New Undergraduate 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

Check here if "Special Topics" x91 course:

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

Example: PHIL 361

Course Title: Power Systems Protection, Operation, & Control

Abbreviated Course Title (≤ 30 chars):

Power Sys protection & ctl

First Semester to be Offered:

Spring 2014

Submitted by:

Rob Maher

x2505 rob.maher@montana.edu

Submitter's Contact Info: Phone, Email:

Instructor:

Prof. Matt Donnelly (local MSU coord. Prof. Hashem Nehrir)

Department:

Electrical and Computer Engineering

College:

Engineering

New Course Review Process

Instructor completes the New Course Packet, with Core information if a Core designation is requested.

Instructor checks for "equivalent" course in the MUS system and recommends a common or unique course number.

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

The Chair of the College Curriculum Committee signs to indicate College academic approval.

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

The New Course Packet (as PDF) is uploaded to the Provost's Office server for distribution to other committees.

Course requests are sent to Curriculum and Program Committee (CPC). Core reviews are sent to appropriate Core subcommittee. Committees work in parallel when possible to speed approval process. Special topics courses (291,491) skip the CPC review (limited to two years.)

Provost's Office reviews the new course request. New courses are submitted to MUS for Common Course Number (CCN) review. Dean and Department informed upon approval.

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

APPROVALS

Submitter *

Department Head *

Chair, College Curriculum Comm.

Dean *

Chair, Core Subcommittee (if app.)

Chair, CPC

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) require fewer signatures, 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/Qtools/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):

<table>
<thead>
<tr>
<th>Course Title: EELE 456</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Systems Protection, Operation, &amp; Control</td>
</tr>
<tr>
<td>Abbrev. Course Title (≤ 30 char): Power Sys protection &amp; ctl</td>
</tr>
<tr>
<td>Credits: 3</td>
</tr>
<tr>
<td>Department Offering Course: Electrical and Computer Engineering</td>
</tr>
<tr>
<td>College: Engineering</td>
</tr>
</tbody>
</table>

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

Learning Outcomes for the Course:

With the completion of EELE 456, students are expected to:

1. Know the need for and principles of power system components.
2. Know the protection philosophy of radial and mesh power systems.
3. Know the operation and modeling of turbine-governor, generator voltage control, and load-frequency control.
4. Know the philosophy behind economic dispatch.
5. Be able to develop simplified synchronous machine models for the purpose of studying transient stability.
6. Be able to develop the electromechanical swing equation for a simplified model of a synchronous generator.
7. Know the equal-area criterion and the reason for transient stability.
8. Know a design method for improving transient stability of simple power systems.
9. Know the difference between primary and secondary distribution systems.
10. Know methods of voltage control in distribution systems.
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.

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

<table>
<thead>
<tr>
<th>Course Title (for Catalog):</th>
<th>EELE 456</th>
</tr>
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</tr>
<tr>
<td>Core Designation (if needed)</td>
<td>Power sys protection &amp; ctl</td>
</tr>
</tbody>
</table>

First Semester to be Offered: \[\square Yes \quad \square No\]

Instructor's GID (last 4 digits only): 8589

Department Offering Course: Electrical and Computer Engineering

College: Engineering

Is the requested course number available? (x4155 to check): \[\square Yes \quad \square No\]

Frequency of course offering: \[\square Annually \quad \square Spring\]

Semester(s) offered (check all that apply): \[\square Summer \quad \square Fall \quad \square Spring\]

Summer Options (check all that apply): \[\square First 6 weeks \quad \square Second 6 weeks \quad \square 12 weeks\]

Credits by mode of instruction:

- Lecture: 3
- Seminar: 
- Independent Study: 
- Lab/Studio: 
- Recitation/Discussion: 

TOTAL CREDITS: 3

Primary Mode(s) of Delivery:

- Face-to-face
- Web-Enhanced (small on-line comp.)
- On-Line Only
- Blended (significant on-line portion)

Time and Location – Call the Registrar’s Office at x4155 to find a time and location for the course.

