New Graduate Course Approval Cover Form
Montana State University

This four-page form collects basic information about the proposed new course, provides information on the approval process, and includes all required approvals. Additional information (see INFO sheet) is also required as part of the New Course Packet.

Proposed New Course Information

Requested Rubric, Course Number, Core Designation (if needed): EELE 584

Course Title: Laser Engineering

Abbreviated Course Title (≤ 30 chars): Laser Engineering

First Semester to be Offered: Spring 2016

Submitted by:

Instructor: Kevin Repasky
Department: Electrical & Computer Engineering
College: Montana State University
Submitter’s Contact Info: Phone, Email: x2505
robert.maher@montana.edu

New Graduate Course Review Process

Instructor completes the New Course Packet.

New Course Packet

Department Head’s signature indicates that course has been approved by the process used within the Department.

Department Review

The Chair of the College Curriculum Committee signs to indicate College academic approval (if required).

College Review

The College Dean signs to indicate that adequate resources are available to offer the course. Supporting information (Dean’s Statement) is typically required.

Graduate Dean Review

The New Course Packet (as PDF) is submitted to the Graduate School for approval by the Dean.

Provost’s Office reviews the new course request.

Provost Review

Approved new course sent to Registrar for inclusion in the Catalog and Schedule of Classes

Registrar’s Office (for Catalog)

APPROVALS

Submitter * 2/26/2014

Department Head * 2/26/2014

Chair, College Curriculum Comm. 2/26/2014

Graduate School Dean * 04-28-14

Assoc. Provost *

Note: This diagram illustrates the typical flow path, but at any review step there can be a request for additional information or modifications. Careful review in early steps is the best way to speed the overall process. * Special topics courses (x91) do not require review by the College Curriculum Committee, but cannot be offered more than two times without committee review.
INFORMATION NEEDED FOR COMMON COURSE NUMBERING

The process for identifying a common course number for a new course is as follows:

1. Course learning outcomes are prepared for the new course.
2. The person submitting the new course request looks at the CCN website to see if a course with similar outcomes already exists in the MUS system.
   
   www.mus.edu/Ctools/CCN/ccn_default.asp

   • If a course exists with at least 80% of the same outcomes, the course is considered “equivalent” to the proposed new course, and the new course should use the existing rubric and course number.
   • If no “equivalent” course is found, the person submitting the new course request should identify a unique course number that has not been used by any other course in the MUS system.
3. The requested rubric and course number are submitted as part of the new course packet.
4. The Provost’s Office submits the learning outcomes and the requested rubric and course number to the MUS to have a course number assigned to the course. (This will typically be the requested course number, but it could be changed.)
5. The assigned common course number is reported back to the person submitting the new course request.

(Requested Rubric, Course Number, Core Designation (if needed):)

- **Course Title:** EELE 584
- **Abbrev. Course Title (≤ 30 char):** Laser Engineering
- **Credits:** 3
- **Department Offering Course:** Electrical & Computer Engineering
- **College:** Engineering

Is this course “equivalent” to a course in the MUS System?: ☐ Yes  ☑ No

Learning Outcomes for the Course:

1. Identify and understand the role of the major components needed for laser operation.
2. Develop the rate equations for both a three-level and four-level laser system.
3. Use the theoretical models to predict laser behavior.
4. Use laser data sheets to identify an appropriate laser for a needed application.
5. Develop a laser system to meet the needed specifications for a needed application.
## INFORMATION REQUIRED BY THE REGISTRAR

The data needed to enter the new course into the MSU Catalog and Schedule of Classes is collected on this page. Once the new course has been approved, this page is automatically forwarded to the Registrar for data entry.

