

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 90 (must be cleared with University Enrollment Services) 4. Instructor K. Rennels
5. Course Title Manufacturing Processes

Recommended Abbreviation (Optional) _____
(Limited to 32 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

Date _____
Dean of Graduate School (when required)

Date _____
Chancellor/Vice-President

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.

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

Textbook: Black and Kohser. (2008). Materials and Processes in Manufacturing, 10th Edition. J. Wiley Publishers, New York, NY.

Workman J., Rennels K., Huerkamp J. (2009). MET 338, Manufacturing Processes, Laboratory Manual.

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:

#Lectures:

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

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.
7. Component machining using manual and CNC milling processes.
8. Component machining using hole and thread generation processes.
9. Component machining using abrasive 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:

TAC/ABET Outcomes Criteria 2

An engineering technology program must demonstrate that graduates have:	
a	an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines,
b	an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology,
c	an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes,
d	an ability to apply creativity in the design of systems, components or processes appropriate to program objectives,
e	an ability to function effectively on teams,
f	an ability to identify, analyze and solve technical problems,
g	an ability to communicate effectively,
h	a recognition of the need for, and an ability to engage in lifelong learning,
i	an ability to understand professional, ethical and social responsibilities,
j	a respect for diversity and a knowledge of contemporary professional, societal and global issues, and
k	a commitment to quality, timeliness, and continuous improvement.

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

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.

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

PROPOSED: Subject Abbreviation <u>MET</u> Course Number <u>338</u> Long Title <u>Manufacturing Processes</u> Short Title _____ <small>Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY)</small>	EXISTING: Subject Abbreviation _____ Course Number _____	TERMS OFFERED Check All That Apply: <input type="checkbox"/> Summer <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring CAMPUS(ES) INVOLVED <input type="checkbox"/> Calumet <input type="checkbox"/> N. Central <input type="checkbox"/> Cont Ed <input type="checkbox"/> Tech Statewide <input type="checkbox"/> Ft. Wayne <input type="checkbox"/> W. Lafayette <input checked="" type="checkbox"/> Indianapolis
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CREDIT TYPE 1. Fixed Credit: Cr. Hrs. <u>4</u> 2. Variable Credit Range: _____ Minimum Cr. Hrs _____ (Check One) To <input type="checkbox"/> Or <input type="checkbox"/> Maximum Cr. Hrs _____ 3. Equivalent Credit: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	COURSE ATTRIBUTES: Check All That Apply 1. Pass/Not Pass Only <input type="checkbox"/> 2. Satisfactory/Unsatisfactory Only <input type="checkbox"/> 3. Repeatable <input type="checkbox"/> Maximum Repeatable Credit: _____ 4. Credit by Examination <input type="checkbox"/> 5. Special Fees <input type="checkbox"/> 6. Registration Approval Type <input type="checkbox"/> Department <input checked="" type="checkbox"/> Instructor <input type="checkbox"/> 7. Variable Title <input type="checkbox"/> 8. Honors <input type="checkbox"/> 9. Full Time Privilege <input type="checkbox"/> 10. Off Campus Experience <input type="checkbox"/>
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Schedule Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated	Cross-Listed Courses
Lecture	150	2	15	75%	
Recitation					
Presentation					
Laboratory	100	1	15	25%	
Lab Prep					
Studio					
Distance					
Clinic					
Experiential					
Research					
Ind. Study					
Pract/Observ					

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 _____		
Fort Wayne Department Head _____	Date _____	Fort Wayne School Dean _____	Date _____		
Indianapolis 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 _____