ME 610 Heat Transfer

Instructor: Dr. Chao Zhu

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Textbook: F. P. Incropera and D. P. DeWitt, *Introduction to Heat Transfer*, 4th Ed., Wiely, 2002

References:
1. F. White, *Heat and Mass Transfer*, Addison-Wesley, 1991.
2. E.R.G Eckert and R.M. Drake, Jr., Analysis of *Heat and Mass Transfer*, McGrill-Hill, 1972.
3. F. C. McQuiston et al., *Heating, Ventilating, and Air Conditioning*, 2000: (for solar radiation; transient heat transfer)
4. W. A. Sirignano, Fluid Dynamics and Transport of Droplets and Sprays, Cambridge Univ., 1999 (for liquid evaporation; general heat transfer coupled with mass transfer)

Course Content

1. Steady heat conduction (composite materials; internal heat sources or sinks; fins)
2. Transient heat conduction (lumped heat capacity model; 1-D unsteady model)
3. Heat convection in a laminar flow
4. Effect of turbulence on heat convection
5. Natural convection
6. Thermal radiation and transport theory
7. Thermal radiation among a system of gray diffusive or reflective surfaces
8. Numerical simulation (use of commercial code and applications)
9. Solar radiation on a surface
10. Radiation through a gaseous media and green-house effect
11. Evaporation and condensation
12. Boiling heat transfer
13. Heat exchanger (with condensation)

Course Arrangement

Week	Subject	Assignment due	
1	**Introduction; Steady heat conduction**		
2	**Transient heat conduction**		
3	**Heat convection in a laminar flow**	HW#1 (1&2)	
4	**Effect of turbulence on heat convection**		
5	**Natural convection**		
6	**Thermal radiation and transport theory**	HW#2 (3,4&5)	
7	**Thermal radiation networks**		
8	**Numerical simulation (project)**	HW#3 (6&7)	
9	**Solar radiation on a surface**		
10	"Midterm Exam"		
11	**Radiation through a gas & green-house effect**		
12	**Evaporation and condensation**	HW#4 (9&11)	
13	**Boiling heat transfer**	Project (8)	
14	**Heat exchanger (with condensation)**	HW#5 (12&13)	
Midterm & Final Exams: open book & notes (3 hours)			

Grade Calculation Method

(1) class attendance (10%)
(2) homework (25%)
(3) project (20%)
(4) mid-term (20%)
(5) final exam (25%)

Final grade is based on accumulative grade.

Homework Requirements

(a) Five Assignments will be given, with 4 problems per assignment.
(b) Late submission will be given 50% grade deduction.
(c) Homework grade is based on “efforts” rather than “correctness”.

Project Requirements

(a) Establish physical model (governing equations);
(b) Problem closure, with proper boundary and initial conditions;
(c) Use commercial code;
(d) Present typical results graphically, with a reasonable discussion;
(e) Topics can be self-imposed or assigned, on "transient heat conduction"; "heat convection in a complex flow system"; "radiation-dominated heat transfer in a multi-surface fluid system"; or "liquid evaporation or vapor condensation on a solid surface".

Examination Requirements

(1) Open books, notes, and any reasonable references;
(2) No share of materials or calculators;
(3) No use of computer, cell phone calculator, or any devices that may be regarded for telecommunication;
(4) With I.D. for identity check-up

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