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

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

Example: PHL 361 RH

Course Title:

Elementary Principles of Chemical & Biological Engineering

Abbreviated Course Title (≤ 30 chars):

Ekm Prin Chem Biol Eng

First Semester to be Offered:

Fall 2014

Submitter’s Contact Info: Phone, Email:

x7902 jeff.heys@gmail.com

Instructor:

Jeffrey Heys

Department:

Chemical and Biological 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.

Dean and Department Head upon approval.

The New Course Packet (as PDF) is uploaded to the Provost’s Office 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.

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.

APPROVALS

Jeff Heys

Submitter *

10/14/2013

Date

Jeff Heys

Department Head *

10/14/2013

Date

Christine M. Foreman

Chair, College Curriculum Comm.

10/28/2013

Date

Dean *

Chair, Core Subcommittee (If app.)

Date

Chair, CPC

Date

Assoc. Provost *

Date
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:</th>
<th>ECHM 201</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbrev. Course Title (≤ 30 char):</td>
<td>Elementary Principles of Chemical &amp; Biological Engineering</td>
</tr>
<tr>
<td>Credits:</td>
<td>Elem Prin Chem Biol Eng</td>
</tr>
<tr>
<td>Department Offering Course:</td>
<td>3</td>
</tr>
<tr>
<td>College:</td>
<td>Chemical and Biological Engineering</td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
</tr>
</tbody>
</table>

Is this course “equivalent” to a course in the MUS System?: Yes

Learning Outcomes for the Course:

At the end of this course, students will be able to:

1. Interpret a written description of a chemical process and generate a flowsheet that represents the written description,
2. Demonstrate the principles of species accounting as they pertain to mass and energy balances,
3. Perform vapor-liquid equilibrium calculations for systems containing one condensable component and for ideal multicomponent solutions,
4. Calculate internal energy and enthalpy changes for process fluids undergoing specified changes in temperature, pressure and phase as well as mixing and chemical reactions and incorporate the results of these calculations into process material and energy balance calculations, and
5. Critically evaluate the soundness of a design.
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): ECHM 201
Course Title (for Catalog): Elementary Principles of Chemical & Biological Engineering

Course Title (for Schedule of Classes, 30 characters, max.): Elem Prin Chem Biol Eng
First Semester to be Offered: Fall 2014

Restricted Entry/Consent of Instructor Required: ☐ Yes ☑ No
Instructor’s GID (last 4 digits only): 2712

Department Offering Course: Chemical and Biological Engineering
College: Engineering

Is the requested course number available? (x4155 to check): ☑ Yes ☐ No

Frequency of course offering: ☑ Annually ☐ Alternate Years, starting ______
Semester(s) offered (check all that apply): ☑ Summer ☑ Fall ☑ Spring
Summer Options (check all that apply): ☐ First 6 weeks ☐ Second 6 weeks ☐ 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): ☑ M ☑ Tu ☐ W ☑ Th ☐ F ☐ Sa ☐ Su
Assigned Time(s): 1:40-2:55
Assigned Building: Reid
Assigned Room: 108
Capacity (room capacity, or enrollment “cap”): 180

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): CHMY 141, M 171
Co-Requisite(s): Material and Energy balance calculations applied to industrial processes. Analysis of gas behavior and gas-liquid systems. Discussion of contemporary issues in engineering and the impact of engineering solutions in a global, economic, environmental and societal context.

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

The proposed new course is roughly resource neutral as we are proposing to replace two existing courses that are taught once per year with a single course that is taught twice a year. It is only roughly resource neutral as the single course will have slightly lower enrollment each semester than the separate courses. This loss of SCH is offset in part by an increase in Technical Elective requirements so the SCH's should largely remain within the College of Engineering.

A second issue associated with resource requirements is student retention. The ChBE faculty are concerned that the single course will have a higher DWF rate than the two separate courses simply because more material will be covered in a single semester. This concern is mitigated by two factors: (1) most universities teach the material as a single course (and one of the current instructors taught the combined course at another university) without an excessively high DWF rate, and (2) students that are unsuccessful on their first attempt will have an immediate opportunity the following semester to pass the class instead of having to wait a full year. The current 1 year wait to retake ECHM 215 is a significant factor in retention as students are unwilling to wait a full year. If the single, combined course does have a significant impact on retention, the ChBE department will return to the current two course model.
Syllabus

Day/Time and Room:  TTh 1:40 - 2:55pm, Reid 108
Instructor: Jeff Heys
Office Hours:  T 10:00a - 11:30a, Th 12:00-1:00p (or by appointment)
Office: COBH 310
Phone: 406-994-7902
E-mail: jeff.heys@gmail.com

Course Description: Material and Energy balance calculations applied to industrial processes. Analysis of gas behavior and multiphase systems.

ABET Outcomes:
- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to identify, formulate, and solve engineering problems.

