05-77

Minnesota State University, Mankato HOLD and CLEAR buttons only compatible with Acrobat V. 4 and 5

Curriculum Proposal

Please type or select the requested information. Print completed forms, add appropriate paper attachments, and route through MSU's curricular process for recommendations and decisions.

College: Science, Engineering and Technology
Department: Mechanical Engineering
Program: Mechanical Engineering
CIP # _____
Type of Change Proposed: COURSE PROPOSALS — New Course

(Check all that apply):
☒ Undergraduate
☒ Graduate

Proposal # 153
Effective Date of Change:
Academic Year 05
(For Office Use Only)

Title Current:
Title Proposed: Aerosol Theory and Technology
24-Char. Abbrev: Aerosol Theory

Course Designator and Number	Number of Credits
ME 426/526	3

(if applicable)

Include a course or program description for the Bulletin (30-40 words maximum for courses, 100 for programs):

Introduction to the theory of aerosols and particulate systems. Properties, behavior, and physical principles of aerosols; including particle size statistics, Brownian motion and diffusion, and coagulation. Application in areas such as environmental systems, respiratory deposition, bioterrorism, and materials processing.
Pre: ME324

Rationale or Justification for change:

New course to expand the selection of electives in the thermal-fluids area.

For General Education or Cultural Diversity Courses Only

General Education Course:

GE Category # **GE Category Name (Maximum of 3 Categories)**

N/A
N/A
N/A

? For Writing Intensive Courses, attach a description of the kind and quantity of writing.
? For Upper Division Courses, include a description of the respects in which it is broad and general rather than narrow and specific, and so suitable as GE.

Cultural Diversity Course:

(Please check one.)

☐ **Core** (At least 75% devoted to topics of race, gender, sexual orientation, age, class, and disabilities as they occur in United States Society.)

☐ **Related** (At least 25% devoted to the above topics or to a global perspective on topics related to African American, Asian, Hispanic, and Native American inhabitants of the United States.)

Attach paper copies of the following:
a. Syllabus or course outline.
b. Course's student learning outcomes associated with each GE competency or CD designation.
c. List of strategies to be used to assess students' achievement of each GE competency or CD designation.

For New Courses

(Check all that apply:)
☒ Course is an elective.
☐ Course is required for program
☒ Pre- or Co-requisites: ME 324: Heat Transfer
☐ Other courses are being changed or eliminated. (Explain.)

Instructional Type: Lecture
Grading Format: ☒ Grade ☐ P/N

Course will be offered:
☒ Fall Semester
☐ Spring Semester
☐ Summer Session

☐ Course content or title is similar to courses in other departments. (Attach copy of letter of agreement with other program(s) contacted. Indicate the nature of the discussions and/or resolution of differences or potential conflicts.)

Attach paper copies of the following:
a. Syllabus or course outline.
b. Course's student learning outcomes.
c. A list of resources required to offer and support this course.
d. A description of how teaching this course will affect department staffing.
e. If 400/500 level course, an explanation of added expectations of graduate students.

Minnesota State University, Mankato

Curriculum Proposal

Signature Page

Department
√ Recommended (Category/ies_____)
__ Not Recommended (Category/ies_____)

Saeed Moori 2/11/05
Department Chair Date

Comments:

College Curriculum Committee
X Recommended (Category/ies_____)
__ Not Recommended (Category/ies_____)

Karen C. Chou 2/24/05
Committee Chair Date

Comments:

College Dean
__ Recommended (Category/ies_____)
__ Not Recommended (Category/ies_____)

Dean 3/1/05
Date

Comments:

General Education Subcommittee
__ Recommended (Category/ies_____)
__ Not Recommended (Category/ies_____)

General Education Subcommittee Chair Date

Comments:

Undergraduate Curriculum and Academic Policy Committee
__ Recommended (Category/ies_____)
__ Not Recommended (Category/ies_____)

UCAP Faculty Chair Date

Comments:

Faculty Association Graduate Committee
__ Recommended
__ Not Recommended

Faculty Association Graduate Chair Date

Comments:

Graduate Dean
__ Recommended
__ Not Recommended

Graduate Dean Date

Comments:

Academic Affairs Council
__ Recommended (Category/ies_____)
__ Not Recommended (Category/ies_____)

Assistant Vice President Date

Comments:

Senior Vice President and Vice President for Academic Affairs
__ Approved (Category/ies_____)
__ Not Approved (Category/ies_____)

Sr. Vice President / Vice Pres. Academic Affairs Date

Comments:

ME426/526 – AEROSOL THEORY AND TECHNOLOGY

Department of Mechanical and Civil Engineering
Minnesota State University, Mankato
Fall Semester 2005

Instructor: Dr. Patrick A. Tebbe — Ext. 6834
Trafton E228 — patrick.tebbe@mnsu.edu

Textbook: Aerosol Technology: Properties, Behavior, and Measurement of Airborne Particles, by William Hinds, Wiley Interscience, 2nd edition, 1998.

References: Aerosol Science: Theory and Practice, M.M.R. Williams and Sudarshan Loyalka, 1991.

Catalog Description: Introduction to the theory of aerosols and particulate systems. Properties, behavior, and physical principles of aerosols; including particle size statistics, Brownian motion and diffusion, and coagulation. Application in areas such as environmental systems, respiratory deposition, bioterrorism, and materials processing.

Prerequisites: ME 324

Grading: Based on three sectional examinations, one comprehensive final examination, homework, and several small projects throughout the semester

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Course Outline
(meeting three times a week with 50 minute classes)

1. Introduction. General definitions and unit systems
2. Particle size, shape, and density
3. Aerosol concentration
4. Kinetic theory of gases
5. Molecular velocity
6. Mean free path
7. Gas viscosity
8. Review of Reynold's number and measurement of velocity
9. Newton's resistance law
10. Stoke's law
11. Settling velocity of a particle
12. Slip correction factor
13. Nonspherical particles and aerodynamic diameter
14. Other factors in particle settling
15. **Examination**
16. Particle size distributions
17. Lognormal distributions
18. Relaxation time for particle motion
19. Particle acceleration

20. Stopping distance
21. Inertial impaction of particles
22. Adhesive forces on particles
23. Brownian motion
24. Aerosol diffusion coefficients
25. Particle mean free path
26. Brownian displacement
27. Deposition by diffusion
28. **Examination**
29. Simple monodisperse coagulation
30. Polydisperse coagulation
31. Condensation and nucleation
32. Macroscopic properties of filters
33. Filter efficiency
34. Pressure drop in filters
35. Measurement of particle size
36. Generation of aerosols
37. Biological applications – respiratory deposition
38. Biological applications – respiratory deposition
39. Environmental applications – smoke and allergens
40. Environmental applications – pollution
41. Bioterrorism – use of aerosols for biological attack
42. Materials processing – Fiber optic preform production
43. **Examination**
44. Numerical modeling of aerosols – Lagragian motion
45. Numerical modeling of aerosols – Deposition

Final Examination (comprehensive)

Program Outcomes Related to this Course:

Each course in the curriculum addresses various ABET and program outcomes. In this course the following outcomes will be addressed:

- an ability to apply knowledge of mathematics, science and engineering
- an ability to identify, formulate, and solve engineering problems
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in a global and societal context
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- a knowledge of time budgeting and management

Resources required to offer this course: Computers with computational fluid dynamics software will be needed for one week of the course (current computer labs and FIDAP software satisfy this requirement).

Affect to departmental staffing: No new faculty are needed, current staff has the expertise to teach this subject.

Added expectations of graduate students: Graduate students enrolled in the ME526 option will be required to perform several additional assignments taken from the reference text. An additional project will be assigned in an area of interest to the student. The project will involve either a numerical solution or elements of design and will required research beyond the course textbook.