Assigned Day(s): \[\square M \quad \square Tu \quad \square W \quad \square Th \quad \square F \quad \square Sa \quad \square Su\]

Please list TBD

Assigned Time(s):

Assigned Building:

Assigned Room:

Capacity (room capacity, or enrollment “cap”):

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.

Prerequisite(s):

Co-Prerequisite(s):

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

EELE 454

Continuation of EELE 454. Symmetrical and unsymmetrical fault analysis, system protection, introduction to load frequency control, voltage control, economic dispatch, and introduction to power system stability.
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.
New Undergraduate Course Narrative
Montana State University
Updated August 23, 2012

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. Requested Public Course Number and Core Designation (if any)

   > EELE 456

2. Course Title

   > Power system Protection and Control

3. 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.

   > Currently, there is only one senior-level elective course on electric power systems (EELE 454, Electric Power System Analysis) offered by the ECE Department. It is not possible to cover all the essential topics that students with the focus area of electric power engineering need to be better marketable at the time of graduation. In the spring semester 2013, a special topics course (EELE 490) was offered to cover the power system protection and control topics proposed (a draft course outline attached). The special topic course was offered on-line for MSU EE students in collaboration with the EE Department at Montana Tech. Dr. Matt Donnelly of MT Tech taught the course, face-to-face for MT-Tech students and on-line (through Boodle recording) for MSU students.

   It is firmly believed that the proposed course will benefit the EE students who choose the electric power engineering focus. They will be introduced to practical topics such as protection of electric power distribution and transmission systems, power system voltage and frequency control, and power system transient stability and control.

   Dr. Hashem Nehrir (MSU Professor) will work with MT-Tech in an effort to make this collaborative course offering successful.

4. Based on what type of student work (e.g., tests, homework assignments, papers, performances, etc.) will grades be determined?

   > All of the above, plus each student will give a 15-minute presentation on a practical (real-world) case/topic.

5. Provide a course content outline containing all major topics, plus a brief description of the material to be covered under each major topic heading.
Please see the attached course outline.

6. List required texts or other required references.

> Required text: Electric Power System Analysis and Design, fifth edition, Glover, Sarma, Overbye, Cengage Learning, 2012. The students taking this course will already have the text since they have already taken the pre-requisite for this course, EELE 454, which uses the same text.

7. What are the estimated enrollment and student credit hour (SCH) production?
   \[\text{SCH} = \text{enrollment} \times \text{credits}\]

> The expected enrollment is 6-10 students, depending on the year.
   \[\text{SCH} = 6-10 \times 3 = 18-30\]

8. Will there be an enrollment cap that restricts enrollment below the level of student demand? If so, what is the enrollment cap and why is it necessary?

> There will be no enrollment cap.

9. Will course be a "restricted enrollment" course? If so, why is restricted enrollment necessary?

> Not a restricted enrollment course. Any student who has the required pre-requisite for the course can take the course.

10. Describe how the success of the course will be evaluated? ("End-of-semester student evaluations" is not the answer to this question. How will the instructor determine if the learning outcomes are being met, and how will the department determine if the course is fulfilling its intended purpose?)

> The success of the course will be evaluated based on the engagement of the students in the lectures and in the course in general. The students’ performance on the exams/projects/homework given throughout the semester will help the instructor determine to what extent the learning outcomes of the course have been met. Satisfaction of the instructor in delivering the required material and getting the students engaged in the course would also be a part of this evaluation.

The feedback from the instructor to the department and the confidential course evaluation by the students at the end of the semester will help the department determine if the course is fulfilling its intended purpose.

11. Is the instructor a member of the regular faculty (i.e., tenured or tenure-track)? 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.

> The instructor who taught the course as a special topic course in the spring semester 2013 (Dr. Matt Donelly, MSU Ph.D. graduate and a tenured Associate Professor at Mt-Tech,) and Dr. Nehrir (MSU tenured Professor) will be involved in teaching the proposed course.
**Level of Offering**

12. Has the course been offered previously under 280/291 or 480/491? If so, when? Under what number? What was the enrollment? What level of students took the course?

