Cover Letter For Math 449

The Department of Mathematics is seeking approval for a new undergraduate course to be co-listed with an existing graduate course, Math 550 Linear Models. Math 550 Linear Models is a graduate course with undergraduate prerequisites, and hence the content is appropriate for both graduate and undergraduate students. Currently, undergraduates must take it as a graduate course, and if approved, Math 449 Linear Models would be available to undergraduate students as an undergraduate course.

Attached are the following forms:

1. Course Form For Math 449
2. Change of Major for B.S. in Mathematics, add Math 449 as an elective
3. Change of Major for B.A. in Mathematics, add Math 449 as an elective
4. Change of Minor in Mathematics, add Math 449 as an elective
5. Requirement Sheets for the B.S. Actuarial and Statistics Tracks, and B.A.
6. Syllabus for MATH 449
7. Syllabus for MATH 550
8. Signature Sheet
• In section A, list ALL of the forms covered by this signature page. If you submit a form that is not listed in A, your proposal will be held back until we receive a new, updated signature page.
• You must obtain the signature of your department chair and dean before submitting your proposal.

A. FORMS COVERED BY THIS SIGNATURE PAGE. List each form you are submitting—for instance, PSYC 383, Course Form; PSYC, Change of Major Form; PSYC, Change of Minor Form.

Proposals for two new undergraduate mathematics courses:

the B.S., B.A. and the Minor in Mathematics, Included Documents for both courses:

Course Form for Math 449

Course Syllabus for Math 449 and Math 550

Change in Major for the BA in Mathematics for Math 449

Change in Major for the BS in Mathematics for Math 449

Description of the BA major and the Actuarial and Statistics Tracks in the BS major

Change in Minor for the Minor in Mathematics for Math 449

Description of the Minor in Mathematics

Accompanying signature sheet
B. APPROVAL AND SIGNATURES.

1. Signature of Department Chair or Program Director:
   
   [Signature]
   Date: 2/3/2015

2. Signature of Academic Dean:
   
   [Signature]
   Date: 2/19/2015

3. Signature of Provost:
   
   [Signature]
   Date: 3/10/2015

4. Signature of Business Affairs (only for course fees):
   
   [Signature]
   Date: ________________
   □ fee approved on ____________
   □ BOT approval pending

5. Signature of Curriculum Committee Chair:
   
   [Signature]
   Date: 3/20/2015

6. Signature of Budget Committee Chair (only for new programs):
   
   [Signature]
   Date: ________________

7. Signature of Academic Planning Committee Chair (only for new programs):
   
   [Signature]
   Date: ________________

8. Signature of Faculty Senate Secretary:
   
   [Signature]
   Date: ________________

Date Approved by Faculty Senate: ________________
FACULTY CURRICULUM COMMITTEE
COURSE FORM

Instructions:
- Please fill out one of these forms for each course you are adding, changing, deactivating, or reactivating.
- Fill out the parts of the form specified in part B. **You must do this before your request can move forward!**
- Remember that your changes will not be implemented until the next catalog year at the earliest.
- If you have questions, start by checking the instructions on the website. Please feel free to contact the committee chairs with any remaining questions you might have.

A. CONTACT/COURSE INFORMATION.

Name: **Martin Jones**  Phone: **953-5735**  Email: **jonesm@cofc.edu**

Department or Program: **Mathematics**  School: **School of Science and Mathematics**

Subject Acronym and Course Number: **MATH 449 Linear Models**

Catalog Year in which changes will take effect: **FALL 2015**

B. TYPE OF REQUEST. Please check all that apply, then fill out the specified parts of the form.

- [X] Add a New Course (complete parts C, D, F, G, H, I, J)
- [ ] Change Part of an Existing Course (complete parts C, D, E, F, G, I, J)
  - [ ] Course Number (you must submit a course deactivation request for the old course number)
  - [ ] Course Name
  - [ ] Course Description
  - [ ] Credit/Contact Hours
  - [ ] Restrictions (prerequisites, co-requisites, junior/senior standing, etc.)
- [ ] Deactivate an Existing Course (complete parts C, D, E, G, I, J)
- [ ] Reactivate a Previously-Deactivated Course (complete parts C, D, E, G, I, J)

C. RATIONALE AND EXPLANATION. Please describe your request and explain why you are making it.

The Department of Mathematics is seeking approval for a new undergraduate course to be co-listed with an existing graduate course, Math 550 Linear Models. Math 550 Linear Models is a graduate course with undergraduate prerequisites, and hence the content is appropriate for both graduate and undergraduate students. Currently, undergraduates must take it as a graduate course, and if approved, Math 449 Linear Models would be available to undergraduate students as an undergraduate course.

D. IMPACT ON EXISTING PROGRAMS AND COURSES. Please briefly describe the impact of your request on your own programs and courses as well other programs and courses. If another program requires the course, you must submit their written acknowledgement with this proposal. Also, the affected program must describe any change in the number of credit hours they require. Include a list of similar courses in other departments and explain any overlap.

This course will be an elective course in the Mathematics Department. It will not be a required course for any of the major tracks, however it will be a recommended elective for the statistics track and the actuarial science track.

This form was last updated on 12/13/13 and replaces all others.
E. EXISTING COURSE INFORMATION. If you are proposing a new course, just leave this blank. Otherwise, please fill out all fields.

Department: 
School: 
Subject Acronym: 
Course Number: 

Credit hours: ___ lecture ___ lab ___ seminar ___ independent study
Contact hours: ___ lecture ___ lab ___ seminar ___ independent study

Course title:

Course description (maximum 50 words, exactly as it appears in the catalog):

Restrictions (pre-requisites, co-requisites, majors only, etc.): 

Cross-listing, if any:

Is this course repeatable? □ yes  X no  If yes, how many total credit hours may the student earn? ____

F. NEW COURSE INFORMATION. If you are deactivating a course, leave this blank. Otherwise, please fill out all fields. For changed courses, use boldface for the information that is changing.

