

NUCL 351: Nuclear Thermalhydraulics II – Spring 2023

Catalog Description: Heat transfer in fluids, analogies, and applications to reactor coolant channel analysis. Two-phase flow and convective boiling. Radiative heat transfer. Applications to safety analysis and reactor design

Instructor: Hitesh Bindra, Office LMBS-5266, (765) 496-2433; e-mail hbindra@purdue.edu

Instruction mode: In-person MWF (10:30 AM – 11:20 PM) Max W & Maileen Brown Hall 236

Textbook: Bergman, Lavine, DeWitt and Incropera, *Fundamentals of Heat and Mass Transfer* 8th Edition

Prerequisites: NUCL 350: Nuclear Thermalhydraulics - I

Topics:

1. Introduction (2 Weeks)
 - Goals. Objectives
 - Math/Calculus review
 - Thermodynamics review
 - Fluid Mechanics Review

2. Heat Conduction (5 Weeks)
 - Fourier Law
 - 1D Heat conduction and thermal resistance
 - Heat conduction in multi-region
 - Transient heat conduction
 - Analytical and numerical methods
 - (i) finite-difference
 - (ii) Green's function approach
 - (iii) eigenfunction expansion technique
 - Fuel elements and fins

3. Convection (3 Weeks)
 - Introduction
 - Nusselt number
 - Flat plate and pipe flow
 - Natural convection

4. Phase-change heat transfer (2 Weeks)
 - Boiling
 - Condensation
 - Solidification

5. Radiative Heat Transfer (2 Weeks)
 - Stefan-Boltzman Law
 - Emissivity
 - Form factors
 - Transport equation and participating media

6. Applications (2 Weeks)
Nuclear Systems
Heat Exchangers

Student Evaluation:

1. Midterm and final examinations - 70% (Including Project)
2. Quizzes - 20%
3. Homework assignments - 10%

Grading:

A+,A,A-: 85-100

B+,B,B-: 70-85

C+,C,C-: 55-70

D+,D,D-: 40-55

F: <40

Examination Dates:

Midterm (s): See Course Schedule

Final: TBD

Attendance:

Although there is no formal requirement of attendance or grade allocation, there will be surprise quizzes in-class which will be included within the overall quiz score.

Other policies See Course page in Brightspace for all other policies.