Engineering Technology –MET Option

Course Number and Name: ET 308L, Fluid Technology Laboratory

Credits & Contact Hours: 1cr., one weekly laboratory session of 2.5 hours.
Total semester contact hours are approximately 40.

Instructor's name: Craig Ricketts
Textbook *title,*
author, and year: *Applied Fluid Mechanics*,
Mott, R. L., 2006.
Supplemental materials: *Spreadsheet tools* provided by author on CD that accompanies textbook, for calculation of friction losses in series and parallel flow pipe systems and for pump selection. *Software application, Flowmaster of Bentley's Haestad Methods,* for open channel flow analysis and design.

Specific Course Information:

a. Course Catalog Description – Measurements in fluid statics, dynamics, and hydraulic systems.

b. Corequisite – ET 308 Fluid Technology

c. Augmenting – This is a required course in the CET and MET curricula.

Course Goals and Objectives:

Student acquires practical exposure to some of the fundamental concepts, experimental methods, and instrumentation encountered in the field of fluid technology. Also, student becomes familiar with the development and application of procedures for laboratory work and for the acquisition, processing, evaluation, and presentation of experimental data. Additionally, student gains experience in the preparation of well-organized technical reports that are accurate, comprehensive, and concise.

Related ABET Outcomes:

The **following** are the **MET** (x.) and ABET student outcomes that directly relate to Criterion 3. *An ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline;* to include:

(1.) **Algebra**, trigonometry, Boolean mathematics, calculus, statistics and probability, **fundamental principles and concepts of science and engineering technology**, **good practice in problem solving**, and **methods of standard practice in the analysis** and applied design **of mechanical systems**.
Also ABET 3.a., 3b, 3.c., 3.e, 3.g., and 3.k.

(2.) **Fundamental aspects of** AC and DC circuits, electrical components, computer programming logic, instrumentation principles, **experimental techniques**, and **methods of standard practice** in the **testing** and **evaluation** of **mechanical systems**, **safety consciousness**, **critical thinking skills**, and **codes and standards**.
Also ABET 3.a., 3b, 3.c., 3.e, 3.g., and 3.k.

(4.) **Current software corresponding to good practice in the application of mechanical engineering technologies. Software application functions to include: word processing**, **spreadsheet calculations**, **graphing**, presentation media, computer assisted drafting and manufacturing, manufacturing processes, **statistics**, **data acquisition**, project management, and the **analysis** and applied design **of systems involving** mechanisms, machines, or **fluid and thermal processes**.

Also ABET 3.a., 3b, 3.c., 3.e, 3.g., and 3.k.

Course topics and lab session hours devoted to each topic:

Topics	**Lab Hours**
· Introduction: laboratory overview, relevance, and significance	1
· Safety in laboratory practice	2
· Academic ethics: a case study in plagiarism of intellectual property in an academic laboratory setting	1
· Professional ethics: a case study in how to seek relevant counsel toward making the best decision to address ethical dilemmas in industrial practice	1
· Good practice in the graphing of experimental data for technical reports	1
· Use of codes and standards in practice	1
· Good practice guidelines for an employment search	1
· Application of sample statistics in the evaluation of experimental data	1
· Application of uncertainty analysis in the evaluation of experimental data	1
· Fluid properties, units and basic definitions; review of in practice	2
· Application of free body diagrams and equations of equilibrium in fluid systems under static equilibrium; review of in practice	3
· Viscosity measurement techniques for *Newtonian* fluids; review of in practice	2
· Pressure-height relation and forces of static fluids on submerged surfaces; review of in practice	3
· Application of buoyancy principles in fluid systems under static equilibrium	2
· Application of an inclined reservoir manometer in practice	1
· Pressure sensor calibration in practice	2
· Dimensionless No.'s in static fluid systems involving surface tension, gravity, buoyancy, and temperature, as an example	2
· Spreadsheet-based calculation of pipe and minor friction losses in viscous flow	3
· Friction loss in series flow piping systems, spreadsheet-based calculation of	3
· Friction loss in parallel flow piping systems, spreadsheet-based calculation of	3
· Generation of system resistance curve and pump selection using spreadsheets	3
· Application of software in open channel flow analysis and design	3
· Exposure to lab- and industrial-scale components such as a pump, a variable frequency drive, a diffuser, pipe and pipe fittings, flow conditioning hardware, a test section, and flow measurement and visualization techniques; via a field trip to an on-campus water channel test facility.	2

Laboratory Exercises: typical topics for four cycles, each of two consecutive lab periods (prelab exercise and laboratory report required):

Determination of the specific weight and subsequent identification of unidentified solid materials (with analytical balance and triple beam analytical balance).

Determination of the viscosity of a liquid (with sinking sphere viscometer, analytical balance, triple-beam balance, vernier caliper, linear scale, Brookfield rotating-spindle viscometer, and highly viscous liquid).

Determination of the surface tension of a liquid (with capillary tubes, vernier caliper, plug go/no-go gages, linear scale, and practical liquid, typically water).

Calibration and adjustment of pressure sensor (with gage-block, inclined reservoir manometer, variable-reluctance pressure transducer, and digital multi-meter *or* with deadweight tester and *Bourdon* tube pressure gauge).

Determination of the upstream water depth required to actuate a submerged, hinged gate (with flow bench consisting of centrifugal pump, variable-area flow meter, dual-chamber reservoir, self-actuating gate, linear scale, and optional variable-reluctance pressure transducer).

Other Typical Lab Assignments and Topics (1 lab period each):

Discussion of laboratory safety and requirements for prelab exercises and lab reports.

Exercise in academic ethics in the laboratory as foundation for the development of professional ethics in the workplace (with video film, *Laboratory Efficiency*). Concept worksheet required.

Exercise in professional ethics in practice as foundation for the development of professional ethics in the workplace (with video film, *Truesteel Affair*). