Office of the Registrar
FORM 40 REV. 9/06

# PURDUE UNIVERSITY
## REQUEST FOR ADDITION, EXPIRATION, OR REVISION OF AN UNDERGRADUATE COURSE
## (100-~~400~~ LEVEL)

50-10

DEPARTMENT: Mechanical Engineering

EFFECTIVE SESSION: ~~Fall 2009~~ (201220) Spring 2012 UP

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

Abbreviated title will be entered by the Office of the Registrar if omitted. (22 CHARACTERS ONLY)

TERMS OFFERED (Check All That Apply): ☐ Summer ☑ Fall ☐ Spring

CAMPUS(ES) INVOLVED: ☐ Calumet ☐ Cont Ed ☐ Ft. Wayne ☐ Indianapolis ☐ N. Central ☐ Tech Statewide ☑ W. Lafayette

CREDIT TYPE

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

COURSE ATTRIBUTES: Check All That Apply

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: Department ☐ Instructor ☐
8. Variable Title ☐
9. Remedial ☐
10. Honors ☐
11. Full Time Privilege ☐
12. Off Campus Experience ☐

| Instructional Type | Minutes Per Mtg | Meetings Per Week | Weeks Offered | % of Credit Allocated | Delivery Method (Asyn. Or Syn.) | Delivery Medium (Audio, Internet, Live, Text-Based, Video) |
|---|---|---|---|---|---|---|
| Lecture | 50 | 3 | 16 | | Syn. | Live |
| Recitation | | | | | | |
| Presentation | | | | | | |
| Laboratory | | | | | | |
| Lab Prep | | | | | | |
| Studio | | | | | | |
| Distance | | | | | | |
| Clinic | | | | | | |
| Experiential | 50 | 1 | 1 | | | |
| Research | | | | | | |
| Ind. Study | | | | | | |
| Pract/Observ | | | | | | |

Cross-Listed Courses

RECEIVED 2011 AUG 11 AM 10:27 OFFICE OF THE REGISTRAR

COURSE DESCRIPTION (INCLUDE REQUISITES):

**ME 43300 Principles of Turbomachinery**
Sem. 1, Class 3, Cr. 3
Prerequisite: ME 20000-Thermodynamics, ME 30900-Fluid Mechanics

Unified treatment of principles underlying fluid mechanic design of hydraulic pumps, turbines, and gas compressors, and turbines. Similarity and scaling laws. Cavitation. Analysis of radial and axial flow machines. Blade element performance. Radial equilibrium theory. Centrifugal pump design. Axial compressor design. Inspection trip to industrial plant required.

| | Date | | Date |
|---|---|---|---|
| Calumet Department Head | | Calumet School Dean | |
| Fort Wayne Department Head | | Fort Wayne School Dean | |
| Indianapolis Department Head | | Indianapolis School Dean | |
| North Central Department Head | | North Central Chancellor | |
| West Lafayette Department Head | 2/20/201 | West Lafayette College/School Dean | 7/25/11 |
| | | West Lafayette Registrar | 9/13/11 |

OFFICE OF THE REGISTRAR

UP 9/13/11

Office of the Registrar
FORM 40 REV. 9/06

# PURDUE UNIVERSITY
## REQUEST FOR ADDITION, EXPIRATION, OR REVISION OF AN UNDERGRADUATE COURSE
(100-400 LEVEL)

ME 43300
50-10
201220 US

DEPARTMENT: Mechanical Engineering

EFFECTIVE SESSION: ~~Fall 2009~~ ~~(201210)~~ ~~Fall 2011~~

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| Short Title | Prin of Turbomachinery | | |

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2. Variable Credit Range: Minimum Cr. Hrs ____ (Check One) To [ ] Or [ ] Maximum Cr. Hrs ____
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4. Thesis Credit: Yes [ ] No [ ]

COURSE ATTRIBUTES: Check All That Apply

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| | Date | | Date |
|---|---|---|---|
| Calumet Department Head | | Calumet School Dean | |
| Fort Wayne Department Head | 9/4/11 | Fort Wayne School Dean | |
| Indianapolis Department Head | | Indianapolis School Dean | |
| North Central Department Head | | North Central Chancellor | |
| West Lafayette Department Head | 2/20/201 | West Lafayette College/School Dean | 7/25/11 |
| | | West Lafayette Registrar | 9/13/11 |

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OFFICE OF THE REGISTRAR

ME 43300

Office of the Registrar
FORM 40 REV. 9/06

**PURDUE UNIVERSITY**
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF AN UNDERGRADUATE COURSE
(100-400 LEVEL)

50-10

DEPARTMENT: Mechanical Engineering

EFFECTIVE SESSION: ~~Fall 2009~~ ~~(20104)~~ ~~Fall 2011~~ Spring 2012 (20120)

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

CAMPUS(ES) INVOLVED
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☐ Cont Ed ☐ Tech Statewide
☐ Ft. Wayne ☐ W. Lafayette
☐ Indianapolis

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(Check One) To ☐ Or ☐
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**ME 43300 Principles of Turbomachinery**
Sem. 1, Class 3, Cr. 3
Prerequisite: ME 20000-Thermodynamics, ME 30900-Fluid Mechanics

Unified treatment of principles underlying fluid mechanic design of hydraulic pumps, turbines, and gas compressors, and turbines. Similarity and scaling laws. Cavitation. Analysis of radial and axial flow machines. Blade element performance. Radial equilibrium theory. Centrifugal pump design. Axial compressor design. Inspection trip to industrial plant required.

| | | | |
|---|---|---|---|
| Calumet Department Head | Date | Calumet School Dean | Date |
| Fort Wayne Department Head | Date | Fort Wayne School Dean | Date |
| | | Wanda L Worley 9/7/11 | |
| Indianapolis Department Head | Date | Indianapolis School Dean | Date |
| North Central Department Head | Date | North Central Chancellor | Date |
| James D. Jones 2/20/201 | | | |
| West Lafayette Department Head | Date | West Lafayette College/School Dean | Date |
| | | | West Lafayette Registrar 9/13/11 Date |

OFFICE OF THE REGISTRAR

9/13/11

ME 43300

Engineering Faculty Document 50-10
December 8, 2009

**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

Unified treatment of principles underlying fluid mechanic design of hydraulic pumps, turbines and gas compressors, and turbines. Similarity and scaling laws. Cavitation. Analysis of radial and axial flow machines. Blade element performance. Radial equilibrium theory. Centrifugal pump design. Axial compressor design. Inspection trip to industrial plant required.

**To:**

**ME 43300 Principles of Turbomachinery**

Sem. 1, Class 3, cr. 3
Prerequisite: ME 20000 and ME 30900 or Equivalent

Unified treatment of principles underlying fluid mechanic design of hydraulic pumps, turbines and gas compressors and turbines. Similarity and scaling laws. Cavitation. Analysis of radial and axial flow machines. Blade element performance. Radial equilibrium theory. Centrifugal pump design. Axial compressor design. Inspection trip to industrial plant required.

**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

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. Cipra

# 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

ME 43300

**COURSE NUMBER:** ME 43300 **COURSE TITLE:** Principles of Turbomachinery

**REQUIRED COURSE OR ELECTIVE COURSE:** Elective

**TERMS OFFERED:** Fall

**TEXTBOOK/REQUIRED MATERIAL:**

**PRE-REQUISITIES:** ME Thermodynamics
ME Fluid Mechanics

**COORDINATING FACULTY:**

**COURSE DESCRIPTION:** Unified treatment of principles underlying fluid mechanic design of hydraulic pumps, turbines and gas compressors and turbines. Similarity and scaling laws. Cavitation. Analysis of radial and axial flow machines. Blade element performance. Radial equilibrium theory. Centrifugal pump design. Axial compressor design. Inspection trip to industrial plant required.

**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]

**ASSESSMENTS TOOLS:**

1. Weekly homework.
2. Two semester exams.
3. One final exam.

**RELATED ME PROGRAM OUTCOMES:**
A2. Engineering fundamentals
A3. Analytical skills

**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.

**PREPARED BY:** Nicole Key **REVISION DATE:** December 8, 2009

ME 43300