ME 447/547 Transport and Rate Processes Winter 2000

Mechanical Engineering Department
Portland State University

Description

Transport and Rate Processes is a core course in the graduate Thermal and Fluid Sciences Curriculum. It is also available to seniors in engineering and related disciplines. The primary focus of the course is mass transfer by diffusion and convection. Analogies to heat transfer, and combined heat and mass transfer will also be discussed.

Topics in mass transfer will be treated by (1) developing an appropriate differential model, (2) obtaining a solution (perhaps approximate) to that model, and (3) exercising the model in an engineering design context. The problems considered will almost exclusively have one dimension of spatial variation, and in some case will include transient behavior.

Prerequisites

EAS 361, ME 323, or equivalents
Senior or graduate standing

Instructor

Gerald Recktenwald, Associate Professor, Mechanical Engineering Department
458 Science Building II, 725-4296, `gerry@me.pdx.edu`
Web site for the course: `http://www.me.pdx.edu/~gerry/class/ME447`

Office Hours

Mondays and Wednesdays, 10:30 AM – noon, 458 Science Building II
Tuesdays and Thursdays, after class
Otherwise by appointment only

Textbook

S. Middleman, *An Introduction to Mass and Heat Transfer: Principles of Analysis and Design*, 1998, Wiley.

Time and Place

Tuesdays and Thursdays, 4:00 – 5:55 PM, Room 108, Science Building II
First class meets 6 January 2000

Independent Work

One quarter of the course grade will be based on an independent of your choice. Two different types of independent are allowed: a detailed analysis or design project or a class portfolio. The analysis/design project will appeal to students who would like to work on a single topic in depth. The class portfolio will appeal to students who would like to pursue a self-directed, survey more than one topic related to the class material.

The report on the independent work will be an evolving document that is submitted for review at three points during the quarter: first as proposal for the work to be done, then a progress report, then as the final report.

Project: You will (1) analyze a practical and nontrivial mass transfer problem in detail, or (2) design a piece of mass transfer equipment. You may chose from a list of projects that have already been identified, or, with instructor approval, you may create your own project. Your final report will include an executive summary of the work performed, citation of relevant literature, and a presentation of the detailed analysis or design you performed.

Class Portfolio: The goal of the portfolio is to allow you to pursue more than one topic related to the course material. During the quarter you will to assemble a list of independent investigations that you have undertaken to better understand the course material. These might include, but are not necessarily limited to the following

- Extra homework problems
- Filling the details of exact solutions to flow problems not presented in class lecture
- Annotated Journal articles you have read
- A list of references to consult for specific fluid mechanics issues
- A written summary and critique of web sites dealing with fluid mechanics
- Detailed parameter studies of homework problems or case studies presented in class.

Grading

Cumulative grades will be based on the following weights

35%	Homework
20%	Midterm
25%	Independent Work (Project *or* Portfolio)
20%	Final Exam

The midterm will be a take home exam. The final exam will be comprehensive. Both exams are mandatory. Discuss any potential conflicts *well before the exam dates.* Make-up exams will not be given.

ME 547 Grading: Students registered for ME 547 are expected to produce an independent project commensurate with their advanced standing. A project pertinent to their thesis research is encouraged, but not required. Extra homework problems (beyond those required of ME 447 students) may also be assigned.

Supplemental References

The following books are on reserve in Millar Library

D.K. Edwards, V.E. Denny, A.F. Mills *Transfer Processes: An Introduction to Diffusion, Convection, and Radiation*, 1979, Hemisphere, Washington D.C.

E.L. Cussler, *Diffusion: Mass Transfer in Fluid Systems*, 1984, Cambridge University Press, New York.

J.M. Kay, and R.M. Nedderman, *Fluid Mechanics and Transfer Processes*, 1985, Cambridge University Press, New York.

F.P. Incropera, and D.P. Dewitt, *Fundamentals of Heat and Mass Transfer*, fourth edition, 1996, Wiley, New York.