Department: Mathematics  School: SSM  Subject Acronym: MATH  Course Number: 449

Credit hours: 3 lecture ___ lab ___ seminar ___ independent study
Contact hours: 3 lecture ___ lab ___ seminar ___ independent study

Course title: Linear Models

Course description (maximum 50 words, exactly as it appears in the catalog):

This course is an introduction to linear models for analyzing data. Topics covered include analysis of variance and regression models, Bayesian estimation, hypothesis testing, multiple comparisons, experimental design models, balanced incomplete block designs, testing for lack of fit, testing for independence, and variance component estimation.

Restrictions (pre-requisites, co-requisites, majors only, etc.): MATH 203 Linear Algebra and MATH 350 Statistical Methods II.

If this is a newly-created course, is it intended to be the equivalent of an existing course? □ yes  X no
If so, which course? ______________________

If equivalent, will the newly-created course replace the existing course? □ yes  □ no
Note: If yes, you must deactivate that course by submitting an additional Course Form.

Cross-listing, if any (submit approval from relevant department):

Note: Cross-listed courses are equivalent  *Graduate Course is not equivalent

Is this course repeatable? □ yes  X no  If yes, how many total credit hours may the student earn? ____

This form was last updated on 12/13/13 and replaces all others.
Is there an activity, lab, or other fee associated with this course? □ yes X no What is the fee? $______

Note: The Senate cannot approve new fees; Business Affairs will submit any such request to the Board of Trustees. The course can still be created, but the fee will not be attached until the Board has approved it.

G. COSTS. List all of the new costs or cost savings (including new faculty/staff requests, library, equipment, etc.) associated with your request.

None, since we have already been MATH 550 as a graduate course and MATH 449 would be taught at the same place and time by the same faculty member.

H. STUDENT LEARNING OUTCOMES AND ASSESSMENT.

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
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<td><strong>1 Understand the statistical theory behind the construction of linear models.</strong></td>
<td>Students are expected at a minimum to identify and explain the relevant statistical theory underlying the development and application of linear models. Students will be assessed on homework and on in class tests. They will be expected to show on average a 75% level of proficiency on assessments.</td>
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<td><strong>2. Understand the connection between geometric and algebraic approaches to linear model theory.</strong></td>
<td>Students are expected at a minimum to identify and explain the connection between geometric and algebraic approaches to linear model theory. Students will be assessed on homework and on in class tests. They will be expected to show on average a 75% level of proficiency on assessments.</td>
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<td><strong>3. Understand and be able to reproduce proofs of aspects of the development of linear model theory.</strong></td>
<td>Students are expected at a minimum to demonstrate an understanding of the basic theoretical underpinnings of linear model theory by reproducing proofs of its fundamental theorems. Students will be assessed on homework and on in class tests. They will be expected to show on average a 75% level of proficiency on assessments.</td>
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<td><strong>4. Be able to apply the theory of linear models to analyze real data using the statistical package R.</strong></td>
<td>Students are expected at a minimum to effectively apply linear model theory by analyzing and drawing conclusions using the statistical package R in order to answer questions about populations drawn from real data sources. Students will be assessed on homework and on in class tests. They will be expected to show on average a 75% level of proficiency on assessments.</td>
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</table>
How does this course align with the student learning outcomes articulated for the major, program, or general education? What program-level outcome or outcomes does it support? Is the content or skill introduced, reinforced, or demonstrated in this course?

SLO 1 Using algebra, geometry, calculus and other track-appropriate sub-disciplines of mathematics, students model phenomena in mathematical terms. This program student-learning outcome will be met through applications to real world situations by modeling random elements as they evolve over time such as financial markets and production line processes using techniques of Stochastic Processes such as Poisson processes, Markov chains, renewal processes, Martingales, random walks, and Brownian motion. SLO 2 Using algebra, geometry, calculus and other track-appropriate sub-disciplines of mathematics, students derive correct answers to challenging questions by applying the models from Learning Outcome 1. This program student-learning outcome will be met through applications to real world situations by using the models from SLO 1 to derive statistical results from the techniques of Stochastic Processes. SLO 3 Students write complete, grammatically and logically correct arguments to prove their conclusions. This program SLO will be addressed by the course student-learning outcome 3. above.

I. PROGRAM CHANGES. Will this course be added to the existing degree requirements or list of approved electives of a major, minor, or concentration X yes □ no

If yes, please attach a Change Minor and/or Change Major/Program Form as appropriate.

J. CHECKLIST.

X I have completed all relevant parts of the form.

□ I have attached a cover letter that describes my request and lists all the documents I am submitting.

X (For new courses only) I have attached a syllabus.

□ (For courses used in any way by other departments, including cross-listing) I have attached an acknowledgement from the relevant department.

□ (For courses intended to fulfill a Gen Ed requirement) I have submitted the proposal to the Gen Ed committee.

□ I have submitted one Signature Form that lists all of the different forms I am submitting.
Math 449 Linear Models
College of Charleston
Department of Mathematics
Fall 2015 Syllabus

INSTRUCTOR INFORMATION

Dr. Martin Jones
Office: RSS 345
Office Hours: T.B.A.
E-mail: jonesm@cofc.edu

COURSE MEETINGS

Mondays and Wednesdays in Maybank 224 from 7:00 - 8:15 PM.

PREREQUISITES

Math 430 Mathematical Statistics I, Math 203 Linear Algebra, or permission of the instructor.

TEXTBOOK

Regression: Linear Models in Statistics by Bingham and Fry.

