New Course Request

Indiana University

Indianapolis Campus

Check Appropriate Boxes: Undergraduate credit [✓] Graduate credit [ ] Professional credit [ ]

1. School/Division: School of Engineering and Technology

2. Academic Subject Code: MET

3. Course Number: 338 NO (must be cleared with University Enrollment Services)

4. Instructor: K. Rennels

5. Course Title: Manufacturing Processes

Recommended Abbreviation (Optional): (Limited to 50 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Fall 2009

7. Credit Hours: Fixed at __4__ or Variable from __________ to __________

8. Is this course to be graded S-F (only)? Yes No [✓]

9. Is variable title approval being requested? Yes No [✓]

10. Course description (not to exceed 50 words) for Bulletin publication:
P: MATH 154 Algebra and Trigonometry II, C: MET 348 Engineering Materials or equivalent. Course covers basic fabrication and material removal manufacturing processes. Areas include casting, forging, material joining, forming, basic metal removal mechanisms, automated manufacturing processes, dimensional metrology for quality control and manufacturing process planning. The course emphasizes the selection and application of the various manufacturing processes

11. Lecture Contact Hours: Fixed at __3__ or Variable from __________ to __________

12. Non-Lecture Contact Hours: Fixed at __2__ or Variable from __________ to __________

13. Estimated enrollment: __25__ of which __0__ percent are expected to be graduate students.

14. Frequency of scheduling: Fall and Spring Will this course be required for majors? Yes

15. Justification for new course: Covers important subject matter for major and is a combination of two existing courses.

16. Are the necessary reading materials currently available in the appropriate library? Yes

17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.

18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant.

19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by:

[Signature]

Date 9-29-09

Department Chairman/Division Director

Approved by:

[Signature]

Date 9-29-09

Dean

[Signature]

Date

Chancellor/Vice-President

[Signature]

Date

University Enrollment Services

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

UPS 724 University Enrollment Services Final—White; Chancellor/Vice-President—Blue; School/Division—Yellow;
Department/Division—Pink; University Enrollment Services Advance—White
MET 338 – Manufacturing Processes

Required Course: Yes

Catalog Description: Credit (4): Class (3) Lab (2)
Course covers basic fabrication and material removal manufacturing processes. Areas studied include casting, forging, material joining, forming, basic metal removal mechanisms, automated manufacturing processes, dimensional metrology for quality control and manufacturing process planning. The course emphasizes the selection and application of the various manufacturing processes.

Prerequisite: MATH 154 Algebra and Trigonometry II

Co-requisite: MET 348 Engineering Materials or equivalent


Coordinator: Kenneth Rennels, P.E., Associate Professor of Mechanical Engineering Technology

Goals:

1. To give the students a functional understanding of the casting, joining, and forming processes used to produce products from engineering materials.

2. To give students a basic understanding of the wide variety of material removal processes used to convert materials into finished products.

3. To introduce students to the basic fabrication and material removal equipment used in industry.

4. To give the students firsthand experience in preparing for and performing many of the basic manufacturing operations.

5. To give students respect and understanding of the power and danger associated with manufacturing equipment and have them recognize the need for safety at all times.

6. To provide a basic understanding of how to determine the logical sequence of operations for a machining project and provide basic cost estimating for these operations.

7. To give the students a basic understanding of the selection criteria used for these processes during the design/production stages of a product.

