# New Undergraduate Course Request

Montana State University

<table>
<thead>
<tr>
<th>M&amp;IE Department</th>
<th>COE College</th>
<th>EIND Rubric</th>
<th>457 Course Number</th>
<th>Core Area(s)</th>
<th>S2014 First Semester to be Offered</th>
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## Regression and Applied Multivariate Analysis

### Course Title (for Catalog)

Regression & Multivariate Analysis

### Course Title (for Schedule - maximum of 22 characters)

Regression & Multivariate Analysis

Have you checked with the Registrar's office (X4155) to make sure the new course number has not been used in the past ten years?  **Yes**

Frequency Offered:  □ Annual  □ Alternate Years  If alternate, starting year: 2014

Semesters(s) Offered:  □ Summer  □ Fall  □ Spring

Credits by Mode of Instruction:
- Lecture: 3
- Independent Study: __________
- Recitation/Discussion: __________
- Seminar: __________
- Lab/Studio: __________
- Total: 3

Primary Mode of Delivery (Check One):
- □ Face-To-Face
- □ Internet/Web-Based
- □ Audio and/or Video Tape
- □ Interactive Video

Time and Location (Contact Registrar's Office for room availability):

<table>
<thead>
<tr>
<th>Days</th>
<th>Times</th>
<th>Bldg</th>
<th>Room</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWF</td>
<td>12 - 12:50</td>
<td>ROBH</td>
<td>307</td>
<td>30</td>
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Prerequisite course(s) (Upper-division courses are normally expected to have prerequisites. When listing multiple prerequisites, please be clear about whether the courses are all required, separated by "and," or only one is required (separated by "or"): **EIND 354 or Instructor Consent**

Co-requisite Courses:

Course Description (40 word limit):  *Please attach a typed copy of the catalog course description immediately following this cover page.*

Person Initiating This Request: **William Schell**
Instructor's Banner ID or SSN:  -00036802
Phone: x2203  E-mail: wschell@ie.montana.edu

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**APPROVAL**

You only need to obtain the 2 that are indicated with an asterisk (*).

- □  [Department Head]  5/2/12  [Date]
- □  [College Dean or Assistant Dean]  5/2/12  [Date]

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Chair, Undergraduate Studies Committee Date

Vice Provost Academic Affairs Date

Revised 10.20.05
New Description for EIND 457

Course Title: Regression and Applied Multivariate Analysis

Course Description:

Advanced topics in applied statistical analysis for engineers. Topics include regression techniques: ANOVA, simple linear regression, multiple linear regression, and variable selection procedures; and multivariate analysis techniques: principal components, factor analysis, canonical correlation analysis, and clustering methods. Statistical analysis for managerial decision-making as applied to engineering problems.
EIND 457 – Regression and Applied Multivariate Analysis

Learning Outcomes: At the end of this course the students will know/understand the following:
1. What regression is and its application to engineering problem solving.
2. When to utilize advanced multivariate techniques for engineering applications.
3. How to conduct multiple regression analysis,
4. How to select regression models and assess model adequacy.
5. How to select and apply appropriate multivariate analysis techniques.
Students will gain hands on experience in these techniques through a capstone project.
Information for Review

Please provide the following information in narrative format. Substantive responses to all criteria are required. Although not required, a draft syllabus can also be helpful to the committee in understanding the details of the proposed course.

General Course Information
1. Provide a general description of the course explaining the need for the course, its goals, and its overall structure. This is the most important part of the application and should offer a good sense of what students will experience by taking this class. As part of a broader enhancement of the Industrial Engineering curriculum, the existing EIND 454 - Engineering Probability and Statistics II course will be replaced with two alternative courses (offered in alternating years). The current 454 course includes two key topics: Regression and Design of Experiments (DOE), spending similar amounts of time on each. Each of these new courses will provide greater depth in one of these topics, while allowing for the inclusion of additional topics important to the current industrial engineering profession. This course, EIND 457, will cover Regression and add additional topics in multivariate analysis.

2. Based on what types of student work (e.g., tests, papers, performance, etc.) will grades be determined? Regular Homework, Exams and a Course Project. See attached syllabus.

3. Provide a course content outline containing all major topics plus a brief description of the material to be covered under each major topic heading. See attached syllabus.

4. List required texts or other required references. See attached syllabus.

5. Describe how the success of the course will be evaluated? Student enrollment, accreditation review, student and industry feedback.

Level of Offering
6. Has the course been offered previously under 280 or 480? No If so, when? Under what number? What was the enrollment? What level of students took the course?

7. Justify the level of course offering. Replacing an existing EIND 400-level course. Complex statistical material typically only offered at the senior or graduate level within engineering and math programs.

Relationship to other Courses, Curricula, and Departments
8. Does this course build on or interrelate with other courses in your curriculum or related curricula? Yes If so, which ones? This course builds on the material from EIND 354. It is related to the material offered in EIND 455 in that both regression and DOE use a foundation of ANOVA.

9. Do the topics in the proposed course duplicate or reiterate those in other courses in this or any other department? Reiterates the material currently covered in EIND 454, which it will replace. Related to material currently covered in the math department in their STAT 410, 412 and 437 course. If so, how do the coverage and educational experience differ and how is this duplication or reiteration justified? Not redundant with current EIND offering, due to course replacement. Differs materially from the topical treatment in the STAT courses as the tools are presented in an engineering and applied context, and coverage is provided for a breadth of topics that would require multiple STAT courses. Also, what liaison (which is expected in cases of apparent overlap) has been conducted with other departments? Meeting with Mark Greenwood in the math department to discuss course and co-convene offering. Report reactions, both favorable and unfavorable. Agreement that the engineering course is substantively different in its approach and topical coverage, consistent with existing practice of offering statistics courses both in math and engineering.