COURSE DESCRIPTION

In this course we will study the theory of linear models and, as such, much of the focus is on the geometric and linear algebraic aspects of regression, analysis of variance and analysis of covariance. However, we will look at some applications to better understand how the theory plays out in practice. The statistical package R will be used to assist us with the construction of models. No previous familiarity with this package is assumed.

STUDENT LEARNING OUTCOMES:

After completing this course, students will be able to

1. Understand the statistical theory behind the construction of linear models.

2. Understand the connection between geometric and algebraic approaches to linear model theory.

3. Understand and be able to reproduce proofs of aspects of the development of linear model theory.

4. Be able to apply the theory to analyze real data using the statistical package R.

These outcomes will be assessed in homework and on in class exams.

GRADED ASSIGNMENTS

In this course, we will have one midterm exam, a final examination, and bi-weekly homework.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm</td>
<td>25%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>25%</td>
</tr>
<tr>
<td>Homework</td>
<td>50%</td>
</tr>
</tbody>
</table>

IMPORTANT DATES

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday, October 07</td>
<td>Midterm</td>
</tr>
<tr>
<td>Wednesday, December 05</td>
<td>Final Exam</td>
</tr>
</tbody>
</table>

COURSE GRADES

Midterm and Final Exams (25% each): These two in class exams will assess your understanding of the mathematical theory in the development of stochastic processes. You will be expected to reproduce short proofs, show facility with the probabilistic tools, and perform calculations and predictions using the stochastic models.
**Homework (50%)**: Every other week you will be expected to turn in assigned problems from the text. These problems may be a combination of the theory of stochastic processes and their applications. Some will require the statistical software package R to aid in the calculations and simulations of stochastic processes.

**Grading Scale**: Grades will be based on the percentage of points earned in the categories listed above. A (90-100%), B+ (87-89%), B (80-86%), C+ (77-79%), C (70-76%), D (60-69%), F (below 60%).

**Attendance Policy**

You are expected to attend class every day. If you miss class, you will need to obtain notes from one of your classmates and talk with me about material that you do not understand. If for some reason you are not able to attend class the day that an assignment is due, you should email me your assignment that day. Late assignments will not be awarded full credit. Late assignments will not be accepted after graded papers are returned or problem solutions have been distributed. Make-up exams are only possible with proper documentation from the Absence Memo Office.

**Disability Policy**

If you have a documented disability that will affect your performance in this class, you should contact Disability Services (953-1431) and speak with me in private. No special testing accommodations can be made without a letter from Disability Services. It is the student’s responsibility to provide me with the accommodation envelope at least one week before any scheduled exam. Without exception, an examination **must** be taken at our scheduled class meeting time.

**Supplementary Material**

Supplementary materials for our course will be posted on OAKS.

**E-Mail**

The best way to contact me is by e-mail. Please **always** include your name, the course name, and the section number in your e-mails. In general, you should expect a response within two school days.

**Coverage of Topics**

**Weeks 1 and 2**: Linear Regression: Method of Least Squares, Bivariate Normal distribution, maximum likelihood estimation, applications.

**Weeks 3 and 4**: ANOVA: Chi-square distribution, change of variable formulas, F distribution, orthogonality, one-way ANOVA, two-way ANOVA with and without interaction.

**Weeks 5 through 7**: Multiple Regression: normal equations, properties of least square estimators, quadratic forms and their distributions, orthogonal projections and sums of projections.

**Weeks 8 and 9**: Further ideas in Multiple Regression: polynomial regression, orthogonal polynomials, multivariate normal distribution, conditioning and regression, mean-square prediction, generalized least squares and weighted regression.

**Weeks 10 through 12**: ANCOVA: Adding categorical predictors to regression models, nested models.

**Weeks 13 through 15**: Variable Selection techniques, model checking and transformation of data, multicollinearity, variance-stabilizing transformations, Generalized Linear Models and applications.
Math 550 Linear Models
College of Charleston
Department of Mathematics
Fall 2014 Syllabus

INSTRUCTOR INFORMATION
Dr. Martin Jones
Office: RSS 345
Office Hours: T.B.A.
E-mail: jonesm@cofc.edu

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STUDENT LEARNING OUTCOMES:
After completing this course, students will be able to
1. Understand the statistical theory behind the construction of linear models.
2. Understand the connection between geometric and algebraic approaches to linear model theory.
3. Understand and be able to reproduce proofs of aspects of the development of linear model theory.
4. Be able to apply the theory to analyze real data using the statistical package R.

These outcomes will be assessed in homework and on in class exams.

GRADED ASSIGNMENTS
In this course, we will have one midterm exam, a final examination, and bi-weekly homework. Graduate students will also be expected to complete a project. Graduate students will be expected to show mastery of the more theoretical aspects of the course. This will involve extra homework exercises, additional problems on exams, and a project, culminating in a report synthesizing material learned from the course. The project will involve reading and understanding primary literature in the field.

<table>
<thead>
<tr>
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</tr>
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<td>Homework</td>
<td>40%</td>
</tr>
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<td>Project</td>
<td>20%</td>
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IMPORTANT DATES
Midterm: Wednesday, October 08
Final Exam: Wednesday, December 06
**Course Grades**

**Midterm and Final Exams (20% each):** These two in class exams will assess your understanding of the mathematical theory in the development of stochastic processes. You will be expected to reproduce short proofs, show facility with the probabilistic tools, and perform calculations and predictions using the stochastic models.

**Homework (40%):** Every other week you will be expected to turn in assigned problems from the text. These problems may be a combination of the theory of stochastic processes and their applications. Some will require the statistical software package R to aid in the calculations and simulations of stochastic processes.

