

From: noreply@wsu.edu
To: [curriculum.submit](#)
Subject: 536809 Mathematics and Statistics Requirements Revise - Revise or Drop Graduate Plan
Date: Tuesday, December 3, 2019 11:32:18 AM
Attachments: [2019.12.03.11.22.04.55.FormData.html](#)
[2019.12.03.11.22.03.14.currentCatalogFile_Statistical_Science_PhD_GS_Reqs_Updated.docx](#)
[2019.12.03.11.22.03.14.currentCatalogFile1_PhD_Statistical_Science_Rationale_for_Updates.pdf](#)
[2019.12.03.11.22.03.14.currentCatalogFile2_Stats_PhD_Proposed_Handbook_Dec_2019.pdf](#)
[2019.12.03.11.22.03.14.currentCatalogFile3_Stats_PhD_Previous_Curriculum_from_2016.pdf](#)

Emily Lewis has submitted a request for a major curricular change. His/her email address is: emily.m.lewis@wsu.edu.

Requested change: Revise or Drop Graduate Plan

Degree: PhD Statistical Science

Title:

Requested Effective Date: Fall 2020

Revise plan requirement: Yes

Dean: Swindell, Samantha - CAS,

Chair: Moore, Charles,

Catalog Subcommittee
Approval Date

AAC, PHSC, or GSC
Approval Date

Faculty Senate
Approval Date

From: [Swindell, Samantha](#)
To: [curriculum.submit](#); charles.n.moore@wsu.edu
Subject: RE: 536809 Mathematics and Statistics Requirements Revise - Revise or Drop Graduate Plan
Date: Monday, December 16, 2019 2:45:27 PM

1. I approve this proposal in its current form.

From: curriculum.submit@wsu.edu <curriculum.submit@wsu.edu>
Sent: Tuesday, December 3, 2019 11:22 AM
To: charles.n.moore@wsu.edu; Swindell, Samantha <sswindell@wsu.edu>
Subject: 536809 Mathematics and Statistics Requirements Revise - Revise or Drop Graduate Plan

Moore, Charles,

Swindell, Samantha - CAS,

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Both Chair and Dean approval is required to complete the submission process. Please indicate that you have reviewed the proposal by highlighting one of the statements below and **reply all** to this email. (curriculum.submit@wsu.edu.) [Details of major change requested can be found in the attached supplemental documentation]

1. I approve this proposal in its current form.
2. I approve this proposal with revisions. Revisions are attached.
3. I do not approve this proposal. Please return to submitter.

If you do not respond within one week, you will be sent a reminder email. If no response is received within three weeks of the submission date, the proposal will be returned to the submitter.

From: [Moore, Charles](#)
To: [curriculum.submit](#)
Subject: Re: 536809 Mathematics and Statistics Requirements Revise - Revise or Drop Graduate Plan
Date: Tuesday, December 3, 2019 12:47:08 PM

I approve this proposal in its current form.

Charles Moore
Professor of Mathematics
Chair, Department of Mathematics and Statistics
Washington State University
Pullman, Washington 99164
On 12/3/2019 11:22 AM, curriculum.submit@wsu.edu wrote:

Moore, Charles,

Swindell, Samantha - CAS,

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Thank you for your assistance as we embark on this new process. If you

PhD Statistical Science Rationale for Updates

10 February 2020

The PhD Statistical Science was officially offered as a degree program for incoming students in Fall 2018. After one full year of the program, there are a few adjustments to the curriculum to improve the rigor of the degree, facilitate completion, and accommodate student interests. Previously requiring 16 graded courses, now the proposed degree requires 12 graded courses, most of which are selected from an approved list of core and elective classes that will guarantee the students are receiving a rigorous doctoral education in statistics. The following changes are requested:

