APPLICATION FOR NEW COURSE

1. Submitted by College of Engineering _______________________________ Date 10/30/03
Department/Division offering course Mechanical Engineering

2. Proposed designation and Bulletin description of this course

   a. Prefix and Number ME 548
   b. Title* Aerodynamics of Turbomachinery

   *NOTE: If the title is longer than 24 characters (including spaces), write
   A sensible title (not exceeding 24 characters) for use on transcripts Aero. of Turbomachinery

   c. Lecture/Discussion hours per week 3
   d. Laboratory hours per week 0

   e. Studio hours per week 0
   f. Credits 3

   g. Course description

   Aerodynamic analysis and design of turbomachines (pumps, compressors and turbines). Blade element performance
   (deflection and losses), and models for performance prediction are present. Special topics - rotating stall and surge, and
   aeromechanical considerations.

   h. Prerequisites (if any)

   ME 321 and ME 330

   i. May be repeated to a maximum of ____________________________ (if applicable)

4. To be cross-listed as

   Prefix and Number ____________________________ Signature, Chairman, cross-listing department

5. Effective Date Spring 2004 (semester and year)

6. Course to be offered 
   □ Fall  
   □ Spring  
   □ Summer

7. Will the course be offered each year?
   (Explain if not annually)

   Yes  No

   Semi-annually for enrollment

8. Why is this course needed?

   Provides a fundamental course in turbomachinery fluid mechanics and thermodynamics as well as design methodology for the
   design for airfoils for pumps, compressor, and turbines.

9. a. By whom will the course be taught? Mechanical Engineering

   b. Are facilities for teaching the course now available?
      If not, what plans have been made for providing them?

         Yes  No

 fixtures 2005
APPLICATION FOR NEW COURSE

10. What enrollment may be reasonably anticipated? 10 - 15

11. Will this course serve students in the Department primarily? ☒ Yes ☐ No
   Will it be of service to a significant number of students outside the Department? ☐ Yes ☒ No
   If so, explain.
   
   Can be. Course is of interest to chemical and civil Engineering students

12. Will the course serve as a University Studies Program course? ☐ Yes ☒ No
   If yes, under what Area?

13. Check the category most applicable to this course
   ☒ traditional; offered in corresponding departments elsewhere;
   ☐ relatively new, now being widely established
   ☐ not yet to be found in many (or any) other universities

14. Is this course applicable to the requirements for at least one degree or certificate at the
    University of Kentucky? ☒ Yes ☐ No

15. Is this course part of a proposed new program?
    If yes, which?

16. Will adding this course change the degree requirements in one or more programs?* ☐ Yes ☒ No
    If yes, explain the change(s) below

17. Attach a list of the major teaching objectives of the proposed course and outline and/or reference list to be used.

18. If the course is a 100-200 level course, please submit evidence (e.g., correspondence) that the Community College System has
    been consulted.

19. Within the Department, who should be contacted for further information about the proposed course?
    Name    Vincent Capece                                         Phone Extension    (270) 534 - 3123

*NOTE: Approval of this course will constitute approval of the program change unless other program modifications are proposed.
APPLICATION FOR NEW COURSE

Signatures of Approval

Department Chair

Dean of the College

Approved at Department of Mechanical Engineering
Faculty Meeting of April 20, 2005. Vote: unanimous.

4/21/05 Date

11/9/05 Date

10/20/05 Date of Notice to the Faculty

*Undergraduate Council

*University Studies

*Graduate Council

*Academic Council for the Medical Center

*Senate Council (Chair)

Date of Notice to University Senate

*If applicable, as provided by the Rules of the University Senate

ACTION OTHER THAN APPROVAL

Rev 8/02
ME548 – Aerodynamics of Turbomachinery

Overall Course Outline

COURSE: ME 548, Aerodynamics of Turbomachinery
Lecture: 3 hrs; Credit: 3

INSTRUCTOR: V.R. Capece

AUDIENCE: Students in mechanical engineering, chemical engineering, and civil engineering

GOALS: Provide the student with the fundamental approach to designing turbomachines (pumps, compressors, and turbines). At the completion of this course the student will be able to perform a preliminary design of a pump, compressor, or turbine and assess the efficiency of the design.

PREREQUISITES: ME 330, ME 321, and engineering standing


HOMEWORK: In general, weekly homework assignments will be given. Homework assignments will in some cases have different problems and/or requirements for graduate students.*

EXAMS: Exams will in some cases have different problems and/or requirements for graduate students.*

GRADING SCALE:

90-100 A
80-89 at least a B
70-79 at least a C
60-69 at least a D (E for graduate students*)
0-59 E

*Our accreditation association and policy of the Graduate School require that there be different assignments and grading criteria for undergraduate students and graduate students in 400G and 500-level courses. For that reason, you will find differences in course requirements and/or grading criteria in this class, posted on the syllabus.
ME548 – Aerodynamics of Turbomachinery

Learning Outcomes: At the completion of this course the students should:

1) Understand the preliminary design of compressor and turbine airfoils. This knowledge will be demonstrated by having successfully worked problems on the preliminary design of different types of turbomachines.
2) Have a working knowledge of velocity diagrams. This knowledge will be demonstrated by being able to compute velocity vectors and flow angles for axial and radial turbomachines, and use Euler’s turbomachine equation.
3) Understand the different efficiency definitions for turbomachinery. This knowledge will be demonstrated by being able to compute the polytropic efficiency, total-to-static efficiency, and total-to-total efficiency.
4) Have a working knowledge of the different loss mechanisms in turbomachinery. This knowledge will be demonstrated by being able to estimate the losses for preliminary airfoil design

TOPICS TO BE COVERED

1. Introduction
2. Review of Thermodynamics
3. Diffusion and Diffusers
4. Energy Transfer in Turbomachines
5. Analysis and Design of 3D Free-Stream Flow
7. Design and Performance Prediction of Axial-Flow Compressors
8. Preliminary Design Methods for Radial-Flow Turbomachines
9. Aeromechanical Considerations and Rotating Stall and Surge