ME 43300 Principles of Turbomachinery

Sem. 1, Class 3, Cr. 3
Prerequisite: ME 20000-Thermodynamics, ME 30900-Fluid Mechanics

## Purdue University Request for Addition, Expiration, or Revision of an Undergraduate Course (100-400 Level)

### Department: Mechanical Engineering  
**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
- [x] 11. Change in semesters offered (department head signature only)
- [ ] 12. Transfer from one department to another

### Proposed:

- **Subject Abbreviation:** ME
- **Course Number:** 43300
- **Long Title:** Principles of Turbomachinery
- **Short Title:** Prin of Turbomachinery

### Existing:

- **Subject Abbreviation:**
- **Course Number:**
- **Long Title:**
- **Short Title:**

### Terms Offered:

- [x] Summer
- [x] Fall
- [ ] Spring

### CAMPUS(ES) Involved:

- [ ] Calumet
- [ ] Cont Ed
- [ ] FL Wayne
- [ ] Indianapolis
- [ ] N. Central
- [ ] Tech Statewide
- [x] W. Lafayette

### Credit Type:

<table>
<thead>
<tr>
<th>1. Fixed Credit Cr. Hrs.</th>
<th>3</th>
</tr>
</thead>
</table>

### Course Attributes:

- [ ] 1. Pass/Not Pass Only
- [ ] 2. Satisfactory/Unsatisfactory Only
- [ ] 3. Repeatable
- [ ] Maximum Repeatable Credit
- [ ] 4. Credit by Examination
- [ ] 5. Designator Required
- [ ] 6. Special Fees
- [ ] 7. Registration Approval Type

### Instructional Type:

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Recitation</th>
<th>Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>3</td>
<td>16</td>
</tr>
</tbody>
</table>

### Course Description (Include Requisites):

**ME 43300 Principles of Turbomachinery**

Sem. 1, Class 3, Cr. 3  
Prerequisite: ME 20000-Thermodynamics, ME 30900-Fluid Mechanics

ME 43300 Principles of Turbomachinery

Sem. 1, Class 3, Cr. 3
Prerequisite: ME 20000-Thermodynamics, ME 30900-Fluid Mechanics

TO: The Engineering Faculty

FROM: The Faculty of the School of Mechanical Engineering

RE: ME 43300 Course offering switched to fall

The Faculty of the School of Mechanical Engineering has approved the following course schedule change and clarification of the prerequisites. This action is now submitted to the Engineering Faculty with a recommendation for approval.

From:

ME 43300 Principles of Turbomachinery
Sem. 2, Class 3, cr. 3
Prerequisite: Thermodynamics, Fluid Mechanics


To:

ME 43300 Principles of Turbomachinery
Sem. 1, Class 3, cr. 3
Prerequisite: ME 20000 and ME 30900 or Equivalent


Reason: ME 43300 will be switched to a fall offering (rather than spring) to provide more opportunity for instructors to incorporate seniors interested in undergraduate research projects prior to graduation with the hope of recruiting more students into our graduate program. Course titles replaced with course numbers to clarify prerequisites.

James D. Jones, Associate Professor and Associate Head
School of Mechanical Engineering

APPROVED BY THE FACULTY
OF THE SCHOOLS OF ENGINEERING
BY THE ENGINEERING
CURRICULUM COMMITTEE

ECC Minutes #8
Date 12/14/10
Chairman ECC R.Cpra
ME 43300  
PRINCIPLES OF TURBOMACHINERY

Course Outcomes  [Related ME Program Outcomes in brackets]
1. Understand principles of operation of pumps, fans, compressors, and turbines.  [A2, A3]
2. Develop the ability to size and select turbomachinery for a specific application.  [A2, A3]
3. Develop the ability to analyze the performance of turbomachinery.  [A2, A3]
4. Master the concepts of classic mean-line and quasi-3D design methods.  [A2, A3]

Fundamental Concepts (2 wks)
1. Review of thermodynamics
2. Review of fluid mechanics
3. Introduction to 1-D compressible flow
4. Basics of energy transfer in a turbomachine

Dimensional Analysis (1 wk)
1. Corrected mass flow and corrected speed
2. Energy transfer coefficient and flow coefficient
3. Specific speed and specific diameter
4. Similitude

Performance Analysis (4 wks)
1. Performance criterion
2. Performance maps
3. Pump Sizing and cavitation
4. Off design performance

Design Method (8 wks)
1. Simple stage analysis
2. Streamline analysis
3. Radial equilibrium
4. Axial blade element design
5. Radial impeller design
6. Design of diffusers

Revision Date: December 8, 2009
**COURSE NUMBER:** ME 43300  
**COURSE TITLE:** Principles of Turbomachinery  
**REQUIRED COURSE OR ELECTIVE COURSE:** Elective  
**TEXTBOOK/REQUIRED MATERIAL:**  
**COORDINATING FACULTY:**  
**ASSESSMENTS TOOLS:**  
1. Weekly homework.  
2. Two semester exams.  
3. One final exam.  
**PROFESSIONAL COMPONENT:**  
1. Engineering Topics: Engineering Design – 3 credits (100%)  
**NATURE OF DESIGN CONTENT:** Preliminary design of a centrifugal pump to satisfy customer performance requirements, motor limitations and installation (cavitation) objectives. Preliminary design of radial flow compressor to satisfy turbocharger performance objectives with optimization of rotational speed, flow channel size and diffuser envelope. Aerodynamic and geometric design of an axial flow compressor (or turbine) stage for a gas turbine.  
**COMPUTER USAGE:** None  
**COURSE STRUCTURE/SCHEDULE:**  
1. Lecture – 3 meetings per week at 50 minutes.  
**TERMS OFFERED:** Fall  
**PRE-REQUISITES:** ME Thermodynamics  
ME Fluid Mechanics  
**COURSE OUTCOMES** [Related ME Program Outcomes in brackets]:  
1. Understand principles of operation of pumps, fans, compressors, and turbines. [A2, A3]  
2. Develop the ability to size and select turbomachinery for a specific application. [A2, A3]  
3. Develop the ability to analyze the performance of turbomachinery. [A2, A3]  
4. Master the concepts of classic mean-line and quazi-3D design methods. [A2, A3]  
**RELATED ME PROGRAM OUTCOMES:**  
A2. Engineering fundamentals  
A3. Analytical skills  
**PREPARED BY:** Nicole Key  
**REVISION DATE:** December 8, 2009