
This course will cover the fluid mechanics and heat transfer aspects of two-phase flow which occur in power generating equipment, the atmosphere, food processing, oil and gas line equipment, combustion, and other situations were there is a requirement for high wall heat fluxes.

The course will consist of:

Approximately 10 Homework assignments, typically due weekly. Two Projects in which the students will write a computer program. Three closed book exams, done at times outside of class time, no quizzes

For distance students the homework should be faxed to the Continuing Education Office no later that the day it is due unless special arrangements have been made with the instructor. The examinations will be administrated by a proctor at the work site.

The grading of the course is approximately as follows:

- Homework 30%
- Projects 30%
- Exams 40%
This may vary depending on the time spent on the projects.

ME - 515 TWO-PHASE FLOW AND HEAT TRANSFER

OUTLINE FALL - 2007
Note: C&T Refers of the text by Collier and Thome

Introduction Outline, grading, tests, homework, projects Films, home experiment Basic definitions in Two-Phase Flow Flow Regimes, patterns, transitions

Flow regime transition points Flow regimes maps Generalized Conservation Equations

Generalized Conservation Equations Con’t Averaging Paper by Lahey on generalized system of equations

Special case of homogeneous flow Two-Phase Pressure Drop Homogeneous flow Pressure drop

Two-phase Pressure Drop, Con’t Two-phase multiplier Separated flow pressure drop

Empirical pressure drop models Pressure drop in fittings Discussion of the first project on two-phase pressure drop
Drift Flux Model Formulation Flow regime dependent correlations

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. Drift Flux, Con’t

. Cocurrent flow, countercurrent flow, flooding

.. Two-Phase Critical Flow Thermodynamics of critical flow

Two-Phase Critical flow, Con’t Homogeneous-equilibrium model
Correlations from the literature

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Exam 1 Time and place TBD

Boiling Phenomena Boiling curve

C&T Ch 4, 5, Thermodynamics of boiling

Boiling Phenomena Con’t Nucleation, vapor formation Boiling mechanisms, bubble dynamics
Pool Boiling Correlations for pool boiling

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.. Convective Boiling Convective effects on boiling

C&T chapter 7 Chen, Hsu papers

Convective Boiling Con’t Boiling curve in convective flow Chen paper and model Boiling suppression Saturated boiling

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Convective Boiling CHF/DNB Critical heat flux concept Pool boiling CHF

Convective Boiling CHF/DNB Con’t Flow boiling DNB, correlations

Annular film dryout, evaporation Discussion of second project

EXAM 2 Time and Place to be determined

Post CHF Heat Transfer Boiling curve for post CHF Heat transfer mechanisms stable film boiling, Berenson paper

Post CHF Heat Transfer Con’t Two and three step film boiling models Dispersed flow film boiling

Minimum Film Boiling Temperature Concept Models/Correlations

Interfacial Heat and Momentum Transfer Conservation equations with interfacial transport Models for transport Interfacial area transport

Condensation Heat Transfer Thermodynamics of condensation Condensation mechanisms Nusselt theory, Laminar Film condensation

Condensation Heat Transfer Con’t

Turbulent film condensation Effects of non-condensibles Flowing condensation

Condensation Heat Transfer Con’t Direct condensation, interfacial heat transfer Effects non-condensibles

C&T chapters 8,9

C&T Section 12.8
Performance of Boiling Systems C&T chapter 11
Performance of Boiling Systems, Con’t

EXAM -3 Time and place TBD