Learning Outcomes: The material and problem solving skills covered in this course form a foundation of knowledge that will be used in all future Chemical and Biological Engineering courses. At the end of this course, students will be able to:

1. Interpret a written description of a chemical process and generate a flowsheet that represents the written description,

2. Demonstrate the principles of species accounting as they pertain to mass and energy balances,

3. Perform vapor-liquid equilibrium calculations for systems containing one condensable component and for ideal multicomponent solutions,

4. Calculate internal energy and enthalpy changes for process fluids undergoing specified changes in temperature, pressure and phase as well as mixing and chemical reactions and incorporate the results of these calculations into process material and energy balance calculations, and

5. Critically evaluate the soundness of a design.

Prerequisites: CHMY 141 (one semester of general chemistry), M 171 (first semester of calculus)


Course Web Page: http://www.coe.montana.edu/jeffrey.heys/web215 (must be checked weekly at a minimum, lecture password is ‘felder’)

Grading: The final grade will be computed as follows:
Homework: 10%
Quizzes: 10% (typically, one per week)
Project: 10%
Midterm Exams (2): 20% each
Final Exam: 30%
While class participation is not a requirement, it is encouraged; it may help with borderline grades.
Homework:
- There will be approximately 10 homework assignments throughout the semester (there are 15 weeks in the semester). Homework will be due at the beginning of class, and late homework will not be accepted.
- You are allowed and encouraged to work together on homework. However, you should write up your own unique solutions.
- Each homework assignment is worth 10 points, and points will be awarded based on the fraction of the assignment that is completed. The accuracy of the work will NOT be graded. An incorrect solution will still receive full credit as long as it is a reasonable attempt.
- Students that turn in problem solutions that are exact or nearly exact reproductions of the problem solutions in the solution manual will not receive any points on that homework assignment.

Homework Format:
- It is absolutely essential that you be able to communicate clearly and write neatly if you plan to work as a professional engineer.
- Problems should generally be started on a new page, but you may have multiple problems on a page if the problem is very short (i.e., less than 0.5 pages).
- Do not write on the back of the paper.
- Any diagrams or pictures should be neatly drawn and clearly labeled.
- Your solution should be easy to follow from the first line to the last – do not put calculations off to the side!
- Box your answers — no box = no answer = no points
- If you turn in unreadable, messy, unclear, unreadable homework I will return it ungraded. Of course, if you turned that stuff in to your boss you would be downsized.
- The homework pages must be attached to one another, preferably with a staple.

Quizzes:
- Quizzes will be one problem, which is either identical or similar to a homework problem, given near the end of class.
- Normally, 15 minutes will be provided for completing the quiz. Quizzes will be closed book and closed notes. You should only have a calculator and pen/pencil on your desk.
- Quizzes will be graded on a 10 point scale.
- I anticipate giving a total of 10 quizzes throughout the semester.
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 Rubric, Course Number, and Core Designation (if any)

> ECHM 201

2. Course Title

> Elementary Principles of Chemical and Biological Engineering

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.

> The Chemical Engineering program currently has 2 courses – ECHM 215 and 216 that cover material balances (ECHM 215) and energy balances (ECHM 216) separately. Teaching this material over 2 classes is not common. Approximately 80% of Chemical Engineering programs teach this material as a single course. We are proposing to move to this more common model and offer ECHM 201, which covers both material and energy balances in a single course, and discontinue offering both ECHM 215 and ECHM 216. A second advantage is related to growth in the Chemical Engineering program. This program has grown from approximately 55 students in ECHM 215 in 2008 to approximately 150 students this year. By combining two courses into a single course, we can then offer the new course twice per year (once each semester) and reduce the size of the class. By offering ECHM 201 twice per year, students have more flexibility with their schedules and a significant bottleneck in our program will be eliminated; in the past, if a student failed ECHM 215, they had to wait until the following year to reattempt the course. Much of the material in ECHM 216 will be condensed to fit in the one semester 3 credit format. The subject material formerly covered by ECHM 216 that is not covered in depth by the new ECHM 201 course will be covered as a component of a subsequent required course, ECHM 307, Chemical Engineering Thermodynamics I.

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

> Grades will be determined by: homework (10%), quizzes (10%), project (10%), 2 midterm exams (20% each) and a final (30%).

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.
> Material Balances:
  Single unit systems
  Multiple unit systems
  Processes with reactions

Single phase systems:
  Solids
  Liquids
  Ideal gases
  Nonideal gases

Multiphase systems:
  Gas-liquid systems
  Solid-liquid systems
  Liquid-liquid systems

Energy Balances:
  Temperature changes
  Phases changes
  Systems with reactions

6. List required texts or other required references.


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

\[ 160 \times 3 = 480 \]

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?

> No cap is anticipated. In fact, this course is being implemented, in part, to avoid space limitations in an existing course.

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

> No

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?)