8. To provide a basic understanding of how materials properties affect the selection of primary processes for manufacturing.
Course Outcomes: After completion of this course, the students should be able to:

Lecture Outcomes

1. Identify welding processes by their AWS designation. [a]
2. Describe the term HAZ in welding and relate this to the heat input of a welding process. [a]
3. Explain the benefits and identify common applications for a given joining process. [b]
4. Recognize the different joining mechanisms utilized in the various joining operations. [a]
5. Distinguish between hot-working and cold-working processes. [b]
6. List some advantages and disadvantages of various common forming operations. [b]
7. Identify dependent and independent process variables and their relationships. [a]
8. Explain the benefits and identify common applications for a given forming process. [b]
9. Describe the difference between expendable and permanent mold casting processes. [a]
10. Explain the benefits and identify common applications for a given casting process. [b]
11. List some advantages and disadvantages of various common casting processes. [a]
12. Identify the steps involved in producing powder metal parts. [a]
13. Recognize the potential safety hazards of a given manufacturing process. [a]
14. Understand the need for safety in the workplace. [a]
15. Appreciate the diversity and complexity of all the available manufacturing processes. [a]
16. Identify potential limitations of a given manufacturing process. [b]
17. Select potential manufacturing processes suitable for making a specific product and explain. [b]
18. Recognize the complexity of goods produced in the world today. [a]
19. Work as a team to investigate topics, write reports, and make presentations on a specified manufacturing topic. [e, g]
20. Provide accurate part measurements using basic metrology equipment. [a]
21. Recognize the need for standardization, quality, precision, and accuracy in manufacturing processes and provide examples of products where this is currently being implemented. [b]
22. Calculate speeds, feeds, depth of cut, material removal rate (MRR), cutting forces, and horsepower (hp) requirements for material removal processes covered in course. [f]
23. Recognize the impact that changing speeds, feeds, or depth of cut has on the MRR, cutting forces, hp requirements, and the life of the cutting tools. [b]
24. Identify advantages, disadvantages, and limitations of the various material removal processes. [a]
25. Recognize machine tools, cutting tools, and workholding devices used in the various material removal processes. [a]
26. Understand the evolution of automation in material removal processes and how new technology impacts the industry. [k]
27. Calculate tool paths and develop G/M code for simple NC milling operations. [b]
28. Identify safe and unsafe operation of basic material removal machine tools. [a]
29. Develop a machining operation sequence for a specified part. [b]
30. Provide basic cost estimation for material removal operations. [b]

31. Work as a team to investigate topics, write reports, and make presentations on a specified material removal topic. [e,g]

**Laboratory Outcomes**

1. Utilize equipment, similar to small industrial settings, to process materials using casting, forming, and joining operations. [a]
2. Identify the importance and need for safety and awareness in processing materials. [a]
3. Recognize the advantages and limitations of various manufacturing processes through hands-on experimentation. [c]
4. Develop a better understanding of the concepts presented in lecture through hands-on experimentation. [c]
5. Utilize basic metrology equipment to collect and analyze data on measurements. [k]
6. Utilize various machine tools to produce manufactured parts of within specification. [a]
7. Identify the importance of and need for safety at all times while in the presence of machine tools. [a]
8. Present data in a concise, readable, and professional format. [g]
9. Develop a better understanding of the concepts presented in lecture through hands-on experimentation. [c]
10. Work with machine tools in a team environment for the completion of laboratory projects. [e]

*Note: The letters within the brackets indicate the program outcomes of MET program.*

**Topics:**

<table>
<thead>
<tr>
<th>#Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction to Metrology, Safety and Workholding</td>
</tr>
<tr>
<td>2. Joining Processes</td>
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<tr>
<td>3. Forming Processes</td>
</tr>
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<td>4. Casting Processes</td>
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<td>5. Metal Cutting Theory and Cutting Tools</td>
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<td>6. Turning and Boring Processes</td>
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<td>7. Drilling and Reaming Processes</td>
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<td>8. Milling, Broaching, Sawing, Filing Processes</td>
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<td>9. Numerical Control and Machining Centers</td>
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<td>10. Abrasive Machining</td>
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<td>11. Gear and Thread Manufacture</td>
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<tr>
<td>12. Non-traditional machining and Automation</td>
</tr>
</tbody>
</table>

**Laboratory Experiments:**

1. Dimensional metrology.
2. Creation of welds using SMAW.
3. Creation of welds using OAW.
4. Induction melting and pouring for sand and lost foam casting.
5. Forming steel using forging, bending and shearing processes.
6. Component machining using turning processes.
8. Component machining using hole and thread generation processes.

