

COURSE NUMBER: ME 4331, 4 credits	COURSE TITLE: Thermal Engineering Laboratory
TERMS OFFERED: Fall, Spring	PREREQUISITES: ME 4031W, ME 3331, ME 3332, ME3333
TEXTBOOKS/REQUIRED MATERIAL: H. W. Coleman & W.G. Steele, Experimentation and Uncertainty Analysis for Engineers, John Wiley & Sons, New York, 1989 - Recommended Incropera, Frank P., and DeWitt, David P., Introduction to Heat Transfer, 3 rd . Ed. – (or equivalent reference)	PREPARED BY: U. Kortshagen and T. Simon DATE OF PREPARATION: 05/05/2007
COURSE LEADER(S): R. Goldstein, U. Kortshagen, F. Kulacki, P. Strykowski, T. Simon,	CLASS/LABORATORY SCHEDULE: Two 50-minute lectures per week One 4 hour lab per week CONTRIBUTION OF COURSE TO MEETING PROFESSIONAL OBJECTIVES: 100% Engineering topics
CATALOG DESCRIPTION: Measurement and analysis of heat transfer in single phase, multiphase, and reacting environments. Emphasis on experimental measurements relevant to thermal/fluid systems as well as the statistical design of experiments and uncertainty analysis. Heat exchangers.	COURSE TOPICS: 1. Temperature Measurement, thermocouples, RTD's, optical methods. 2. Data Acquisition, introduction to C programming, AD-conversion, digitization error. 3. Data and Uncertainty Analysis, mean value, standard deviation, confidence interval, propagation of uncertainty. 4. Statistical Design of experiments, 2 ⁿ factorial design, significant effects, Plackett-Burmann screening method. 5. Laboratory Safety. 6. Heat Exchanger Analysis, co- and counter-flow, ϵ -NTU and LMTD method, different instruments for flow measurements. 7. Boiling Heat Transfer, boiling curve, critical heat flux. 8. Fin heat transfer, fin arrays, forced and free convection, adiabatic tip approximation, effective length of fins, fin efficiency. 9. Optical Interferometer and natural convection. Interference, introduction to optical techniques, natural convection fundamentals. 10. Gas turbine analysis, Brayton cycle, isentropic efficiencies, engine thrust and thrust efficiency.

COURSE OBJECTIVES	<ol style="list-style-type: none"> 1. To teach students a variety of experimental techniques important for studies of heat transfer problems. 2. To teach students to design and perform experiments. 3. To teach students to analyze experimental data and to perform uncertainty analysis. 4. To teach the application of statistical design of experiments and show how to determine which parameters are important. 5. To help students enhance their technical presentation skills. Results are presented in the form of written formal and informal reports, poster presentations, and oral presentations.
COURSE OUTCOMES	<p>(Letters shown in brackets are linked to program outcomes a-k)</p> <ol style="list-style-type: none"> 1. Students learn experimental techniques necessary to study problems in heat transfer [a, k]. 2. Students work in teams of 5-6 students on complex experiments. Students learn to divide and organize tasks and to devise teamwork strategies [d, f]. 3. Students independently plan experiments, design problem solving strategies, and assess and, if necessary, modify those strategies to achieve the given goals [b, c, d, e] 4. Students learn to analyze data and to perform uncertainty analysis. They learn to use uncertainty analysis in the planning of experiments [a, b, e] 5. Students learn to present their results in various forms of presentation: written formal and informal reports, oral presentations, and poster presentations [a, g] 6. Students learn to distinguish between individual achievements and group achievements in their presentations [d, f] 7. Students learn to understand and use modern state-of-the-art instrumentation not usually met in undergraduate education: lasers, optical interferometers. Students learn the value of lifelong learning [i, k]
ASSESSMENT TOOLS:	<ol style="list-style-type: none"> 1. Laboratory notebooks. 2. Written formal and informal lab reports. 3. Poster presentations. 4. Oral presentations.

ME 4331

Nature of Changes

1. *Under course topics #1, pyrometry has been replaced with optical methods*
2. *Other minor wording changes have been made for clarification.*