

**CHEE 6560, 8560**  
***Transport Phenomena II***  
Spring 2016

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Lecture: TTh 4:10 pm - 5:25 pm, PL 3060  
Office Hours: Tue and Thur 10:30 am - 12:30 pm and by appointment.

Course description:

Basic and advanced concepts in transport phenomena including heat and mass transfer, partial differential equations, numerical methods, and computer simulation.

Required text:

- Transport Phenomena, Bird, Stewart, and Lightfoot, 2<sup>nd</sup> Ed., John Wiley & Sons.

Recommended texts:

- Partial differential equations for scientists & engineers (Farlow, John Wiley & Sons, 1982)
- First order partial differential equations (Rhee, Aris, and Amundson, Prentice-Hall, 1986)

Course Objectives:

- Students will be able to explain the basic and advanced concepts in heat and mass transfer.
- Students will be able to derive the governing equations for heat and mass transfer in Cartesian, cylindrical and spherical coordinates.
- Students will be able to solve the partial differential equations using analytical methods.
- Students will be able to use computer software such as Matlab to solve PDEs numerically.
- Students will be able to use computer program such as COMSOL Multiphysics to simulate heat and mass transfer in various systems.

Grading:

Midterm	30%
Term Project	30%
Final Exam	40%

wk	#	Date	Topic	Reading Assignment
1	1	Jan 12, 2016	- Overview of class - Thermal conductivity	Ch. 9
	2	Jan 14, 2016	- Heat conduction	Ch. 10.1 – 3
2	3	Jan 19, 2016	- Heat conduction problems	Ch. 10.4 – 7
	4	Jan 21, 2016	- Forced convection - Free convection	Ch. 10.8 – 9
3	5	Jan 26, 2016	- Equations of change: Steady-state problems	Ch. 11.1 – 4
	6	Jan 28, 2016	- Equations of change: Nonisothermal systems	Ch. 11.5 – Ch. 12.2
4	7	Feb 2, 2016	- Parabolic PDEs: Separation of variables	Ch. 12.2
	8	Feb 4, 2016	- Sturm-Liouville problem	Ch. 12.2
5	9	Feb 9, 2016	- Parabolic PDEs: Fourier transform	Lecture note
	10	Feb 11, 2016	- Laplace transform	Lecture note
6	11	Feb 16, 2016	- Boundary layer theory for nonisothermal flow	Ch. 12.4
	12	Feb 18, 2016	- Interphase transport in nonisothermal systems	Ch. 14.1 – 2
7	13	Feb 23, 2016	- COMSOL Simulation	Lecture note
	14	Feb 25, 2016	- COMSOL Simulation	Lecture note Term project
8	15	Mar 1, 2016	- Heat transfer coefficients for force convection	Ch. 14.3 – 4
	16	<b>Mar 3, 2016</b>	<b>Midterm Exam</b>	Lectures 1 – 13
9	17	Mar 8, 2016	No Class – Spring Break	
	18	Mar 10, 2016	No Class – Spring Break	
10	19	Mar 15, 2016	- Colburn j-factor	Ch. 14.3 – 4
	20	Mar 17, 2016	- Heat transfer in pipe flow	
11	21	Mar 22, 2016	- Integral method	
	22	Mar 24, 2016	- Heat transfer coefficients for forced convection through packed beds	Ch. 14.5 – 6
12	23	Mar 29, 2016	- Heat transfer coefficients for mixed convection	Ch. 14.5 – 6
	24	Mar 31, 2016	- Diffusivity	Ch. 17
13	25	Apr 5, 2016	- Diffusion through nonisothermal film - Diffusion with a heterogeneous chemical reaction	Ch. 18.1 – 3
	26	Apr 7, 2016	- Diffusion into a falling liquid film - Diffusion into a falling liquid film (solid dissolution)	Ch. 18.5 – 6
14	27	Apr 12, 2016	- Diffusion and chemical reaction inside a catalyst	Ch. 18.7
	28	Apr 14, 2016	- Equation of change	Ch. 19.1 – 3
15	29	Apr 19, 2016	- Boundary layer problems	Ch. 20.2 – 3
	30	Apr 21, 2016	- Taylor dispersion	Ch. 20.5
16	31	Apr 26, 2016	- Interphase transport in nonisothermal mixtures	Ch. 22.1 – 3
	32	Apr 28, 2016	- Combined heat and mass transfer by free convection - Marangoni instability	Ch.22.6 – 7
17		<b>May 2-6, 2016 (Fri)</b>	<b>Final Exam</b>	