ME 340-2 Winter 2014 **HEAT TRANSFER** *March 21, 2014*

Instructor: Vladimir Soloviev 422-3051 133CB Office Hours: MWF 12:00 – 1:00 pm

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HW#	Date		Class Discussion	Reading	Homework
	Jan 6 Mn		Class overview	1.1	**1:** 1,7,10,18,30, 44,49a
1	Jan 8 Wd	Chap. 1	Introduction	1.2	
	Jan 10 Fr			1.3-5	**HW#1: Due Jan 13**
2	Jan 13 Mn	Chap. 2	Introduction to Conduction	2.1-2	**2:** 10,11,19,31,42ab
	Jan 15 Wd		Fourier's Law	2.3-4	**HW#2: Due Jan 17**
	Jan 17 Fr	Chap. 3	The Plane Wall	3.1	**3:** 3a,7,13,18
3	Jan 22 Wd		Radial Systems	3.3	**3:** 55,57abc,68
	Jan 24 Fr		Thermal Energy Generation	3.5	**3:** 81,84,~~88a~~,93
4	Jan 27 Mn		Extended Surfaces	3.6	**3:** 111,130,
	Jan 29 Wd				132,~~150a~~,158
5	Jan 31 Fr	Chap. 4	2-D Steady Conduction, Graphical Method	4.3	**4:** 4,13,23,31
6	Feb 3 Mn		Numerical Methods	4.4-5	**4:** 62,64
7	Feb 5 Wd	Chap. 5	Unsteady Conduction, Lumped Capacitance	5.1-2	**5:** 2,3,6
8	Feb 7 Fr		Analytical Methods	5.5-7	**5:** 51,52,61,75ab,109
	Feb 10 Mn		Numerical Methods	5.10	due Feb 14
	Feb 12 Wd		Review Chapters 1-5		
	Feb 11-12-13 Tu-Wd-Th		*Testing Center* **Exam #1**	***Conduction***	
9	Feb 14 Fr	Chap. 6	Similarity, Solution Forms, Analogies	6.1-3, 6.5-8	**6:** 1,2,4,29
10	Feb 18 Tu	Chap. 7	External Flow, Flat Plate	7.1-3	**7:** 2,3,27
11	Feb 19 Wd		Cylinders and Spheres	7.4	**7:** 46,47ab,
	Feb 21 Fr			7.5	68,85ab
12	Feb 24 Mn	Chap. 8	Internal Flow,Thermodynamic Consideration	8.1	**8:** 3ab,4a,
	Feb 26 Wd		Overall Energy Balance	8.2	6,16,
	Feb 28 Fr			8.3	17,19a
	Mar 3 Mn		Convection Correlations - Laminar	8.4	**8:** 26,31
13	Mar 5 Wd		Convection Correlations - Turbulent	8.5	35a,42a,
	Mar 7 Fr		Convection Correlations - Non-Circular Pipe	8.6	80a
	Mar 10 Mn	Chap. 9	Free Convection, Introduction, Vertical Plate	9.1-5	**9:** 10,16,27
14	Mar 12 Wd		Convection Correlations - External	9.6-7	37,56ab
	Mar 14 Fr		Convection Correlations – Enclosures	9.8-9	101,107 due Mar 21
15	Mar 17 Mn	Chap. 10	Boiling	10.1-10.5	**10:** 5,12,30 due Mar 21
	Mar 19 Wd		Review Chapters 6-10		
	Mar 18-19-20 Tu-Wd-Th		*Testing Center* **Exam #2**	***Convection***	
16	Mar 21 Fr	Chap. 12	Radiation Concepts, Radiation Intensity	12.1-3	**12:** 6a,9,10
17	Mar 24 Mn		Blackbody Radiation	12.4	**12:** 20,24,28
18	Mar 26 Wd		Radiation Emission	12.5	**12:** 37,39,48
19	Mar 28 Fr		Absorption, Reflection, Tran, Kirchoff's Law	12.6-7	**12:** 49,50,56,57
20	Mar 31 Mn		Gray Surfaces, Environmental Radiation	12.8	**12:** 66,130,131
21	Apr 2 Wd	Chap. 13	View Factors	13.1	**13:** 1abcefh,7,9a due Apr 9
	Apr 4 Fr		Class meeting on Design Project		
	Apr 7 Mn		Design Project Presentation		**Project Report Due (PPP)**
22	Apr 9 Wd		Blackbody Exchange	13.2	**13:** 17,19,21,33
23	Apr 11 Fr		Radiation in Diffuse-Gray Enclosures	Notes	**13:** 55,65,85
	Apr 14 Mn				due Apr 15
	Apr 18 - 23	Fr-Wd	*Testing Center* **Final**	***Comprehensive***	