- **Core Statistics Courses:**
 - Stat 533 is no longer being offered regularly, so it is being replaced with Stat 577.
 - Stat 556 is a prerequisite for many other required courses, so it is being added to the core curriculum.
- **Core Applied Statistics Courses**
 - This 2-course section was added because Stat 512 and Stat 530 were deemed necessary.
- **General Statistics Electives**
 - This section was narrowed down to include courses appropriate for PhD Statistics students. Previously, students could have included service courses including Stat 511 or Stat 523, courses meant for students outside of the statistics program.
 - This requirement was also decreased from 5 to 2 courses (15 to 6 credits) so students can prioritize research sooner.
- **External Department Subject Matter**
 - This requirement was also decreased from 5 to 2 courses (15 to 6 credits) so students can prioritize research sooner.
- **Research Credits**
 - Stat 800 was not in the catalog at the time of the degree creation but is now what PhD Statistical Science students should be taking for research credits.

VII. Curriculum

Program of Study for Ph.D.:

- 72 hours minimum total credits
- 39 hours minimum from graded graduate-level (500-level) courses
- 20 hours minimum 800-level research credits
- 12 hours maximum of non-graduate courses (300- or 400-level)

The concept for the degree in Statistical Science reflects the interdisciplinary nature of the field. Hence, the required courses will be divided into 4 groups.

Group 1: Basic Statistics Courses (6 courses: 18 credits)

This will emphasize core Statistical training that we expect all the Ph.D. students to have.

Group 2: Statistics Electives (5 courses: 15 credits)

Represents electives with a STAT prefix (or an elective from the CISER website) that have thrust towards a specific subject matter area that the student wants to pursue.

Group 3: External Department Subject Matter (5 courses: 15 credits)

Courses taken from another discipline (including Mathematics) that the student wants to emphasize in. At least 3 of these courses *must be* graduate level courses. Since we require 5 courses, if **all** the courses are taken at the Graduate level, this automatically gives students a Graduate Minor and requires a faculty member from the minor Department to be a part of the Ph.D. committee. This reinforces the interdisciplinary nature of this degree.

Group 4: Practicum (1 course: 2 credits)

All incoming students will be encouraged to take Math 401 and Math 420 if they have not already done so. All students will be required to take Stat 590 (Consulting Practicum for at least 2 credit hours) which is a P/F class.

Table 3: Basic Statistics Courses Required for Ph.D. in Statistical Science (new courses highlighted):

Course Name	Course # STAT	Prerequisites	M.S. Requirement Currently?
Statistical Theory I (Advanced Prob.)	548	443	No
Statistical Theory II (Advanced Inference)	549	548	No
Statistical Computing	536	443	Yes
Theory of Linear Models	533	443, 556	Yes
Linear and Non-linear Mixed Models	574	556, 533, 530	No
Theory of Multivariate Analysis	575	556, 536, 519	No

Table 4: Statistics Electives (new courses highlighted):

Course Name	Course # STAT
Time Series Analysis	516
Statistical Analysis of Qualitative Data	520
Applied Stochastic Models	542
Spatial Statistics	508
Quality Control	572
Reliability Theory	573
Biostatistics and Statistical Epidemiology	522
Bayesian Analysis	576
Statistical Learning Theory	577
Analyzing Microarray and Other Genomic Data	565

The courses that can be taken from a subject area OTHER than Statistics are too many to put in a concise list. Depending on their preference and their specialization, the student must take five courses (at least 15 credits) from one or more subject areas of their choice. These may include (but are not limited to) courses offered by the following Departments, Schools, or Colleges:

1. Department of Mathematics and Statistics
2. Department of Finance and Management Science
3. Department of Psychology
4. Department of Crop and Soil Sciences (CSS)
5. School of Economic Sciences (SES)
6. School of Electrical Engineering and Computer Science (SEECS)
7. School of Biological Sciences (SBS)
8. School of Molecular Biosciences (SMB)
9. School of the Environment (SOE)
10. College of Veterinary Medicine
11. College of Educational Psychology

Letters of support for the Ph.D. in Statistical Sciences from faculty in almost all of the departments mentioned above can be found in Appendix III. These letters clearly show that there is wide support on the WSU campus for the proposed Ph.D. degree program. The student, with proper advice from his/her

committee, makes the final choice regarding the specific courses that make up this part of the Program of Study.