10. Is the instructor a member of the regular faculty (i.e., tenured or tenure-line)? yes If no, please describe the instructor's qualifications, attach a Vita, and provide a separate letter of support, signed by the department head (or appropriate unit director), addressing the instructor's qualifications to teach this course.

Students Served
11. Does the proposed course serve majors only? Non-majors only? Both majors and non-majors? State areas or disciplines to be served and indicate what specific efforts will be made to make the course material relevant to all disciplines served. Predominantly majors. Some students from other engineering disciplines periodically enroll in the existing EIND 454 (< 5% of enrollment), which is expected to continue.

Revised 10.20.05
12. What is the anticipated enrollment? 20 - 30 Please state any enrollment cap and explain the reason for the cap.

Resources
13. What additional resources, if any, will be required to offer this course? Please explain. None
14. What existing information resources -- print (books, journals, documents), audiovisual (videos, DVDs, CDs or other), and/or electronic (e-books, databases, electronic journals and web sites) -- provided by the MSU Libraries will be used by students in this course? Provide examples as well as descriptive information. If additional information resources are necessary, please discuss those acquisitions with the library at least three months prior to the beginning of the semester in which this course will be taught. None

Other Supporting Material
15. Include any additional information you feel is needed to support this request. This is a component of the overall redesign of the Industrial Engineering curriculum, and improves the instructional efficiency of the statistics series of the current graduate and undergraduate programs.
16. Our vision document asserts that, between 2004 and 2009, MSU's academic offerings will be increasingly interdisciplinary. The goal is for fifty percent or more of all new courses, options, and degree programs to have an interdisciplinary basis. If this proposed course has a significant interdisciplinary component, please explain briefly. Otherwise, indicate n/a. n/a
Spring 2014

EIND 457 – Regression and Applied Multivariate Analysis

Instructor: William Schell, PhD, PE

Office Hours: Roberts Hall 403, times TBD and by request
Contact: wschell@ie.montana.edu, 406.994.5938 (office), 406.224.0857 (cell / text)

General Course Information

Website: http://www.coe.montana.edu/ie/faculty/schell/teaching/eind457/
Meeting Time: MWF 12:00 – 12:50
Meeting Location: Roberts 307

Description: Advanced topics in applied statistical analysis for engineers. Topics include regression techniques: ANOVA, simple linear regression, multiple linear regression, and variable selection procedures; and multivariate analysis techniques: principal components, factor analysis, canonical correlation analysis, and clustering methods. Statistical analysis for managerial decision-making as applied to engineering problems.

Prerequisites: EIND 354 or EIND 455 or Instructor Approval


Etiquette and Attendance: All members of the class are expected to conduct themselves professionally at all times. Key components of professional behavior include arriving on time, engaging in course discussions, and not adding distractions to class. Class attendance is not mandatory, however, class members are expected to be present when attending and are expected to know all course materials regardless of attendance. MSU Student Conduct Guidelines can be found at www2.montana.edu/policy/studentconduct

Objectives: Develop an understanding of regression and introduce students to advanced multivariate techniques focusing on how these tools can be utilized for engineering problem solving. At course complete, students will be able to:

1. Conduct multiple regression analysis, select models and assess model adequacy.
2. Select and apply appropriate multivariate analysis techniques for a given problem.

Students will gain hands on experience in these techniques through a capstone project.
Grading and Evaluation

Grading Scale: Grades will be earned based on performance against the following cut offs:

A: 92   A-: 90   B+: 88   B: 82   B-: 80   C+: 78   C: 72   C-: 70
D+: 68   D: 60   F: Below 60

Graded Assignments: The final course grade will be earned through performance on the following set of assignments:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Weight</th>
<th>Description</th>
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<tbody>
<tr>
<td>Homework</td>
<td>45%</td>
<td>Assigned in most class periods</td>
</tr>
<tr>
<td>Exams (3)</td>
<td>45%</td>
<td>Three full period exams</td>
</tr>
<tr>
<td>Course Project</td>
<td>10%</td>
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<tr>
<td>Final Exam</td>
<td>25%</td>
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Note - The grading scale presented above represents the guaranteed grade a student will earn if these performance levels are met. Final grades may be curved, or additional opportunities to earn course points presented, if determined necessary by the instructor.

Late Assignments: Homework is due at the beginning of the class period after it was assigned. Late assignments will be accepted up until the next class period begins, but will be penalized 20%. Exams must be taken during the scheduled time period. Make up exams are allowed only for unanticipated and approved absences.

Exams: Students will generally have the entire period to complete exams. Students may utilize a hand written single side of one 8.5 x 11” sheet of paper for each exam, and any non-communicating calculator of their choosing (unless otherwise noted). The final exam will be comprehensive in nature and will take place during the common hour exam period assigned by the university. Students may utilize both sides of two hand written 8/5 x 11” sheets of paper for the final exam.

Grade Corrections: Adjustments will be made to the score of a graded assignment only when a grading error has been made. If the student believes an error was made in grading, the written request for correction must be made within 24 hours of the assignment being returned and include the original graded material.

Course Communications

Assignments and other key information regarding this course will be published to the course website immediately after the class period in which it was assigned. The course listserv will be utilized for any reminders, and/or to draw student's attention to any new materials (e.g. corrections) published to the website. As noted above, the instructor is available outside of office hours.