- **Course Number and Title:** M E 345. Experimental Methods I
- **Catalog Description:** Emphasis on experimental techniques, basic instrumentation, data acquisition and analysis, and written presentation of results. Includes experiments in dynamics and deformable body mechanics.
- **Credit Hours:** 3 Credits (2+3P)
- **Prerequisite(s) / Corequisite(s)**

  Prerequisites: (M E 228 or MATH 392) and (M E 210 or PHYS 2140) and ENGR 234

  Pre / Corequisites: C E 301
- **Required:** Required for BSME and BSAE Degrees
- **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:**

  <u>After completing this course, a student should be able to:</u>

  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 (sensors, data-recording software, scales, calipers, micrometers, strain gages, tensile testing machines/load cells, vibration generators, oscilloscopes, function generators, power supplies, Wheatstone bridges, physical reference standards, and specimen preparation equipment) 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) Obtain technical writing skills as a team and individual.

8) Obtain effective team presentation skills and deliver peer review.
9) Work effectively in a team as a team lead or member (rotating roles).
10) Use software (SolidWorks and PASCO Capstone) software in labs.

- 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 discrete and continuous vibrations (Labs 2 and 2), longitudinal and transverse wave propagation (Lab 3), stress/strain and photoelasticity (Lab 4), fracture (Lab 5), nondestructive evaluation (NDE) (Lab 6), and Monte Carlo simulations (individual Lab 7) are covered.
  - Fundamental principles related to vibration, damping, harmonic oscillation, wave propagation, deformation (cantilever beam), material properties (stress/strain, elongation, modulus, creep, Poisson's ratio, tensile and bending tests), ductile/brittle failure, crack growth, fracture and fatigue, NDE (ultrasonic testing), and accept-reject criteria are covered. 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.