For example a student with a Mathematics emphasis might take:

Stat 542, Stat 573, and Stat 516, Stat 576, Stat 577 as Stat electives
 Math 501, Math 504, Math 511, Math 544, Math 574 as electives from their field.

Or a student with an EconS Minor could potentially take:

Stat 520, Stat 572 and Stat 516 as Stat 576, Stat 577 Stat electives, and
 EconS 511, EconS 512, EconS 513, EconS 514 and EconS 525 as electives from their field.

Clearly, there are too many other course combinations that involve one or more of the above mentioned Departments, Schools and Colleges to be able to put here in a detailed manner.

A timeline for the courses to be taken is provided in the table below. This may, however, vary depending upon the individual student's background and the courses already taken.

Table 5: Typical Course Schedule for a Beginning Ph.D. Student (Post Bachelor's Degree)

1st year	Fall	Spring
	STAT 443 (Applied Probability)	STAT 556 (Intro. to Stat. Theory)
	STAT 512 (ANOVA)	STAT 530 (Applied Linear Models)
	Math 401 (if not already taken)	Elective from Statistics
	Math 420 (if not already taken)	Elective from Statistics
Qualifying Exams given early Fall (Two exams: Part 1. Covers 443, 556; Part 2. Covers 512, 530)		
2nd Year	STAT 548 (Adv. Prob.: Stat. Th. I)	STAT 549 (Adv. Inference: Stat. Th. II)
	STAT 533 (Theory Lin. Models)	STAT 519 (Multivariate Analysis)
	STAT 536 (Stat. Computing)	Elective from Statistics
	Elective from Domain Area	Elective from Domain Area
3rd Year	STAT 575 (Theory of Multivariate Stats)	STAT 574 (Linear and Non-linear mixed models)
	Elective from Statistics	Elective from Domain Area
	Elective from Statistics	Elective from Domain Area
	Elective from Domain Area	Stat 590 (Consulting Practicum)

(A student with a MS degree in Stats from WSU or other institutes would have the option to start with the course work prescribed for the second year.)

By the end of third year, all required core courses and statistics electives and domain classes can be satisfied. Subsequently, the student may continue to take electives for the next two years depending upon the chosen subject area. The course plan is such that all course work could be finished by the end of the 3rd year, allowing for the recommended internships possible for the students after finishing their core requirements. The last year(s) would be used to make progress on original contributions and dissertation writing, satisfying the required 800 level research credits.

Updates proposed 2/10/2020
Statistical Science PhD:

- Basic-Core Statistics Courses: must complete the following:
 - STAT 533, STAT 536, STAT 548, STAT 549, STAT 556, STAT 574, STAT 575, STAT 577
- Core Applied Statistics Courses: must complete the following:
 - STAT 512, STAT 530
- General Statistics Electives: 5-2 courses minimum chosen from the following:
 - ~~Selected in consultation with the committee from courses with a STAT prefix, those listed on the CISER website, or those with a specific subject matter the student wishes to pursue.~~
 - STAT 508, STAT 516, STAT 519, STAT 520, STAT 522, STAT 544, STAT 565, STAT 572, STAT 573, STAT 576
- External Department Subject Matter: 5-2 courses minimum:
 - Selected in consultation with the committee from courses in another discipline (including mathematics) that the student wishes to emphasize in.
 - ~~At least 3 of these course must be graduate (500) level courses.~~
- Practicum: must complete the following:
 - STAT 590
 - ~~All incoming students will be encouraged to take MATH 401 and MATH 420 if they have not already done so.~~
- Pass Departmental Qualifying Exam (QQE):
 - Refer to the student handbook for information regarding this requirement.
- Pass Departmental Doctoral Qualifying Exam (DQE):
 - Refer to the student handbook for information regarding this requirement.
- Research Credits: 20 credits minimum:
 - MATH STAT 800
- Total Graded Credits: 34 credits minimum
- Total Credits: 72 credits minimum

