Proposal Form For Addition And Revision Of Courses

1. Proposing College / School: College of Engineering
   Department: Mechanical Engineering

2. Course Prefix and Number: MECH 5270/6270/6276
   3. Effective Term: Fall 2012

4. Course Title: Metalworking and Manufacturing Tribology
   Abbreviated Title (30 characters or less): Metal and Manf. Tribology

5. Requested Action:
   - [ ] Renumber a Course
   - [ ] Add a Course
   - [ ] Revise a Course
   - [ ] Type of Revision:

6. Course Credit:
   Contact/Group Hours: 3
   Scheduled Type (e.g.: Lab, Lecture, Practicum, Directed Study): Lecture
   Weekly or Per Term?: Weekly
   Credit Hours: 3
   Anticipated Enrollment: 45

   Maximum Hours (Repeatability): 3
   Total Credit Hours: 3

7. Grading Type:
   - [ ] Regular (ABCDF)
   - [ ] Satisfactory/Unsatisfactory (S/U)
   - [ ] Audit

8. Prerequisites/Corequisites:
   Use "P:" to indicate a prerequisite, "C:" to indicate a corequisite, and "P/C:" to indicate a prerequisite with concurrency.
   MECH 3210 or Departmental Approval.

9. Restrictions: List specific restriction in space above.
   - [ ] College
   - [ ] Major
   - [ ] Standing
   - [ ] Degree

10. Course Description:
    (20 Words or Less; exactly as it should appear in the Bulletin)
    Theory and optimization techniques for tool life and surface finish considering friction, wear and lubrication in manufacturing processes including both metalworking fluids and hard/dry machining.

11. May Count Either: [ ] or [ ]
    (Indicate if this particular course cannot be counted for credit in addition to another)
    Program Type: [ ] Program Title: [ ] Requirement or Elective? [ ]
    (e.g.: minor, major, etc.) (e.g.: MS in Chemistry, Performance Option, Minor in Art) (required or optional?)
    Major: Mechanical Engineering Elective
    Minor: Tribology Elective

12. Affected Program(s):
    (Respond "N/A" if not included in any program; attach memorandum if more space is required)
    Major: [ ] Minor: [ ]

13. Overlapping or Duplication of Other Units' Offerings:
    (If course is included in any other degree program, is used as an elective frequently by other unit(s), or is in an area similar to that covered by another college/school, attach correspondence with relevant unit)
    - [ ] Applicable
    - [ ] Not Applicable
14. Justification: It will cover in depth the science and engineering of tribology as it relates to manufacturing processes, such as metal working, metal forming, molding, and surface polishing and finishing. This course is important elective for Tribology Minor students and also other engineering students.

(Include a concise, yet adequate rationale for the addition/revision of the course, citing accreditation, assessments (faculty, graduate, and/or external) where applicable)

15. Resources: None - no additional course-load is expected. This course will be added to the schedule of rotating technical electives and graduate courses. If demand increases enough that it needs to be taught more frequently, external funds will be used to purchase faculty time.

(Indicate whether existing resources such as library materials, classroom/laboratory space, and faculty appointments are adequate to support the proposed addition/revision; if additional resources are required, indicate how such needs will be met, referencing the appropriate level of authorization -- i.e.: Dean -- where necessary; if no additional resources or shifting of resources will be necessary, respond "Not Applicable")

16. Student Learning Outcomes: Students will understand the basic concepts of friction, wear, and tool life prediction. They will become familiar with all the modern manufacturing processes used throughout the southeastern United States in the marine, aerospace and automotive industries. Heavy emphasis will be placed on use of dry cutting, hard turning and water based additives as environmentally friendly alternatives to traditional metal working fluids. Students will learn the various predictive models for tool wear and apply them to case studies.