LEARNING APPROACH:

Textbook
Fundamentals of Heat and Mass Transfer, 7th Edition by Bergman/Lavine /Incropera/DeWitt, Wiley & Sons.
The sections in the textbook to be covered for each lesson are indicated in the schedule.
Students are expected to read the material before it is covered in class.

Homework
Homework assignments will come from selected problems at the end of each chapter as indicated in the class schedule.
Credit will be given for problems completed, and a select subset of the assigned problems will be graded in detail.

Quizzes
Unannounced quizzes will be given in class, **which cannot be made up for any reason**. However, you will be able to drop 10% of the quizzes. The quizzes will cover either material already covered, or material from the reading assignment.

Examinations
There will be two midterm examinations and one final exam. **Exams cannot be made up unless prior arrangements are made**. You must notify me of an emergency by telephoning me or by email *prior to class*. Only under unusual circumstances can a student arrange to take an exam *after* the regularly scheduled time. The final examination will be comprehensive.

Design Project
There will be one design project in the class, to be outlined as the term proceeds. Students can work in groups (2 students). Project report in the form of Power Point Presentation will be prepared by each group according to a specified format.

GRADING:

Homework	15%
Test 1	20%
Test 2	20%
Final	20%
Quizzes	15%
Project	10%

COURSE OUTCOMES:

1. Students should be able to apply conservation of mass and energy to a control volume or control surface.

2. Students should understand Fourier's law, be able to derive the general heat diffusion equation, and reduce and solve the general equation for one-dimensional, steady-state problems. This will include application of thermal resistance concepts and extended surface analysis.

3. Students will understand the methods for analysis of 2-D steady-state heat conduction, including flux plots and finite difference methods.

4. Students will know when and how to apply the lumped capacitance method and when to use analytical methods for transient conduction. They will understand the use of transient finite difference methods to solve transient conduction problems.

5. Students will understand Newton's law of cooling, and the physical mechanisms for convection (boundary layer, friction, the convective heat transfer coefficient), and will understand the significance of non-dimensional parameters in convection heat transfer.

6. Students will be able to obtain convection heat transfer coefficients for external and internal forced and free convection problems. Where appropriate, they will understand the dependence on geometry, reference temperature, flow type, turbulence, entrance and fully-developed regions, *etc.*

7. Students will understand the physical mechanisms involved in radiation heat transfer. They will understand its directional and spectral dependence. They will know how to calculate total, hemispherical radiative properties from their spectral, directional counterparts.

8. Students will be able to calculate radiative heat exchange in diffuse gray enclosures.

CITIZENSHIP:

This and other Mechanical Engineering Department classes are designed to help you achieve the 12 attributes of an engineering education. It is expected that you will seek to develop a professional attitude inside and outside of the classroom which will carry you through your engineering career. Although we will hope to have fun in class, you are encouraged to avoid unprofessional behavior, including tardiness, poor attendance, "academic whining" regarding homework, grading, *etc.* Remember, you will design the cars your children will drive, the elevators they will ride in, the airplanes that will transport them, *etc.* I expect you to be the best-prepared heat transfer engineers in the country. This is accomplished by punctual attendance at class, active participation in discussions, preparation, advanced planning, *etc.*