Applicable Graduate School Requirements (All Tracks):

- Graded Credits: 34 credits minimum:
 - Students may use a maximum of 9 credits of undergraduate coursework (300-400)
- Research Credits: 20 credits minimum
 - MATH STAT 800
- Total Credits: 72 credits minimum

1.1 PHD IN STATISTICAL SCIENCE

Description and Learning Outcomes: Students pursuing a PhD in Statistical Science will gain core knowledge in statistics and working knowledge in an allied interdisciplinary domain. Students will take core and elective statistics courses offered through the Department of Mathematics and Statistics, statistics courses offered through allied departments that have in-depth application of statistical methods, and at least two courses from one of the partnering allied departments. The PhD dissertation will be focused on developing new statistical methods and solving problems for data challenges in a chosen field of interest. Internships will be recommended for all students in the third and fourth year depending on areas of interest.

This PhD program is designed to lead the student to the following learning objectives:

- Have knowledge of advanced statistical theory and statistical methodology
- Have a working knowledge of a domain that generates their problem
- Have knowledge in statistical computing and be familiar with commonly used statistical software such as R, S-PLUS, SAS, and data management programs.
- Apply statistical knowledge to real life problems effectively and ethically, understanding the theoretical assumptions and practical limitations of the methodologies applied
- Communicate effectively the principles and methods of statistical science in both written and oral forms
- Conduct independent research in statistical sciences with focus on interdisciplinary research

Courses – Students pursuing a PhD in Statistical Science must complete a total of 72 credit hours. The curriculum is comprised of seven core statistics courses (21 credit hours), two fundamental applied statistics courses (6 credit hours), two general statistics electives (6 credit hours), and two elective courses in an external subject (6 credit hours), for a total of 39 graded credit hours. Examples of interdisciplinary, external subjects include Veterinary Medicine, Electrical Engineering, Computer Science, Economics, and Biological Sciences, but courses can be taken from any other department as agreed upon by the student's PhD committee. Students must also take 7 non-graded credit hours: Stat 590 (2 credit hours), Stat 591 Seminar (4 credit hours), and Math 500 (1 credit hour, taken their first fall semester). Additional credits can be obtained through Stat 800. Teaching assistants are required to take three semesters of Math 533 (Teaching College Mathematics). The degree requirements are listed below:

Core Statistics:

(21 credits)	Stat 536	Statistical Computing
	Stat 548	Statistical Theory I
	Stat 549	Statistical Theory II
	Stat 556	Introduction to Statistical Theory
	Stat 574	Linear and Nonlinear Mixed Models
	Stat 575	The Theory of Multivariate Analysis
	Stat 577	Statistical Learning Theory

Core Applied Statistics:

(6 credits)	Stat 512	Analysis of Variance of Designed Experiments
	Stat 530	Applied Linear Models

General Statistics Electives – 2 courses

(6 credits)	Stat 508	Environmental Spatial Statistics
	Stat 516	Time Series
	Stat 519	Applied Multivariate Analysis
	Stat 520	Statistical Analysis of Qualitative Data
	Stat 522	Biostatistics and Statistical Epidemiology
	Stat 544	Applied Stochastic Processes
	Stat 565	Analyzing Microarray and Other Genomic Data
	Stat 572	Quality Control
	Stat 573	Reliability
	Stat 576	Bayesian Analysis

Interdisciplinary Electives – 2 courses, in consultation with PhD committee, at the 400-level or higher.
(6 credits)

Practicum (2 credits) Stat 590 Statistical Consulting Practicum

Seminar (4 credits – 4 semesters) Stat 591 Seminar in Statistics

Proseminar (1 credit) Math 500 Proseminar