> This course is simply a combination of two existing courses, and will be evaluated in the same way as the previous courses. The Chemical and Biological Engineering faculty evaluate each course once every three years. The course content is presented by the instructor to all faculty members, and the instructor answers questions about course content. Further, the ABET outcomes are assessed by peer faculty members and the department's advisory committee through the examination of samples of student work once every three years.
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.

> Yes

**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?

> No, but the content has been offered under the ECHM 215 and 216 rubrics.

13. Justify the level of course offering.

> It is a foundational course in the Chemical Engineering program that builds on the student’s knowledge of chemistry (CHMY 141) and math (M 171) and precedes more specific content on thermodynamics (ECHM 307), heat transfer (ECHM 322), fluid dynamics (ECHM 321), and separations (ECHM 323).

**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?

> Yes, this course ‘lays the foundation’ for understanding more complex and specific material on thermodynamics (ECHM 307) heat transfer (ECHM 322), fluid dynamics (ECHM 321), and separations (ECHM 323).

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.

> No, but it does replicate a pair of previous courses (ECHM 215 and 216) that it is replacing.

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 course is likely to only be taken by students in Chemical and Biological Engineering.

17. If this proposed course has a significant interdisciplinary component, please explain briefly. Otherwise, indicate n/a.
> Only to the extent that the content covers topics in both Chemical Engineering and Biological Engineering.

**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.

> Majors primarily, but there are occasionally non-majors considering a major in Chemical or Biological Engineering.

**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, online access requirements)? Will there be an additional fee charged to students taking this course? Please explain.

> The course should not require any additional resources as it is replacing two existing courses that were offered once per year. The instructors of the two semester series (ECHM 215 and ECHM 216) will be responsible for teaching the course as a part of their regularly assigned instructional obligations.

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 (x6549 Collection Development) at least three months prior to the beginning of the semester in which this course will be taught.

> None

**Other Supporting Material**

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

> The proposal that was approved by the CHBE faculty is available upon request and provides more information regarding the pros and cons of this change.
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>T Aug 26</td>
<td>Basic Concepts</td>
<td>1.0 - 2.8</td>
</tr>
<tr>
<td>Th Aug 28</td>
<td>Process Variables</td>
<td>3.0 - 3.6</td>
</tr>
<tr>
<td>T Sept 2</td>
<td>Balances</td>
<td>4.0 - 4.3</td>
</tr>
<tr>
<td>Th Sept 4</td>
<td>Multiple Units</td>
<td>4.4 - 4.5</td>
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<td>T Sept 9</td>
<td>Stoichiometry</td>
<td>4.6</td>
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<td>Th Sept 11</td>
<td>Atom Balances</td>
<td>4.7</td>
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<td>T Sept 16</td>
<td>Combustion</td>
<td>4.8 - 4.9</td>
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<td>Th Sept 18</td>
<td>Phases</td>
<td>5.0 - 5.2</td>
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<td>T Sept 23</td>
<td>Non-Ideal Gases</td>
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<td>Compressibility Factor</td>
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<td>T Sept 30</td>
<td>Review</td>
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<td>Th Oct 2</td>
<td>Midterm #1</td>
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<td>T Oct 7</td>
<td>Equilibrium</td>
<td>6.0 - 6.2</td>
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<td>Th Oct 9</td>
<td>Gas-Liquid systems</td>
<td>6.3 - 6.4</td>
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<td>T Oct 14</td>
<td>Solid-Liquid systems</td>
<td>6.5, 6.7</td>
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<td>Th Oct 16</td>
<td>Liquid-Liquid systems</td>
<td>6.6</td>
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<td>T Oct 21</td>
<td>Forms of Energy</td>
<td>7.0 - 7.2</td>
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<td>Th Oct 23</td>
<td>Closed/Open Systems</td>
<td>7.3 - 7.4</td>
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<td>T Oct 28</td>
<td>Data Tables</td>
<td>7.5 - 7.8</td>
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<td>Th Oct 30</td>
<td>ΔP, constant T</td>
<td>8.0 - 8.2</td>
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<tr>
<td>T Nov 4</td>
<td>No Class (Election Day)</td>
<td></td>
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<tr>
<td>Th Nov 6</td>
<td>ΔT</td>
<td>8.3</td>
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<td>T Nov 11</td>
<td>No Class (Veterans Day)</td>
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<tr>
<td>Th Nov 13</td>
<td>Phase Change and Mixing</td>
<td>8.4 - 8.5</td>
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<tr>
<td>T Nov 18</td>
<td>Review</td>
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<td>Th Nov 20</td>
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<td>T Nov 25</td>
<td>Heats of Reaction</td>
<td>9.0-9.3</td>
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<td>Th Nov 27</td>
<td>No Class (Thanksgiving)</td>
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<td>T Dec 2</td>
<td>Formation Reactions</td>
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<td>Th Dec 4</td>
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<td>9.5-9.7</td>
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<tr>
<td>T Dec 9</td>
<td>FINAL EXAM</td>
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