**Project (20%):** Graduate students will be given a project to work on that will involve constructing computer simulations of stochastic processes to model various stochastic phenomena. These projects will demonstrate and synthesize the tools learned in the course and the application can be one of interest to the student provided that the topic is approved by the instructor.

**Grading Scale:** Grades will be based on the percentage of points earned in the categories listed above. A (90-100%), B+ (87-89%), B (80-86%), C+ (77-79%), C (70-76%), D (60-69%), F (below 60%).

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**E-Mail**

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**Coverage of Topics**

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**Weeks 10 through 12:** ANCOVA: Adding categorical predictors to regression models, nested models.

**Weeks 13 through 15:** Variable Selection techniques, model checking and transformation of data, multicollinearity, variance-stabilizing transformations, Generalized Linear Models and applications.
FACULTY CURRICULUM COMMITTEE
CHANGE/DELETE PROGRAM FORM

Instructions:
- Please fill out all of the portions of the form that are specified in section B. You must do this before your request can move forward!
- Remember that your changes will not be implemented until the next catalog year at the earliest.
- If you have questions, please start by checking the detailed instructions on the website.
- Please feel free to contact the committee chair with any remaining questions you might have.

A. CONTACT INFORMATION.
Name: Martin Jones Phone: 953-5735 Email: jonesm@cofc.edu
School: Science and Mathematics Department or Program: Mathematics
Name and Acronym of Major: B.S. Mathematics MATH (Actuarial and Statistics Concentrations)

B. CATEGORY OF REVIEW. Please check all that apply, then fill out the specified parts of the form.

☐ Change Request (fill out all sections)
☐ Add an existing course to requirements or electives
☐ Add a new course to requirements or electives (attach completed course form for each)
☐ Delete courses from requirements or electives
☐ Add or modify concentration*
☐ Add or modify cognate*

*Note: Only concentrations and cognates requiring 18 or more credit hours will be tracked in Banner and Degree Works and noted on the transcript.

☐ Terminate Program (fill out E, G, H, and I)
☐ Terminate degree
☐ Terminate major
☐ Terminate concentration
☐ Terminate cognate

C. GENERAL INFORMATION
Number of Current Credit Hours (for existing program): ___46___
Number of Proposed Credit Hours (for changed program): ___46___
Catalog Year in which changes will take effect: FALL 2015

D. CURRICULUM. Please list every change you are making below AND attach the current Program of Study Worksheet for this major (http://registrar.cofc.edu/program-of-study-resources/program-of-study-worksheets/index.php) with changes marked in RED. Additions should show where the course will be inserted, deletions should be noted by crossing out the course, and moves indicated with arrows. Distinguish between required and elective courses, and note any prerequisites, co-requisites, sequencing, or other restrictions. Provide the catalog description and course list exactly as they should appear in the catalog. For each new course, submit the Curriculum Committee’s Course Form and a sample syllabus.

This form was last updated on 6/6/2013 and replaces all others. Page 1 of 3
E. RATIONALE AND EXPLANATION. Please provide a narrative addressing the request you are making and why you are making it.

The Department of Mathematics is seeking approval for a new undergraduate course, MATH 449, to be co-listed with an existing graduate course, Math 550 Linear Models. Math 550 Linear Models is a graduate course with undergraduate prerequisites, and hence the content is appropriate for both graduate and undergraduate students. Currently, undergraduates must take Linear Models as a graduate course, and if approved, Math 449 Linear Models would be available to undergraduate students as an undergraduate course. Since the Mathematics Minor includes, beyond its core, “Ten additional credit hours at the 200 level or above, of which three credit hours must be at the 300 level or above,” MATH 449 would be added to the mathematics course listings and hence it would be available as three of the ten additional credit hours.

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT.

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**SLO 1 Using algebra, geometry, calculus and other track-appropriate sub-disciplines of mathematics, students model phenomena in mathematical terms.** This program student-learning outcome will be met through applications to real world situations by modeling random elements as they evolve over time such as financial markets and production line processes using techniques of Stochastic Processes such as Poisson processes, Markov chains, renewal processes, Martingales, random walks, and Brownian motion. **SLO 2 Using algebra, geometry, calculus and other track-appropriate sub-disciplines of mathematics, students derive correct answers to challenging questions by applying the models from Learning Outcome 1.** This program student-learning outcome will be met through applications to real world situations by using the models from SLO 1 to derive statistical results from the techniques of Stochastic Processes. **SLO 3 Students write complete, grammatically and logically correct arguments to prove their conclusions.** This program SLO will be addressed by the course student-learning outcome 3. above.

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**G. IMPACT ON EXISTING PROGRAMS AND COURSES.** Please describe the impact of this request on other programs and courses. If you are deleting a program, please describe the effect on all programs that will be impacted; if you are adding or changing a program, please explain any overlap with existing programs at the College.

The addition of MATH 449 Linear Models will enhance the options of students seeking upper-level elective courses in the Mathematics Minor Program. The course will be particularly attractive to students with an interest in probability and statistics.

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**H. COSTS ASSOCIATED WITH THE REQUESTED ACTION.** List all of the new costs or cost savings (including new faculty/staff requests, library, or equipment) associated with your request.

None, since we have already been MATH 550 as a graduate course and MATH 449 would be taught at the same place and time by the same faculty member.

---

**I. CHECKLIST**

- I have completed all relevant parts of the form.
- I have attached a cover letter that describes my request and lists all the documents I am submitting.
- I have attached a Course Form for each newly-created or modified course.
- (For proposals that affect other departments in any way) I have attached an acknowledgement from the relevant department.
- I have provided the complete curriculum for the program, concentration, emphasis, etc., including the description and course list, exactly as it should appear in the catalog.
- I have submitted one Signature Form that lists all of the different forms I am submitting.