<table>
<thead>
<tr>
<th>Assigned Rubric, Course Number, Core Designation (if needed):</th>
<th>EELE 584 Laser Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Title (for Catalog):</td>
<td>Laser Engineering</td>
</tr>
<tr>
<td>Course Title (for Schedule of Classes, 30 characters, max.):</td>
<td>Laser Engineering</td>
</tr>
<tr>
<td>First Semester to be Offered:</td>
<td>Spring 2016</td>
</tr>
<tr>
<td>Restricted Entry/Consent of Instructor Required:</td>
<td>Yes</td>
</tr>
<tr>
<td>Instructor’s GID (last 4 digits only):</td>
<td>8417</td>
</tr>
<tr>
<td>Department Offering Course:</td>
<td>Electrical &amp; Computer Engineering</td>
</tr>
<tr>
<td>College:</td>
<td>Engineering</td>
</tr>
<tr>
<td>Is the requested course number available? (x4155 to check):</td>
<td>Yes</td>
</tr>
<tr>
<td>Frequency of course offering:</td>
<td>Annually</td>
</tr>
<tr>
<td>Semester(s) offered (check all that apply):</td>
<td>First 6 weeks</td>
</tr>
<tr>
<td>Summer Options (check all that apply):</td>
<td>2 summers</td>
</tr>
<tr>
<td>Credits by mode of instruction:</td>
<td>Lecture: 3</td>
</tr>
<tr>
<td></td>
<td>Seminar: 0</td>
</tr>
<tr>
<td></td>
<td>Independent Study: 0</td>
</tr>
<tr>
<td></td>
<td>Lab/Studio: 0</td>
</tr>
<tr>
<td></td>
<td>Recitation/Discussion: 0</td>
</tr>
<tr>
<td></td>
<td>TOTAL CREDITS: 3</td>
</tr>
<tr>
<td>Primary Mode(s) of Delivery:</td>
<td>Face-to-face</td>
</tr>
<tr>
<td></td>
<td>Web-Enhanced (small on-line comp.)</td>
</tr>
<tr>
<td></td>
<td>On-Line Only</td>
</tr>
<tr>
<td></td>
<td>Blended (significant on-line portion)</td>
</tr>
<tr>
<td>Time and Location – Call the Registrar’s Office at x4155 to find a time and location for the course.</td>
<td>M: 1100-1150 Tu: 1100-1150 W: 1100-1150 Th: 1100-1150 F: 1100-1150 Sa: 1100-1150 Su: 1100-1150</td>
</tr>
<tr>
<td>Assigned Day(s):</td>
<td>EPS</td>
</tr>
<tr>
<td>Assigned Time(s):</td>
<td>101</td>
</tr>
<tr>
<td>Assigned Building:</td>
<td>EPS</td>
</tr>
<tr>
<td>Assigned Room:</td>
<td>101</td>
</tr>
<tr>
<td>Capacity (room capacity, or enrollment “cap”):</td>
<td>25</td>
</tr>
<tr>
<td>Co- and Pre-Requisites – Courses numbered 200 and above are normally expected to have prerequisites. When listing multiple prerequisites, please separate courses with “and” if both are required, or “or” if only one is required.</td>
<td>PHYS 222</td>
</tr>
<tr>
<td>Prerequisite(s):</td>
<td>PHYS 222</td>
</tr>
<tr>
<td>Co-Requisite(s):</td>
<td></td>
</tr>
</tbody>
</table>

**Course Description** – Provide a course description of 40 words or less for the MSU Catalog.

The laser engineering course provides a basic understanding of the design and operational principles of lasers. Discussions of design and operation of several types of lasers will be covered including solid state lasers, gas lasers, and semiconductor lasers.
DEAN'S STATEMENT

The reviewing committees are being asked to take a closer look at the resources required for each proposed new course. In many cases new courses will replace existing courses and the new course request is effectively resource neutral, however that is not always the case. For example, a new elective course that would result in distributing an existing student population across a larger number of courses would represent a significant increase in expenditures for the new course, and no increase in total student credit hours. A funding mechanism for such a course would need to be identified. The Dean’s Statement is the place to document how the costs of the proposed new course will be covered.

This course will be co-convened with an undergraduate level 484 course. Offering these courses together will increase faculty efficiency and create an enhanced learning environment for the students. Co-convening these courses will allow the graduate students to fulfill their 500-level course requirements in a timely fashion. The learning outcomes are clearly defined with the additional expectations for graduate students well explained, the instructor will be including an assessment component. The course will not involve a significant increase in resources to teach.
NEW GRADUATE COURSE NARRATIVE
Updated: 12/31/2013

REQUIRED DOCUMENTATION FOR REVIEW OF NEW GRADUATE COURSES

1. Course Description:
   a. What are the special goals or purposes of the course that support a "graduate" level of the course?

   The goals of the course are to provide graduate level students with an in-depth introduction to laser physics, laser engineering, and other accompanying technology. This course will prepare students whose research will involve the use, modification, or development of lasers for research.

   b. Is this course intended to be a required part of a new degree curriculum option, major, or minor?

   No.

   c. Provide a course syllabus containing all major topics to be covered.

   {see attached syllabus}

   d. List required texts or other required references.


2. Level of Offering:
   a. Has the course been offered previously as a 591?

   No.

   i. If so, when?

   ii. What was the enrollment?

   iii. What level of students took the course?

   iv. What were the evaluations?

   b. Does the course represent an upgraded version of an undergraduate level course?