(State in measurable terms (reflective of course level) what students should be able to do when they have completed this course)

17. Course Content Outline: Following Topics are covered (at a minimum).
1. Historical background
2. Literature sources and industrial standards
3. Analysis of Variance (ANOVA) as a decision tool
   a. The "F" Statistic
   b. Analysis of Variance
4. Friction in metalworking
5. Fundamentals of Tribology in metalworking
   a. Real interfaces
   b. Surface Contact and friction theories
   c. Solid-Film lubrication
   d. E.P. Lubrication
   e. Boundary lubrication
   f. Fluid-film lubrication
   g. Mixed-film lubrication
   h. Surface roughness effects
   i. Frictional instabilities
   j. Wear
   k. Material effects
6. Metalworking lubricants
   a. Attributes of lubricants
   b. Mineral Oils
   c. Natural Oils, Fats and derivatives
   d. Synthetic Fluids
   e. Compounded Lubricants
   f. Aqueous Lubricants
   g. Coatings and Carriers
   h. Lubricant Application, Maintenance and Removal
   i. Health Aspects
7. Measurement techniques
   a. Simulation
   b. Force measurements
   c. Interface temperature
   d. Surface characterization
   e. Film thickness
f. Wear measurement
g. Staining property and corrosion
h. Detailed process studies
   a. Cold and hot rolling
   b. Drawing
   c. Extrusion
d. Forging
e. Sheet metalworking
f. Metal removal

(Provide a comprehensive, week-by-week breakdown of course content, including assignment due dates)

18. Assignments / Projects: Undergraduate students will be evaluated based on the following:
   Home works 150 Points
   Weekly Quizzes 150 Points
   Examinations 450 Points
   Team Project 100 Points
   Final Exam 150 Points
   Total Possible Points 1000 Points
   Graduate students will be evaluated based on the following:
   Home works 200 Points
   Weekly Quizzes 100 Points
   Examinations 400 Points
   Team Project 150 Points
   Final Exam 150 Points
   Total Possible Points 1000 Points
   Additional and more advanced problems may be added to the graduate students’ home works, quizzes, exams and projects.

(List all quizzes, projects, reports, activities and other components of the course grade -- including a brief description of each assignment that clarifies its contribution to the course's learning objectives)

19. Rubric and Grading Scale: Course grades will be assigned based upon points obtained in course (10 percent scale)
   => 90% A
   => 80% B
   => 70% C
   => 60% D

(List all components of the course grade -- including attendance and/or participation if relevant -- with point totals for each; indicate point totals and ranges or percentages for grading scale; for S/U grading, detail performance expectations for a passing grade)

20. Justification for Graduate Credit: This course reviews the fundamental concept of sliding friction. It extends this concept to address the different types of wear experienced by all industrial tooling (adhesive wear, abrasive wear, fatigue wear, chemical wear, and mixed wear mechanisms). Students learn how to best optimize their tool life without harming environment and worker.

(Include a brief statement explaining how the course meets graduate educational standards (i.e.: rigorous standards for evaluation, development of critical thinking and analytical skills, etc.))

(Included below are standard statements regarding course policies. If necessary, a statement may be altered to reflect the academic policies of individual faculty members and/or the academic unit or department, provided that there is no conflict with the Tiger Cub, Faculty Handbook, or any existing university policy.)

POLICY STATEMENTS

Attendance: Although attendance is not required, students are expected to attend all classes, and will be held responsible for any content covered in the event of an absence.

Excused Absences: Students are granted excused absences from class for the following reasons: illness of the student or serious illness of a member of the student's immediate family, the death of a member of the student's immediate family, trips for student organizations sponsored by an academic unit, trips for university classes, trips for participation in intercollegiate athletic events, subpoena for a court appearance, and religious holidays. Students who wish to have an excused absence from class for any other reason must contact the instructor in advance of the absence to request permission. The instructor will weigh the merits of the request, and render a decision. When feasible, the student must notify the instructor prior to the occurrence of any excused absences, but in no case shall such notification occur more than one week after the absence. Appropriate documentation for all excused absences is required. Please see the Tiger Cub for more information on excused absences.)
**Make-Up Policy:** Arrangement to make up a missed major examination (e.g.:hour exams, mid-term exams) due to properly authorized excused absences must be initiated by the student within one week of the end of the period of the excused absence(s). Except in unusual circumstances, such as the continued absence of the student or the advent of university holidays, a make-up exam will take place within two weeks of the date that the student initiates arrangements for it. Except in extraordinary circumstances, no make-up exams will be arranged during the last three days before the final exam period begins.

**Academic Honesty Policy:** All portions of the Auburn University student academic honesty code (Title XII) found in the Tiger Cub will apply to university courses. All academic honesty violations or alleged violations of the SGA Code of Laws will be reported to the Office of the Provost, which will then refer the case to the Academic Honesty Committee.

