

- Course Number and Title: M E 445. Experimental Methods II
- Catalog Description: Emphasis on experimental techniques, instrumentation and data acquisition in fluid mechanics, heat transfer, and thermodynamics. Laboratory results will be presented in written and verbal formats.
- Credit Hours: 3 Credits (2+3P)
- Prerequisite(s) / Corequisite(s): Prerequisites: (M E 338 or A E 339), M E 340, M E 341, and M E 345
Pre / Corequisites: None
- Required: Required for BSME Degree
- Course Availability: Fall and Spring Semesters
- Instructor (Usual): Dr. Jesse Waller (See <https://mae.nmsu.edu/people/faculty.html>)
- Textbook:
 1. Armstrong, T.W., *Introduction to Experimental Methods*, CRC Press, Taylor Francis Group, 1st Ed. (2023). ISBN-13: 978-1003329237
 2. Finkelstein, L., *Technical Writing for Engineers & Scientists*, McGraw-Hill, 4th Ed. (2023). ISBN-13: 978-1264163120.
- Course Learning Objectives: After completing this course, a student should be able to:
 - 1) Thoroughly understand how to work in a laboratory with a focus on safety (use of PPE, waste disposal, and knowledge of common laboratory hazards and their mitigation).
 - 2) Implement good laboratory practice (GLP) to ensure proper documentation of results, accuracy of results, and adherence to written procedures to allow replication of results.
 - 3) Obtain hands-on laboratory skills using lab equipment (thermocouples, multimeters, anemometers, bridgewire fixtures, power supplies, soldering equipment, propane torches, data acquisition systems, vacuum pumps and gages, calipers, micrometers, dynamic viscometers, and a wind tunnel) along with various tools and equipment accessories.
 - 4) Corroborate experimental findings with theoretical predictions.
 - 5) Apply the scientific method to experiments, including hypothesis, deduction, extrapolation (trend analysis), and inference.
 - 6) Obtain experience reducing data including error analysis, basic statistics, basic plotting and graphing, outlier identification, propagation of errors, SI/English units, and appropriate use of implied precision and significant figures.
 - 7) Gain technical writing skills as a team and individual.

8) Obtain effective individual and team presentation skills and deliver peer review.

• Topics Covered:

- This course places an emphasis on experimental techniques, basic instrumentation, data acquisition and analysis, and written and verbal presentation of results. Experiments dealing with Thermocouples (Lab 1), Thermal Loading (Labs 2 and 3), Fins (Lab 4), heat pipes (Lab 5), power plant operation (Lab 6, individual), Pitot tubes (Lab 7), and wind tunnels (Lab 8) are covered. Empirical observations based on measurements of temperature, velocity, pressure, heat transfer, fluid flow, viscosity, buoyancy, lift, and drag are corroborated by theoretical predictions and comparison to literature values.
- Fundamental principles related to temperature measurement, resistive heating, heat dissipation by convection and radiation, thermal management, vapor-condensation cycles, electricity producing power plants, dynamic and kinematic viscosity, Newtonian and non-Newtonian flow, turbulent and non-turbulent flow, and airfoils. The importance of material traceability, precision & bias (repeatability and reproducibility), and equipment maintenance and calibration are stressed.
- Technical writing and presentation are also covered in detail, focusing on technical paper content rules, citing references, equation editing, data presentation, formatting (equations, tables, figures and graphs), rules for units, use of symbols, and rules for providing peer review.