> Yes, please refer to the answer to Questions 4, 11.

13. Justify the level of course offering.

> The course is a senior-level EE course. Its pre-requisite is another senior-level course, EELE 454.

**Relationship to other Courses, Curricula, and Departments**

14. Does this course build on or interrelate with other courses in your curriculum or related curricula? If so, which ones?

> As explained above, the course will build on the material covered in EELE 454 offered by the ECE Department.

15. 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 coverage and educational experience differ and how is this duplication or reiteration justified? Also, what liaison (which is expected in cases of apparent overlap) has been conducted with other departments? Report reactions, both favorable and unfavorable.

> The proposed course will be a continuation of EELE 454.

16. What programs (departments, colleges) will be impacted by the SCH production of this course? That is, where do you think the SCH in the proposed course are likely to come from? If the expected SCH production of the proposed course is greater than 1000, and the SCH are expected to come from other colleges, what steps have been taken to make the other units aware of the potential loss of SCH? Report reactions, both favorable and unfavorable.

> The ECE Department of the College of Engineering will be impacted by the SCH production.

17. If this proposed course has a significant interdisciplinary component, please explain briefly. Otherwise, indicate n/a.

> N/A.

**Students Served**

18. Does the proposed course serve majors only? Non-majors only? Both majors and non-majors? What other majors might be interested in this course? State areas or disciplines to be served and indicate the specific efforts that will be made to make the course material relevant to all disciplines served.

> The course will serve majors (those students who have taken the course pre-requisite, EELE 454) only.
Resources

19. What additional resources (e.g., additional instructional FTE, required technologies), if any, will be required to offer this course? Are there any resource issues for the students who will take the course (e.g., required technologies, travel, on-line access requirements)? Will there be an additional fee charged to students taking this course? Please explain.

> No additional fee will be charged to the students taking the course. The course may be taught in person and on-line concurrently at MSU or Montana Tech so that the students from the other campus could have access to all the lectures and course materials.

20. 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 (36539 Collection Development) at least three months prior to the beginning of the semester in which this course will be taught.

> The text used for this course is comprehensive and has most of the information needed for the course. Students can download the educational version of a professional software free of charge and use for their projects. MSU library also has many books related to the topics covered in the course that the students can use.

Other Supporting Material

21. Include any additional information you feel is needed to support this request.

> Draft course syllabus attached.
EELE 456 Draft Course Syllabus

Introduction: Power system protection and control

Learning outcomes:
With the completion of EELE 456, students are expected to:

1. Know the need for and principles of power system components.
2. Know the protection philosophy of radial and mesh power systems.
3. Know the operation and modeling of turbine-governor, generator voltage control, and load-frequency control.
4. Know the philosophy behind economic dispatch.
5. Be able to develop simplified synchronous machine models for the purpose of studying transient stability.
6. Be able to develop the electromechanical swing equation for a simplified model of a synchronous generator.
7. Know the equal-area criterion and the reason for transient stability.
8. Know a design method for improving transient stability of simple power systems.
9. Know the difference between primary and secondary distribution systems.
10. Know methods of voltage control in distribution systems.

Power System Protection
- Distribution system protection
- Transmission system protection
- Generator, transformer, and substation protection
- Special protection schemes
- Motor protection
- Review

Power System Control
- Generator voltage control
- Turbine-governor control
- Load-frequency control
- Economic dispatch
- Optimal power flow

Transient Stability
- The swing equation
- Simplified Synchronous machine model and system equivalent
- Two-axis synchronous machine model
- The equal-area criterion
- Solving the swing equation – numerical integration
- Multi-machine stability
Design methods for improving transient stability
Wind turbine machine model and stability issues

**Power Distribution and Control**
- Distribution systems
- Primary distribution
- Secondary distribution
- Distribution system voltage control
  - Transforms
  - Shunt capacitors
- Distribution system reliability
- Distribution system automation
- Smart grid

Grading: Two midterm exam (50%), homework/projects/presentation (25%), Final exam (25%)