**Disability Accommodations:** Students who need special accommodations in class, as provided for by the Americans With Disabilities Act, should arrange for a confidential meeting with the instructor during office hours in the first week of classes (or as soon as possible if accommodations are needed immediately). The student must bring a copy of their Accommodation Letter and an Instructor Verification Form to the meeting. If the student does not have these forms, they should make an appointment with the Program for Students with Disabilities, 129B Haley Center, 844-2096 (VTT).
1. **Course:** MECH 5270/5276 Metalworking and Manufacturing Tribology  
**Department:** Mechanical Engineering  
**Credit Hours:** 3 hours total – 3 hours lecture, 0 hour lab  
**Designation:** E  
2. **Prerequisites:** MECH 3210  
**Web site:** Course website is maintained on Blackboard  
**Date Prepared:** 11 January 2011 (by Lewis N. Payton)  
3. **Instructor(s):** Lewis N. Payton  
   270 Ross Hall  
   payton@auburn.edu  
   844-3315  
4. **Course Time:** Lecture Tuesdays and Thursdays: 8:00 – 9:15 (Lecture) in Shelby 1126  
   **Textbooks and class materials:**  
   An extensive course package is maintained on Blackboard along with lecture slides and lab handouts.  
5. **Course Description:** “Auburn Bulletin: Metalworking and Manufacturing Tribology.” 3 hours credit (Lecture (3), Lab (0)). Students work in multidisciplinary teams to learn theory and optimization techniques for considering friction, wear and lubrication in manufacturing processes used throughout industry. These processes include actual metalworking lubricants, measurement techniques, casting, rolling, drawing, extrusion, pultrusion, forging, sheet metalworking, metal removal and simulation of the processes listed. This is extended to cover the same processes in ceramics, plastics and composites.  
6. **Course Objectives:** Students will understand the basic concepts of friction, wear, and tool life prediction. They will become familiar with all the modern manufacturing processes used throughout the southeastern United States in the marine, aerospace and automotive industries. Heavy emphasis will be placed on use of dry cutting, hard turning and water based additives as environmentally friendly alternatives to traditional metal working fluids. Students will learn the various predictive models for tool wear and apply them to case studies.  
7. **Course Requirements/Evaluation:** Students will be evaluated based on the following:  
<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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<tbody>
<tr>
<td>Home works</td>
<td>150</td>
</tr>
<tr>
<td>Weekly Quizzes</td>
<td>150</td>
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<tr>
<td>Examinations</td>
<td>450</td>
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<tr>
<td>Team Project</td>
<td>100</td>
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<tr>
<td>Final Exam</td>
<td>150</td>
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<tr>
<td>Total Possible Points</td>
<td>1000</td>
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   Course grades will be assigned based upon points obtained in course (10 percent scale)  
   
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<th>Percentage</th>
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<tr>
<td>=&gt; 90%</td>
<td>A</td>
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<td>=&gt; 80%</td>
<td>B</td>
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<tr>
<td>=&gt; 70%</td>
<td>C</td>
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<tr>
<td>=&gt; 60%</td>
<td>D</td>
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   Student grades are posted continuously on Blackboard throughout the term. You can always calculate your current grade by applying the 10 percent scale to the current points graded for the term.
8. **Class Policy Statements:** Course attendance is recommended, but will not be evaluated as part of the course grade. The University academic honesty policies will be strictly enforced. Students will sign the attached honesty affirmation.

9. **Disabilities:** Any student with a disability needing special accommodation should notify the instructor and contact Dr. Kelly Haynes, Director of the Program for Students with Disabilities, located in 1244 Haley Center.

10. **Topics and Schedule:** All lectures meet for 85 minutes.

Following Topics are covered (at a minimum).