This form was last updated on 6/6/2013 and replaces all others.  
Page 3 of 3
Math Major with Actuarial Track Requirements
Catalog Year: 2014-15
Degree: Bachelor of Science
Credit Hours: 52+

"PR" indicates a pre-requisite. "CO" indicates a co-requisite.

Courses within this major may also satisfy general education requirements. Please consult http://registrar.cofc.edu/general-edu for more information.

Required Courses

☐ MATH 120 Introductory Calculus (4) PR: Placement or C or better in MATH 111
☐ MATH 220 Calculus II (4) PR: MATH 120 or HONS 115
☐ MATH 203 Linear Algebra (3) PR: MATH 120 or instructor permission
☐ MATH 221 Calculus III (4) PR: MATH 220

Select one of the following tracks (Actuarial, Applied, Pure, Statistics or Teacher Education):

Actuarial Track

☐ MATH 250 Statistical Methods I (3) PR: MATH 105 with a C-grade or better or MATH 111 or MATH 120 or permission of instructor
☐ MATH 350 Statistical Methods II (3) PR: MATH 120 and MATH 250
☐ MATH 430 Mathematical Statistics I (3) PR: MATH 221
☐ MATH 431 Mathematical Statistics II (3) PR: MATH 430

Select one of the following course/lab pairings:

☐ CSCI 220 Computer Programming I (3) PR: CSCI 120 or CSCI 180 or CSCI 210 or MATH 111 or department permission
☐ CSCI 220L Computer Programming I Lab (1) PR or CO: CSCI 220

OR

☐ MATH 245 Numerical Methods and Mathematical Computing (3) PR: MATH 203 or MATH 220 or Instructor permission; CO: MATH 246
☐ MATH 246 Mathematical Computing and Programming Lab (1) PR: MATH 220 or instructor permission

Select 3 additional credit hours from the following:

☐ MATH 440 Statistical Learning I (3) PR: MATH 203 and MATH 220 and MATH 350
☐ MATH 445 Numerical Analysis (3) PR: MATH 203 and MATH 245 and MATH 323
☐ MATH 449 Linear Models (3) PR: MATH 350
☐ MATH 451 Linear Programming and Optimization (3) PR: MATH 203 and MATH 221, and CSCI 220 or MATH 245, or instructor permission

Business Coursework

☐ ACCT 203 Financial Accounting (3) PR: Sophomore standing
☐ ACCT 204 Managerial Accounting (3) PR: ACCT 203; sophomore standing
☐ ECON 200 Principles of Microeconomics (3) PR: None
☐ ECON 201 Principles of Macroeconomics (3) PR: ECON 200
☐ FINC 303  Business Finance (3) PR: ACCT 203, 204, ECON 200, 201, MATH 104/250; junior standing

☐ FINC 385  Individual Risk Management and Insurance (3) PR: Junior standing
Math Major with Statistics Track Requirements
Catalog Year: 2014-15
Degree: Bachelor of Science
Credit Hours: 46+

"PR" indicates a pre-requisite. "CO" indicates a co-requisite.

Courses within this major may also satisfy general education requirements. Please consult http://registrar.cofc.edu/general-edu for more information.

Required Courses

☐ MATH 120 Introductory Calculus (4) PR: Placement or C- or better in MATH 111
☐ MATH 220 Calculus II (4) PR: MATH 120 or HONS 115
☐ MATH 203 Linear Algebra (3) PR: MATH 120 or instructor permission
☐ MATH 221 Calculus III (4) PR: MATH 220

Select one of the following tracks (Actuarial, Applied, Pure, Statistics or Teacher Education):

Statistics Track

☐ MATH 295 Introduction to Abstract Mathematics (3) PR: MATH 203 or MATH 221
☐ MATH 311 Advanced Calculus I (3) PR: MATH 221 and MATH 295
☐ MATH 250 Statistical Methods I (3) PR: MATH 105 with a C- grade or better or MATH 111 or MATH 120 or permission of instructor
☐ MATH 350 Statistical Methods II (3) PR: MATH 120 and MATH 250
☐ MATH 430 Mathematical Statistics I (3) PR: MATH 221
☐ MATH 431 Mathematical Statistics II (3) PR: MATH 430

Select one of the following course/lab pairings:

☐ ___________ ☐ ___________ lab

CSCI 220 Computer Programming I (3) PR: CSCI 120 or CSCI 180 or CSCI 210 or MATH 111 or department permission
CSCI 220L Computer Programming I Lab (1) PR or CO: CSCI 220

OR

MATH 245 Numerical Methods and Mathematical Computing (3) PR: MATH 203 or MATH 220 or instructor permission; CO: MATH 246
MATH 246 Mathematical Computing and Programming Lab (1) PR: MATH 220 or instructor permission

Select 9 additional credit hours from the following:

☐ ___________ ☐ ___________ ☐ ___________

CSCI 334 Data Mining (3) PR: CSCI 221 and MATH 207 and MATH 250
MATH 440 Statistical Learning I (3) PR: MATH 203 and MATH 220 and MATH 350
MATH 441 Statistical Learning II (3) PR: MATH 440
MATH 449 Linear Models (3) PR: MATH 350
MATH 451 Linear Programming and Optimization (3) PR: MATH 203 and MATH 221, and CSCI 220 or MATH 245, or instructor permission
MATH 452 Operations Research (3) PR: MATH 203 and MATH 430, and CSCI 220 or MATH 245
MATH 455 Bayesian Statistical Methods (3) PR: MATH 430
MATH 475* Statistical Consulting (3) PR: MATH 350 and one of MATH 440 or MATH 441 or MATH 451 or MATH 452 or CSCI 334

Note: *MATH 475 Statistical Consulting is the recommended capstone for this track.
FACULTY CURRICULUM COMMITTEE
CHANGE/DELETE PROGRAM FORM

Instructions:
- Please fill out all of the portions of the form that are specified in section B. **You must do this before your request can move forward!**
- Remember that your changes will not be implemented until the next catalog year at the earliest.
- If you have questions, please start by checking the detailed instructions on the website.
- Please feel free to contact the committee chair with any remaining questions you might have.