   The graduate level course is meant to be co-convened with the EELE484 Laser engineering.

   i. If so, how has the course been changed to justify offering it at the graduate level? (Be specific)

   The graduate level course will require an in-depth research paper and presentation.
The graduate level course will require the students to keep a journal for documenting outside reading included from the higher level Lasers textbook by Siegman.

Problems will be assigned from the higher level Lasers textbook from Siegman.

Tests will be written separately for graduate and undergraduate students.

c. What are the prerequisites for this graduate course? (List exact MSU courses - e.g. ESCI XXX or equivalent)

The prerequisite is ELE334 Electromagnetic Theory I or equivalent.

d. What performance requirements are placed on students which make this a graduate course?
   i. Specifically state the written requirements or products of this course.
      The students will be required to complete an in-depth research paper and complete a 20 minute presentation based on their research paper.

      Students will be required to keep a journal where outside reading is documented.

      Students will be required to complete approximately ten homework assignments over the course of the semester.

   ii. How will the student=s learning be assessed and graded?
      Student learning will be assessed by grading the homework assignments, through midterm and final exams, through grading of the research paper and presentation, and through monthly grading of the course journal.

3. Relationship to other courses, curricula, and Departments:
   a. Does this course build on or interrelate with other courses in your curriculum or related curricula? If so, which one(s)?
      This course requires a basic introduction to electromagnetic theory and will be accessible to Electrical and Computer Engineering students, Physics students, and chemistry students.
b. Does this course replace one or more courses that will not be offered? If so, which one(s)?

No.

c. Will this course be co-convened with an undergraduate course? If so, what additional requirements will students enrolled in the graduate course be expected to fulfill?

Yes. The additional requirements for the graduate students include:

- The graduate level course will require an in-depth research paper and presentation.
- The graduate level course will require the students keep a journal for documenting outside reading included from the higher level Lasers textbook by Siegman.
- Problems will be assigned from the higher level Lasers textbook from Siegman.
- Tests will be written separately for graduate and undergraduate students.

d. Do the topics in the proposed course duplicate or reiterate those in other courses in this or any other department? If so, how do the coverages and education experiences differ, and how are these duplications or reiterations justified?

No.

e. When the course is to be co-sponsored, taught by faculty from more than one department, or when content overlaps areas of common concern, the concurrence of all department heads and deans involved must be indicated. What liaison has been conducted with other departments? State reactions, both favorable and unfavorable.

N/A

4. Students Served:

a. Does the proposed course serve:

   i. Majors only?
   ii. Non-majors only? State area(s) or discipline(s) to be served.
   iii. Both majors and non-majors? Indicate what specific efforts will be made to make the course materials relevant to all disciplines served. How are faculty and students in the other areas to be served being made aware of this course?

This course can serve graduate students in electrical and computer engineering, physics, and chemistry. Many research programs in these disciplines utilize lasers. This course will build on basic physics principles each of the above majors will have been exposed to. The other requirement is an introductory
electromagnetic theory class which is typically available to each of the above majors.

5. What is the anticipated course enrollment?
   Typically, 1-3 graduate students enroll in EELE484. These students will most like enroll in EELE584.

6. Resources (including instructor):
   a. Are department financial resources sufficient for offering this course?
      Yes.
   b. Does the instructor have the requisite academic training to offer this course?
      i. Describe these qualifications briefly and include a vita (if the instructor is non-tenured).
      The instructor is Prof. Kevin Repasky, tenured Associate Professor of Electrical & Computer Engineering. Prof. Repasky is an expert in laser systems and very qualified to teach this course.
   c. Are the library holdings adequate to support this course?
      Yes.

7. Course Evaluation:
   a. How will the students evaluate the course and instructor?
      The students will evaluate the course through the online course evaluation process already in place. The course will be included in the standard instructor evaluation process and in our ABET-accreditation processes. The instructor also provides a mid-term assessment survey that is tabulated and then discussed with the students.
   b. How will the department evaluate the course and instructor?
      In addition to an assessment based on the process outlined above for student feedback, the graduate courses in the ECE Department are subject to regular review by the ECE Graduate/Research Committee to determine if the course is meeting its learning outcomes and supporting the goals of the graduate program.