   a. Historical background
   b. Literature sources and industrial standards
   c. Analysis of Variance (ANOVA) as a decision tool
      a. The “F” Statistic
      b. Analysis of Variance
   d. Friction in metalworking
   e. Fundamentals of Tribology in metalworking
      a. Real interfaces
      b. Surface Contact and friction theories
      c. Solid-Film lubrication
      d. E.P. Lubrication
      e. Boundary lubrication
   f. Metalworking lubricants
      a. Attributes of lubricants
      b. Mineral Oils
      c. Natural Oils, Fats and derivatives
      d. Synthetic Fluids
      e. Compound Lubricants
   g. Measurement techniques
      a. Simulation
      b. Force measurements
      c. Interface temperature
      d. Surface characterization
   h. Detailed process studies
      a. Cold and hot rolling
      b. Drawing
      c. Extrusion
   i. Frictional instabilities
   j. Wear
   k. Material effects
   f. Fluid-film lubrication
   g. Mixed-film lubrication
   h. Surface roughness effects
   i. Health Aspects
   j. Wear measurement
   k. Staining property and corrosion
   l. Mixed-film lubrication
   m. Aqueous Lubricants
   n. Coatings and Carriers
   o. Lubricant Application, Maintenance and Removal
   p. Health Aspects
   q. Metal removal
   r. Cold and hot rolling
   s. Drawing
   t. Extrusion
   u. Forging
   v. Sheet metalworking
   w. Metal removal

11. **Contribution to Meeting the Professional Component**

This course reviews the fundamental concept of sliding friction. It extends this concept to address the different types of wear experienced by all industrial tooling (adhesive wear, abrasive wear, fatigue wear, chemical wear, and mixed wear mechanisms). Students learn how to best optimize their tool life without harming environment and worker.

12. **Relationship to Program Outcomes**

This course supports the following ABET outcomes:

   (b) an ability to design and conduct experiments, as well as to analyze and interpret data
   (e) an ability to identify, formulate, and solve engineering problems
   (j) a knowledge of contemporary issues
   (p1) an ability to apply principles of engineering, basic science and mathematics to model, analyze, design and realize physical systems, components or processes.

**Special Accomodations:** Students needing special accommodation will be handled privately between the instructor and the student in accordance with Auburn University policies. Please contact the instructor as early in the course as possible.
Academic Honesty: All portions of the Auburn University student academic honesty code (Title X11) found in the Tiger Cub will apply to this class. All academic honesty violations or alleged violations of the SGA Code of Laws will be reported to the Office of the Provost, which will then refer the case to the Academic Honesty Committee.

Violations include, but are not limited to:

**Cheating on an examination.** This includes such things as copying from another’s paper, using unauthorized notes, calculators, etc., or giving or receiving unauthorized aid, such as trading examinations, whispering answers, passing notes, or using electronic devices to transmit or receive information. This includes cell phones, blue-tooth and/or wireless. Notes stores on a PDA, laptop/pen tablet, calculator or cell phone are also prohibited.

**Plagiarism.** This is using someone else’s work without giving credit. It is, for example, using ideas, phrases, papers, laboratory reports, computer programs, data - copied directly or paraphrased - that you did not arrive at on your own. Sources include published works such as book, movies, web sites, and unpublished works such as other students’ papers or material from a research service. In brief, representing someone else’s work as your own is academically dishonest. The risk of plagiarism can be avoided in written work by clearly indicating, either in footnotes or in the paper itself, the source of any major or unique idea or wording that you did not arrive at on your own. Sources must be given regardless of whether the material is quoted directly or paraphrased.

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**Multiple submission.** This means using the same work to fulfill the academic requirements in more than one course. *Prior permission of the instructors is essential.*

I have read and understand the departmental and university academic honesty policy.

__________________________________________________________

Name, date
MECH 6270/6276 Metalworking and Manufacturing Tribology

1. **Course:** MECH 6270/6276 Metalworking and Manufacturing Tribology  
   **Department:** Mechanical Engineering  
   **Credit Hours:** 3 hours total – 3 hours lecture, 0 hour lab  
   **Designation:** E

2. **Prerequisites:** Graduate student in good standing  
   **Web site:** Course website is maintained on Blackboard  
   **Date Prepared:** 11 January 2011 (by Lewis N. Payton)

3. **Instructor(s):** Lewis N. Payton  
   270 Ross Hall  
   payton@auburn.edu  
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MECH 6270/6276 Metalworking and Manufacturing Tribology

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11. Contribution to Meeting the Professional Component

This course reviews the fundamental concept of sliding friction. It extends this concept to address the different types of wear experienced by all industrial tooling (adhesive wear, abrasive wear, fatigue wear, chemical wear, and mixed wear mechanisms). Students learn how to best optimize their tool life without harming environment and worker. Graduate students will use analysis of variance (ANOVA) to design a masters level thesis project.

12. Relationship to Program Outcomes

This course supports the following ABET outcomes:

(b) an ability to design and conduct experiments, as well as to analyze and interpret data  
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