A. CONTACT INFORMATION.

Name: Martin Jones  
Phone: 953-5735  
Email: jonesm@cofc.edu

School: Science and Mathematics  
Department or Program: Mathematics

Name and Acronym of Major: B.A. Mathematics MATH

B. CATEGORY OF REVIEW. Please check all that apply, then fill out the specified parts of the form.

- [X] Change Request (fill out all sections)
  - [ ] Add an existing course to requirements or electives
  - [X] Add a new course to requirements or electives (attach completed course form for each)
  - [ ] Delete courses from requirements or electives
  - [ ] Add or modify concentration*
  - [ ] Add or modify cognate*

*Note: Only concentrations and cognates requiring 18 or more credit hours will be tracked in Banner and Degree Works and noted on the transcript.

- [ ] Terminate Program (fill out E, G, H, and I)
  - [ ] Terminate degree
  - [ ] Terminate major
  - [ ] Terminate concentration
  - [ ] Terminate cognate

C. GENERAL INFORMATION

Number of Current Credit Hours (for existing program): ___36+_ 
Number of Proposed Credit Hours (for changed program): ___36+_______ 
Catalog Year in which changes will take effect: FALL 2015

D. CURRICULUM. Please list every change you are making below AND attach the current Program of Study Worksheet for this major (http://registrar.cofc.edu/program-of-study-resources/program-of-study-worksheets/index.php) with changes marked in RED. Additions should show where the course will be inserted, deletions should be noted by crossing out the course, and moves indicated with arrows. Distinguish between required and elective courses, and note any prerequisites, co-requisites, sequencing, or other restrictions. Provide the catalog description and course list exactly as they should appear in the catalog. For each new course, submit the Curriculum Committee’s Course Form and a sample syllabus.

This form was last updated on 6/6/2013 and replaces all others.  
Page 1 of 3
E. RATIONALE AND EXPLANATION. Please provide a narrative addressing the request you are making and why you are making it.

The Department of Mathematics is seeking approval for a new undergraduate course, MATH 449, to be co-listed with an existing graduate course, Math 550 Linear Models. Math 550 Linear Models is a graduate course with undergraduate prerequisites, and hence the content is appropriate for both graduate and undergraduate students. Currently, undergraduates must take Linear Models as a graduate course, and if approved, Math 449 Linear Models would be available to undergraduate students as an undergraduate course. Since the Mathematics Minor includes, beyond its core, “Ten additional credit hours at the 200 level or above, of which three credit hours must be at the 300 level or above,” MATH 449 would be added to the mathematics course listings and hence it would be available as three of the ten additional credit hours.

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT.

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Assessment Method and Performance Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>What will students know and be able to do when they complete the course?</td>
<td>How will each outcome be measured? Who will be assessed, when, and how often? How well should students be able to do on the assessment?</td>
</tr>
<tr>
<td><strong>1</strong> Understand the statistical theory behind the construction of linear models.</td>
<td>Students are expected at a minimum to identify and explain the relevant statistical theory underlying the development and application of linear models. Students will be assessed on homework and on in class tests. They will be expected to show on average a 75% level of proficiency on assessments.</td>
</tr>
<tr>
<td><strong>2.</strong> Understand the connection between geometric and algebraic approaches to linear model theory.</td>
<td>Students are expected at a minimum to identify and explain the connection between geometric and algebraic approaches to linear model theory. Students will be assessed on homework and on in class tests. They will be expected to show on average a 75% level of proficiency on assessments.</td>
</tr>
<tr>
<td><strong>3.</strong> Understand and be able to reproduce proofs of aspects of the development of linear model theory.</td>
<td>Students are expected at a minimum to demonstrate an understanding of the basic theoretical underpinnings of linear model theory by reproducing proofs of its fundamental theorems. Students will be assessed on homework and on in class tests. They will be expected to show on average a 75% level of proficiency on assessments.</td>
</tr>
<tr>
<td><strong>4.</strong> Be able to apply the theory of linear models to analyze real data using the statistical package R.</td>
<td>Students are expected at a minimum to effectively apply linear model theory by analyzing and drawing conclusions using the statistical package R in order to answer questions about populations drawn from real data sources. Students will be assessed on homework and on in class tests. They will be expected to show on average a 75% level of proficiency on assessments.</td>
</tr>
</tbody>
</table>
How does this course align with the student learning outcomes articulated for the major, program, or general education? What program-level outcome or outcomes does it support? Is the content or skill introduced, reinforced, or demonstrated in this course?

**SLO 1** Using algebra, geometry, calculus and other track-appropriate sub-disciplines of mathematics, students model phenomena in mathematical terms. This program student-learning outcome will be met through applications to real world situations by modeling random elements as they evolve over time such as financial markets and production line processes using techniques of Stochastic Processes such as Poisson processes, Markov chains, renewal processes, Martingales, random walks, and Brownian motion. **SLO 2** Using algebra, geometry, calculus and other track-appropriate sub-disciplines of mathematics, students derive correct answers to challenging questions by applying the models from **Learning Outcome 1**. This program student-learning outcome will be met through applications to real world situations by using the models from SLO 1 to derive statistical results from the techniques of Stochastic Processes. **SLO 3** Students write complete, grammatically and logically correct arguments to prove their conclusions. This program SLO will be addressed by the course student-learning outcome 3. above.