8. Other Supporting Material: Include any additional information you feel is needed to support this request.

Syllabi for existing EELE 484 and proposed EELE 584.
Laser Engineering
FELE-484

Instructor: Kevin Repasky
Office: Cobleigh 537
Office Hours: M, W, F 10:00 – 10:50
Phone: 406-994-6082
Email: repasky@ece.montana.edu

Tentative Topics to be Covered
- Introduction to Lasers
- Energy States and Gain
- Fabry-Perot Etalon
- Transverse Mode Properties
- Gain Saturation
- Transient Processes
- Nonlinear Optics (Brief Introduction and Survey)
- Supportive Technologies
- Conventional Gas Lasers (Helium Neon Laser)
- Conventional Solid State Lasers (Nd:YAG and Ti:Sapphire)
- Diode Lasers

Grading
Homework will be assigned approximately every week. These assignments will consist of 2-4 problems.

Two midterm exams are scheduled for this course. The first midterm is scheduled for Friday, February 21 while the second midterm is scheduled for Friday, March 21.

A paper will be required for this course and will be Monday, April 14. The topic area for this paper is an application that involves a laser. What is expected in this paper is a description of the laser application including the needed laser specifications and a discussion of the laser used to meet these needed specifications.

The Final exam is scheduled for Tuesday, April 29 at 4:00-5:50 pm.

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>40%</td>
<td>A &gt;92%</td>
</tr>
<tr>
<td>Paper</td>
<td>10%</td>
<td>A- &gt;90%</td>
</tr>
<tr>
<td>Midterm 1</td>
<td>15%</td>
<td>B+ &gt;88%</td>
</tr>
<tr>
<td>Midterm 2</td>
<td>15%</td>
<td>B &gt;82%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
<td>B- &gt;80%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C+ &gt;78%</td>
</tr>
</tbody>
</table>

A >92%, A- >90%, B+ >88%, B >82%, B- >80%, C+ >78%, C >72%, D+ >68%, D >60%, F <60%
Laser Engineering
EELE-584

Instructor
Kevin Repasky
Office
Cobleigh 537
Office Hours
M,W,F 10:00 – 10:50
Phone
406 994 6082
Email
repasky@ece.montana.edu
Textbook
Laser Engineering, Kelin J. Kuhn, Prentice Hall, 1998
Lasers, Anthony E. Siegman, University Science Books, 1986

Tentative Topics to be Covered
Introduction to Lasers
Energy States and Gain
Fabry-Perot Etalon
Transverse Mode Properties
Gain Saturation
Transient Processes
Nonlinear Optics (Brief Introduction and Survey)
Supportive Technologies
Conventional Gas Lasers (Helium Neon Laser)
Conventional Solid State Lasers (Nd:YAG and Ti:Sapphire)
Diode Lasers

Grading

Homework will be assigned approximately every week. These assignments will consist of 3-5 problems. The homework will consist of problems from both textbooks.

Two midterm exams are scheduled for this course. The first midterm is scheduled for Friday, February 21 while the second midterm is scheduled for Friday, March 21.

A 15 page research paper will be required for this course and will be Monday, April 14. The topic area for this paper is an application that involves a laser. You will be required to present a 20 minute PowerPoint presentation based on this research paper. What is expected in this paper is a description of the laser application including the needed laser specifications and a discussion of the laser used to meet these needed specifications.

You will be required to keep a journal detailing the reading done outside of class including notes taken from the textbook Lasers by Siegman as well as other textbooks and notes generated from journal papers.

The Final exam is scheduled for Tuesday, April 29 at 4:00-5:50 pm.

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>30%</td>
</tr>
<tr>
<td>Paper</td>
<td>10%</td>
</tr>
<tr>
<td>Midterm 1</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm 2</td>
<td>15%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
</tr>
<tr>
<td>Journal</td>
<td>10%</td>
</tr>
</tbody>
</table>

Letter Grade:
A >92%
A- >90%
B++ >88%
B+ >82%
B >80%
C++ >78%
C+ >72%
C >70%
D++ >68%
D+ >60%
D >50%
F <50%
Learning Outcomes

EELE484

1. Identify and understand the role of the major components needed for laser operation.
2. Develop the rate equations for both a three-level and four-level laser system.
3. Use the theoretical models to predict laser behavior.
4. Use laser data sheets to identify an appropriate laser for a needed application.

EELE584

1. Identify and understand the role of the major components needed for laser operation.
2. Develop the rate equations for both a three-level and four-level laser system.
3. Use the theoretical models to predict laser behavior.
4. Use laser data sheets to identify an appropriate laser for a needed application.
5. Develop a laser system to meet the needed specifications for a needed application.