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):

EMAT 462

Course Title: Manufacturing of Composites
Abbreviated Course Title (≤ 30 chars):
First Semester to be Offered: Fall 2014
Submitted by: David Miller
dmiller@me.montana.edu
Instructor: David Miller
Department: Mechanical and Industrial Engineering
College: Manufacturing of Composites

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

12/5/2013
David Miller
Submitter

10/31/13
Department Head

11/21/2013
Chair, College Curriculum Comm.

11/25/2013
Dean

Notes: 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):
Course Title:
Abbrev. Course Title (≤ 30 char):
Credits:
Department Offering Course:
College:

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

Learning Outcomes for the Course:

EMAT 462
Manufacturing of Composites
Manufacturing of Composites
Mechanical and Industrial Engineering
Engineering

Through completion of this course students will:

• develop skills and technical expertise in the breadth of composite manufacturing techniques and technologies
• develop an understanding between composite manufacturing processes and composite structural performance
• gain hands-on experience in a laboratory environment demonstrating common fabrication methods
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):

Course Title (for Catalog): EMAT 462

Manufacturing of Composites

Course Title (for Schedule of Classes, 30 characters, max.):

Fall 2014

First Semester to be Offered: Fall

Restricted Entry/Consent of Instructor Required: [No]

Instructor's GID (last 4 digits only): 494

Department Offering Course: Mechanical and Industrial Engineering

College: Engineering

Is the requested course number available? [Yes]

Frequency of course offering: [Alternate Years, starting Fall]

Semester(s) offered (check all that apply): [Fall]

Summer Options (check all that apply): [First 6 weeks]

Credits by mode of instruction:

Lecture: 2

Seminar: 3

Independent Study: 1

Lab/Studio: 1

Recitation/Discussion: 1

TOTAL CREDITS: 3

Primary Mode(s) of Delivery: [Face-to-face]

On-Line Only [No]

Web-Enhanced (small on-line comp.) [No]

Blended (significant on-line portion) [No]

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

Assigned Day(s): M

Assigned Time(s): Tu

Assigned Building: W

Assigned Room: Th

Capacity (room capacity, or enrollment “cap”): 24

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):

EMEC 341, 320, and 303 or ETME 310, 203, and EGEN 324

Co-Requisite(s):

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

This course will examine the fundamentals of composite manufacturing, focusing on fiber reinforced plastics. Techniques such as open moulding, resin transfer moulding, pultrusion, and filament winding will be covered.
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.

EMAT 462, Manufacturing of Composites, is being offered as a professional elective course to Mechanical Engineering and Mechanical Engineering Technology Students. The Mechanical Engineering Department has seen record increases in enrollment over the past several years. This course will allow us to expand our offerings to upper division students by offering them a course relevant to composite manufacturing, with hands on opportunities to develop technical expertise. The lab section will be taught in existing space and Dr. Miller's faculty teaching load will be balanced accordingly to allow for this course.

New courses are necessary to meet the demands of our growing student body for relevant coursework with sections open to them to allow for timely degree progression. The increased enrollment has allowed us to add extra faculty to help to meet this demand.
New Undergraduate Course Narrative
Montana State University

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)

EMAT 462

2. Course Title

Manufacturing of Composites

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.

Presently, students at MSU-Bozeman have the opportunity to take two courses (1 undergrad and 1 graduate) related to composites. Both of these courses are theoretical in application, and focus primarily on the solid mechanics aspects of composite materials. The rationale for a new course is to provide students with additional knowledge in the field of composites that will increase their marketability to prospective employers. Additionally, training engineers with composite manufacturing skill sets has the ability to create a local Montana workforce in composite manufacturing.

The inclusion of a laboratory component with this course has 3 motivations: (1) to take advantage of department composite technology workspaces and leverage research experience to expand educational assets, (2) to increase student’s manufacturing skill set to provide support for build requirements in Senior Capstone projects, and (3) to develop students and facilities to support research endeavors across the university. Multiple student competitions (e.g., Formula SAE, SAE Aero, Lunabotics, and ASME- Human Powered Vehicle) and campus research (SSEL, Composite Technologies Research Group) groups could reap benefits from the implementation of this course. Courses currently offered in the MET program (Design for Manufacturing and Tooling, Machining and Industrial Safety, CNC & CAM Technology and Fluid Power Technology) could support the long-term laboratory development for this new course. In turn, this new course could share laboratory platforms with the existing courses, thus integrating this important topic throughout the curriculum more effectively.