**G. IMPACT ON EXISTING PROGRAMS AND COURSES.** Please describe the impact of this request on other programs and courses. If you are deleting a program, please describe the effect on all programs that will be impacted; if you are adding or changing a program, please explain any overlap with existing programs at the College.

The addition of MATH 449 Linear Models will enhance the options of students seeking upper-level elective courses in the Mathematics Minor Program. The course will be particularly attractive to students with an interest in probability and statistics.

**H. COSTS ASSOCIATED WITH THE REQUESTED ACTION.** List all of the new costs or cost savings (including new faculty/staff requests, library, or equipment) associated with your request.

None, since we have already been MATH 550 as a graduate course and MATH 449 would be taught at the same place and time by the same faculty member.

**I. CHECKLIST**

- [ ] I have completed all relevant parts of the form.
- [ ] I have attached a cover letter that describes my request and lists all the documents I am submitting.
- [ ] I have attached a Course Form for each newly-created or modified course.
- [ ] (For proposals that affect other departments in any way) I have attached an acknowledgement from the relevant department.
- [ ] I have provided the complete curriculum for the program, concentration, emphasis, etc., including the description and course list, exactly as it should appear in the catalog.
- [ ] I have submitted one Signature Form that lists all of the different forms I am submitting.
Math Major Requirements
Catalog Year: 2014-15
Degree: Bachelor of Arts
Credit Hours: 36+

*PR* indicates a pre-requisite. *CO* indicates a co-requisite.

Courses within this major may also satisfy general education requirements. Please consult http://registrar.cofc.edu/general-edu for more information.

Required Courses

☐ MATH 120 Introductory Calculus (4) PR: Placement or a C or better in MATH 111
☐ MATH 220 Calculus II (4) PR: MATH 120 or HONS 115
☐ MATH 203 Linear Algebra (3) PR: MATH 120 or instructor permission
☐ MATH 221 Calculus III (4) PR: MATH 220
☐ MATH 295 Introduction to Abstract Mathematics (3) PR: MATH 203 or 221
☐ MATH 303 Abstract Algebra I (3) PR: MATH 203 and MATH 295
☐ MATH 311 Advanced Calculus I (3) PR: MATH 221 and MATH 295
☐ MATH 315 Introduction to Complex Variables (3) PR: MATH 221 with a minimum grade of C or better

Select one of the following courses:

☐ MATH 403 Abstract Algebra II (3) PR: MATH 303
☐ MATH 411 Advanced Calculus II (3) PR: MATH 203 and MATH 311

Complete one of the following options:

Option 1: Select 6 credit hours from the following 300 and 400-level MATH courses of which at least 3 credit hours must be at the 400-level or above:

☐ MATH 305 Elementary Number Theory (3) PR: MATH 295 or instructor permission
☐ MATH 307 Discrete Structures II (3) PR: MATH 207 or MATH 295 or instructor permission
☐ MATH 320 History of Mathematics (3) PR: MATH 295
☐ MATH 323 Differential Equations (3) PR: MATH 221 and MATH 203 or instructor permission
☐ MATH 340 Axiomatic Geometry (3) PR: MATH 295 or instructor permission
☐ MATH 350 Statistical Methods II (3) PR: MATH 120 and MATH 250
☐ MATH 397 Research Experience Mathematics (0) PR: Only declared math majors may take a Zero Credit Research course; instructor permission and department chair approval
☐ MATH 399 Tutorial (3; repeatable up to 12 credit hours) PR: Junior standing; tutor and department chair permission
☐ MATH 401 Intro Point Set Topology (3) PR: MATH 311
☐ MATH 402 Advanced Linear Algebra (3) PR: MATH 203 and MATH 303 or MATH 311
☐ MATH 403 Abstract Algebra II (3) PR: MATH 303
MATH 411   Advanced Calculus II (3) PR: MATH 203 and MATH 311
MATH 415   Complex Analysis (3) PR: MATH 311
MATH 417   Reading and Research (3) PR: Senior standing; instructor and department chair permission
MATH 418   Reading and Research (3) PR: Senior standing; instructor and department chair permission
MATH 421   Vector and Tensor Analysis (3) PR: MATH 311
MATH 423   Introduction to partial Differential Equations (3) PR: MATH 221 and MATH 323
MATH 430   Mathematical Statistics I (3) PR: MATH 221
MATH 431   Mathematical Statistics II (3) PR: MATH 430
MATH 440   Statistical Learning I (3) PR: MATH 203 and MATH 220 and MATH 350
MATH 441   Statistical Learning II (3) PR: MATH 440
MATH 445   Numerical Analysis (3) PR: MATH 203 and MATH 245 and MATH 323
MATH 451   Linear Programming and Optimization (3) PR: MATH 203 and MATH 221 and CSCI 220 or MATH 245 or Instructor permission
MATH 452   Operations Research (3) PR: MATH 203 and MATH 430 and CSCI 220 or MATH 245
MATH 455   Bayesian Statistical Methods (3) PR: MATH 430
MATH 470   Mathematical Modeling (3) PR: MATH 203 and MATH 323 and MATH 246 or CSCI 220 or Instructor permission
MATH 485   Topics in Pure Mathematics (3) PR: Instructor permission
MATH 480   Topics in Applied Mathematics (3) PR: Instructor permission
MATH 490   Practicum in Mathematics (3) PR: Senior standing; instructor and department chair permission

Option II: Complete the following:

☐ MATH 499 Bachelor's Essay (6) PR: Instructor and department chair permission
FACULTY CURRICULUM COMMITTEE
MINOR FORM

Instructions:
- Please fill out all of the portions of the form that are specified in section B. You must do this before your request can move forward!
- Remember that your changes will not be implemented until the next catalog year at the earliest.
- If you have questions, please start by checking the detailed instructions on the website. Please feel free to contact the committee chair with any remaining questions you might have.