**Computer Usage:** Word processors, spreadsheets, and metal cutting analysis software.
Laboratory reports are to be submitted in word-processor form including spreadsheets and graphs for data representation.

**Evaluation Methods:** Homework, Lab Projects, Lab Reports, Exams, Quizzes

**Prepared by:** Ken Rennels, P.E.

**Revised:** February 20, 2009
Course Outcomes and Assessment Data Sheet – Procedure

This is an internal document to identify and record expected outcomes and anticipated assessment strategies for all courses taught within the School of Engineering and Technology. Submission of this form, as noted below, is required and must accompany all new course and course change requests. Copies of this form should also be retained within the department and kept on file with the outline or syllabus for each course.

1. First, identify all instructional outcomes expected for this course, and then select all ABET outcomes which are consistent with those anticipated objectives from the table below:

<table>
<thead>
<tr>
<th>TAC/ABET Outcomes Criteria 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>An engineering technology program must demonstrate that graduates have:</td>
</tr>
<tr>
<td>a</td>
</tr>
<tr>
<td>b</td>
</tr>
<tr>
<td>c</td>
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<tr>
<td>d</td>
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<td>i</td>
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<tr>
<td>j</td>
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<tr>
<td>k</td>
</tr>
</tbody>
</table>

2. Subsets for each of the six IUPUI Principles of Undergraduate Learning (PUL) are given on the reverse side table. Using a number corresponding to each ABET outcome identified from the table above to select a column, place an "X" in the applicable cell(s) for each PUL. Courses will often address multiple ABET outcomes and ABET outcomes frequently will overlap more than one PUL subset. Thus, it is expected completed data sheets may contain marks in several cells thereby indicating the course simultaneously satisfies multiple Principles of Undergraduate Learning which fulfilling its intended ABET objectives(s).

3. After completing the table, briefly define or explain how the course outcomes or objectives will be evaluated within the context of the departmental assessment program in the space below:

Assessment methods will include:

- Evaluation of specific examination questions which are mapped to the course outcomes.
- Evaluation of laboratory report analysis problems which are mapped to the course outcomes.

Prepared by: Ken Rennels
Date: February 20, 2009
### Course: MET 338  
**Course Title:** Manufacturing Processes

#### PRINCIPLES OF UNDERGRADUATE LEARNING

*Require All Students to Demonstrate An Ability to:*

<table>
<thead>
<tr>
<th>1(a) - Express ideas and facts effectively in written formats</th>
<th>TECHNOLOGY OUTCOMES - TAC CRITERIA #2; items (a) to (k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(b) - Comprehend, interpret, and analyze texts</td>
<td></td>
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<tr>
<td>1(c) - Communicate orally in one-on-one and group settings</td>
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<tr>
<td>1(d) - Solve problems that are quantitative in nature</td>
<td></td>
</tr>
<tr>
<td>1(e) - Make efficient use of information resources and technology for personal and professional needs</td>
<td></td>
</tr>
</tbody>
</table>

| 2(a) - Analyze complex issues and make informed decisions      |
| 2(b) - Synthesize information in order to arrive at reasoned conclusions |
| 2(c) - Evaluate the logic, validity, and relevance of data    |
| 2(d) - Solve challenging problems                             |
| 2(e) - Use knowledge and understanding to generate and explore new questions |

| 3(a) - Apply knowledge to enhance personal lives              |
| 3(b) - Apply knowledge to meet professional standards and competencies |
| 3(c) - Apply knowledge to further the goals of society       |

| 4(a) - Display substantial knowledge and understanding of at least one field of study |
| 4(b) - Compare and contrast approaches to knowledge in different disciplines |
| 4(c) - Modify their approach to an issue or problem based on contexts and requirements of particular situations |

| 5(a) - Compare and contrast the range of diversity and universality in human history, societies, and ways of life |
| 5(b) - Analyze and understand the interconnectedness of global and local concerns |
| 5(c) - Operate with civility in a complex social world |

| 6(a) - Make informed and principled choices regarding conflicting situations in their personal and public lives and to foresee the consequences these choices |
| 6(b) - Recognize the importance of aesthetics in their personal lives and to society |
PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF AN UNDERGRADUATE COURSE
(10000-40000 LEVEL)

