take the Graduate Record Examination (GRE) and have their scores (verbal, quantitative, and analytical writing) sent to the Graduate Division using the institution code 4835.

All international applicants from non-English speaking countries are required to submit TOEFL or IELTS scores with their applications. International students who have received a degree from an English-speaking institution are exempt from taking the TOEFL or IELTS. All new international

students for whom English is not the native language are required to take the ELPE (English Language Placement Examination) at the beginning of the quarter in which they first enroll at UCSB. Performance on this examination will determine placement in the courses on English as a Second Language offered by the Department of Linguistics.

An application will not be considered complete until the following supporting materials are received:

- Official embossed and/or stamped transcripts submitted online by the applicant from all colleges or universities where 12 or more units of coursework have been completed.
- TOEFL or IELTS scores for the students from non-English speaking universities; sent to the Graduate Division using institution code 4835
- GRE scores (verbal, quantitative and analytical writing); sent to the Graduate Division using institution code 4835
<http://www.graddiv.ucsb.edu/admissions/how-to-apply/index.aspx#exam-scores>
- Three letters of recommendation; Submitted online by the recommenders via the online application
- Statement of Purpose and Personal Statement; submitted online by the applicant

Students will be notified of the department's admission decision via the online application.

IMPORTANT APPLICATION DEADLINES

Ph.D. Program Deadlines:

December 15: Ph.D. Admission for fall quarter with priority consideration for funding
February 15: Final deadline for Fall admission (with consideration for TAships only)

MA Program Deadlines:

February 15: MA Admission for Fall quarter
November 1: MA Admission for Winter quarter
January 10: MA Admission for Spring quarter

For more information, please contact:

*Statistics and Applied Probability
University of California
Santa Barbara, CA 93106-3110*

E-mail: gradinfo@pstat.ucsb.edu

Phone: 805-893-2129

Or visit our web site: <http://www.pstat.ucsb.edu>.