Spring 2015 **MAE 221** **Y. Wang**
Office: EG4231 email: yunw@uci.edu

CONVECTIVE HEAT & MASS TRANSFER
SYLLABUS

Catalog Data: **MAE221: Convective Heat & Mass Transfer** (Credit Units: 4). Laminar and turbulent convective heat and mass transfer in external and internal flows. Forced and free convection. Exact and approximate solutions. Similarity solutions. Variable properties. Concentration boundary layer theory,
Mass transfer conductance. Prerequisite: MAE230B.

Textbooks:
- *Convective Heat and Mass Transfer,* 4th Edition, W. M. Kays, M.E.Crawford, B. Weigand, W. Kays, and M. Crawford, McGraw-Hill Inc., 2004.
- *Convective Heat Transfer*, 3rd Edition, Kakac, Sadik, Yaman Yener, and Anchasa Pramuanjaroenkij. CRC press, 2013.

References:
Transport Phenomena, 2nd Edition, R.B. Bird, W.E. Stewart, and E.N.Lightfoot, Wiley, 2001.
Analysis of Transport Phenomena, William M. Deen, Oxford University Press, 1998.
Viscous Fluid Flow, F.M. White, McGraw-Hill Inc., 2005.
Boundary Layer Theory, H. Schlichting, K. Gersten, and E. Krause, H.J. Oertel, and C. Mayes, Springer, 2004.
F.P. Incropera, D.P. DeWitt, T.L. Bergman and A.S. Lavine, *Fundamentals of Heat and Mass Transfer, Sixth Edition,* John Wiley & Sons, 2006.
(All the books have been reserved in the library)

Instructor: Prof. Wang (4231EG) email: yunw@uci.edu

Office hours:

Course Outcomes: Students will be able to:
Demonstrate a fundamental understanding of physical principles associated with the study of convective heat & mass transfer.
Solve convection heat & mass transfer problems involving either laminar or turbulent and external or internal flow.

Prerequisites By Topic: Viscous Incompressible Flow

Lecture Topics: **Outline:**
1. Conservation equations: continuity, momentum, energy

and chemical species equations.
2. Some exact solutions.
3. Dimensional analysis and dimensionless numbers.
4. Boundary layer equations: differential and integral form.
5. Laminar solutions for external flows. Similarity. Wedge flows
6. Laminar solutions for internal flows. Fully developed and developing flows.
7. Fundamental concepts of turbulent flows. Turbulent boundary layers.
8. Turbulent boundary layer with heat transfer. Law of the wall.
9. Turbulent flow in tubes with heat transfer.
10. Free convective heat transfer. Laminar and turbulent flows.
11. The effect of variable properties.
12. Mass transfer conductance.
13. Simplified convective mass transfer problems such as air-water-vapor system and wet-bulb psychomotor.
14. Other topics

Class Schedule: Each class meets 3 hours per week for 10 weeks.

Computer Usage: Used for homework problems (Fortran/C, Matlab and Mathcad) and homework writing (Word, Excel).

Class Project: N/A.

Professional Component: Contributes toward the Mechanical Engineering Topics courses.

Relationship to Program Outcomes: This course relates to the MAE Graduate Program as stated at: http://mae.eng.uci.edu/grad/graduate_program.html

Design Content Description

Grading Criteria:

Homework:	20%
Midterm:	40%
Final:	40%
Class project/presentation:	0%
	100%

Prepared by Prof. Wang
April 2015