DEPARTMENT: Engineering Technology  EFFECTIVE SESSION: Fall 2009

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

☐ 1. New course with supporting documents
☐ 2. Add existing course offered at another campus
☐ 3. Expiration of a course
☐ 4. Change in course number
☐ 5. Change in course title
☐ 6. Change in course, credit/type
☐ 7. Change in course attributes (department head signature only)
☐ 8. Change in instructional hours
☐ 9. Change in course description
☐ 10. Change in course requisites
☐ 11. Change in semesters offered (department head signature only)
☐ 12. Transfer from one department to another

PROPOSED:

Subject Abbreviation: MET
Course Number: 338
Long Title: Manufacturing Processes
Short Title:

Existing:

Subject Abbreviation:
Course Number:

TERMS OFFERED:
Check All That Apply:
☐ Summer
☐ Fall
☐ Spring

CAMPUS(ES) INVOLVED:

☐ Calumet
☐ Cont Ed
☐ Tech Statewide
☐ Ft. Wayne
☐ W. Lafayette
☐ Indianapolis

Abbreviated Title will be entered by the Office of the Registrar. (32 CHARACTERS ONLY)

CREDIT TYPE
1. Fixed Credit Cr. Hrs.:
2. Variable Credit Range:
Minimum Cr. Hrs (Check One):
To  Or  
Maximum Cr. Hrs:
3. Equivalent Credit:
Yes ☐ No ☐

COURSE ATTRIBUTES: Check All That Apply
1. Pass/No Pass Only
2. Satisfactory/Unsatisfactory Only
3. Repeatable
4. Credit by Examination
5. Special Fees
6. Registration Approval Type
7. Variable Title
8. Honors
9. Full Time Privilege
10. Off Campus Experience

Schedule Type

<table>
<thead>
<tr>
<th>Lecture</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replcat</td>
<td>2</td>
</tr>
<tr>
<td>Present</td>
<td>100</td>
</tr>
<tr>
<td>Labora</td>
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</tr>
<tr>
<td>Lab Prep</td>
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</tr>
<tr>
<td>Studio</td>
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<tr>
<td>Distance</td>
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</tr>
<tr>
<td>Clinic</td>
<td>15</td>
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<tr>
<td>Experien</td>
<td>25</td>
</tr>
<tr>
<td>Resarch</td>
<td>1</td>
</tr>
<tr>
<td>Ind. Stud</td>
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</tr>
<tr>
<td>Res/Obsv</td>
<td>1</td>
</tr>
</tbody>
</table>

% of Credit

| 75% |

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):
P: MATH 154 Algebra and Trigonometry II, C: MET 348 Engineering Materials or equivalent. Course covers basic fabrication and material removal manufacturing processes. Areas studied include casting, forging, material joining, forming, basic metal removal mechanisms, automated manufacturing processes, dimensional metrology for quality control and manufacturing process planning. The course emphasizes the selection and application of the various manufacturing processes.

Calumet Department Head  Date  Calumet School Dean  Date

Ft. Wayne Department Head  Date  Ft. Wayne School Dean  Date

Indy Department Head  Date  Indianapolis School Dean  Date

North Central Department Head  Date  North Central Chancellor  Date

West Lafayette Department Head  Date  West Lafayette College/School Dean  Date  West Lafayette Registrar  Date

OFFICE OF THE REGISTRAR