The Student Outcomes of this course are:

- develop skills and technical expertise in the breadth of composite manufacturing techniques and technologies
• develop an understanding between composite manufacturing processes and composite structural performance
• gain hands-on experience in a laboratory environment demonstrating common fabrication methods

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

Grades will be determined through evaluation of homework, tests and laboratory exercises.

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.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Composites; overview of composite forms; applications: This material will acquaint students with the breadth and scope of composites, terminology used for the duration of the semester, and the depth of knowledge required for precise composite manufacturing</td>
</tr>
<tr>
<td>2</td>
<td>Materials: Matrix and fiber forms This material will introduce students to the types of matrix materials, ranging from polymers, metals and ceramics, and different fiber materials and forms.</td>
</tr>
<tr>
<td>3</td>
<td>Materials: Matrix and fiber forms</td>
</tr>
<tr>
<td>4</td>
<td>Open Molding Methodologies and applications</td>
</tr>
<tr>
<td>5</td>
<td>Compression molding</td>
</tr>
<tr>
<td>6</td>
<td>Resin Infusion Techniques</td>
</tr>
<tr>
<td>7</td>
<td>Filament winding Techniques and Applications</td>
</tr>
<tr>
<td>8</td>
<td>Pultrusion of composite structures</td>
</tr>
<tr>
<td>9</td>
<td>Sandwich Structures and Joints</td>
</tr>
<tr>
<td>10</td>
<td>Thermoplastics</td>
</tr>
<tr>
<td>11</td>
<td>Damage Repair and tolerance</td>
</tr>
<tr>
<td>12</td>
<td>Composite Quality Metrics and Testing</td>
</tr>
<tr>
<td>13</td>
<td>Composite design</td>
</tr>
<tr>
<td>14-15</td>
<td>2 weeks for tests and expansion of material</td>
</tr>
</tbody>
</table>

6. List required texts or other required references.

Fundamentals of Composites Manufacturing, 2nd ed., Brent Strong
7. What are the estimated enrollment and student credit hour (SCH) production?  
[SCH = (enrollment * credits)]

It is estimated that with a cap of 24 students and an offering rate of alternate years, the SCH would be 72 per year.

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?

Yes. The enrollment cap will be 24 students in an initial offering. The course will be limited by the laboratory capacity (12 students/section). The department does not currently have the space to house a large composites fabrication facility.

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

No, except through prerequisites. Prerequisites exist before any ME and MET student can take Professional Electives.

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?)

Course outcomes will be measured through student performance in homework, exams and laboratory exercises. As a department, course success will be measured through faculty course evaluations, which occur on a 3-year rotation. Each ME/MET course is evaluated by the faculty on a 3-year cycle. Student evaluations, both mid-semester and end-of-semester, will be reviewed as a means to monitor student engagement and to support the continuous improvement philosophy.

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, Associate Professor of Mechanical Engineering

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.

13. Justify the level of course offering.

This course will be a professional elective in the Mechanical Engineering and Mechanical Engineering Technology curriculums. The background material for this course will require junior level knowledge and skill sets; therefore, a 400 level course is the appropriate level for the offering.
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?

This course will be directly related with two courses in the Mechanical Engineering curriculum and complimentary with several others. Presently, students at MSU-Bozeman have the opportunity to take two courses (1 undergrad and 1 graduate) related to composites. Both of these courses are theoretical in application, and focus primarily on the solid mechanics aspects of composite materials. The proposed course is designed such that the material presented will remain independent yet complementary with the present courses. Therefore, a student could take the current courses and the proposed course in no particular order. Complementary courses currently offered in the MET program (Design for Manufacturing and Tooling, Machining and Industrial Safety, CNC & CAM Technology and Fluid Power Technology) could support the long-term laboratory development for this new course.

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, other than those already mentioned. The ME and MET programs reside in the same department. The appropriate discussions and coordination have occurred.

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 3000, 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.

No programs would be impacted. This course would simply provide another elective option for ME/MET students.

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.
This course could serve other majors outside ME/MET. Other engineering majors, and perhaps physics majors, could possibly be interested in this course in the future. However, due to class size limits it will first be offered to ME and MET students exclusively.

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 largest impact on resources from this course will be a required laboratory space requirement. For this course to be truly successful and expandable, a dedicated lab space will be required at a point in the future. For the current implementation, this lab space will be located in current research lab space. No additional requirements will be placed on the students.

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.