A. CONTACT INFORMATION.

Name: Martin Jones
Phone: 953-5735
Email: jonesm@cofc.edu

School: Science and Mathematics
Department or Program: Mathematics

Name and Acronym of Minor: Mathematics MATH

B. TYPE OF REQUEST. Please check all that apply, then fill out the specified parts of the form.

☐ Add a New Minor (complete all portions)

☐ Change an Existing Minor (complete C, D, E, G, H, and I)
  ☐ Add existing course or courses to requirements or electives
  ☐ Remove existing course or courses from requirements or electives
  ☐ Add new course(s) to requirements or electives (attach completed course form for each)
  ☐ Delete courses from requirements or electives

☐ Terminate a Minor (complete E, G, H, and I)

C. GENERAL INFORMATION.

Number of Current Credit Hours (for existing minors): ___21___
Number of Proposed Credit Hours (for new or changing minors): ___21___

Catalog year in which changes will take effect: FALL 2015

☐ Interdisciplinary (please see guidelines on the Curriculum Committee website and include acknowledgments from relevant departments)

According to academic policy, students may not obtain a major/concentration and minor in the same subject. Will students in specific majors be prohibited from declaring this minor because of this policy?
  ☐ X Yes—Which major(s) or concentration(s)? Mathematics__________
  ____ No

D. CURRICULUM. For a changed minor, please list every change you are making below AND attach the current catalog entry for this minor (from the Minor Requirements section) with changes marked in RED. Additions should show where the course will be inserted, deletions should be noted by crossing out the course, and moves indicated with arrows. Distinguish between required and elective courses, and note any prerequisites, co-requisites, sequencing, or other restrictions. For each new course, submit the Curriculum Committee's Course Form and a sample syllabus. For

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a new program, please submit the complete curriculum and catalog description exactly as they should appear in the catalog.

There will be no changes to the catalog entry for the Mathematics Minor. These courses will be elective options for students wishing to complete the Mathematics Minor Program. No changes in the hours or requirements will be made as a result of the addition of these to courses to the Mathematics course listings.

E. RATIONALE AND EXPLANATION. Please provide a narrative addressing the request you are making and why you are making it. In addition, for a new minor, please address its objectives, provide evidence of student interest (e.g., interviews with student focus groups, enrollment in special-topics courses in this area), and explain how the minor supports the liberal arts tradition as well as the mission of the institution.

The Department of Mathematics is seeking approval for a new undergraduate course, MATH 449, to be co-listed with an existing graduate course, Math 550 Linear Models. Math 550 Linear Models is a graduate course with undergraduate prerequisites, and hence the content is appropriate for both graduate and undergraduate students. Currently, undergraduates must take Linear Models as a graduate course, and if approved, Math 449 Linear Models would be available to undergraduate students as an undergraduate course. Since the Mathematics Minor includes, beyond its core, “Ten additional credit hours at the 200 level or above, of which three credit hours must be at the 300 level or above,” MATH 449 would be added to the mathematics course listings and hence it would be available as three of the ten additional credit hours.

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT.

G. STUDENT LEARNING OUTCOMES AND ASSESSMENT.

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4. Be able to apply the theory of linear models to analyze real data using the statistical package R.

Students are expected at a minimum to effectively apply linear model theory by analyzing and drawing conclusions using the statistical package R in order to answer questions about populations drawn from real data sources. Students will be assessed on homework and on in class tests. They will be expected to show on average a 75% level of proficiency on assessments.

How does this course align with the student learning outcomes articulated for the major, program, or general education? What program-level outcome or outcomes does it support? Is the content or skill introduced, reinforced, or demonstrated in this course?

**SLO 1 Using algebra, geometry, calculus and other track-appropriate sub-disciplines of mathematics, students model phenomena in mathematical terms.** This program student-learning outcome will be met through applications to real world situations by modelling random elements as they evolve over time such as financial markets and production line processes using techniques of Stochastic Processes such as Poisson processes, Markov chains, renewal processes, Martingales, random walks, and Brownian motion. **SLO 2 Using algebra, geometry, calculus and other track-appropriate sub-disciplines of mathematics, students derive correct answers to challenging questions by applying the models from Learning Outcome 1.** This program student-learning outcome will be met through applications to real world situations by using the models from SLO 1 to derive statistical results from the techniques of Stochastic Processes.

**H. IMPACT ON EXISTING PROGRAMS AND COURSES.** Please describe the impact of this request on other programs and courses. If you are deleting a minor, please identify all programs that will be affected. If you are adding or changing a minor, please explain any overlap with existing programs at the College.

The addition of MATH 449 Linear Models will enhance the options of students seeking upper-level elective courses in the Mathematics Minor Program. The course will be particularly attractive to students with an interest in probability and statistics.

**I. COSTS.** List all of the new costs or cost savings (including new faculty/staff requests, library, equipment, etc.) associated with your request.

None, since we have already been MATH 550 as a graduate course and MATH 449 would be taught at the same place and time by the same faculty member.

**J. CHECKLIST.**

- [ ] I have completed all relevant parts of the form.
- [ ] I have attached a cover letter that describes my request and lists all the documents I am submitting.
- [ ] I have attached a Course Form for each newly-created or modified course.
- [ ] (For proposals that affect other departments in any way) I have attached an acknowledgement from the relevant department.

This form was last updated on 6/6/2013 and replaces all others.
☐ I have provided the complete curriculum for the minor, including the description and course list, exactly as it should appear in the catalog.

☐ I have submitted one Signature Form that lists all of the different forms I am submitting.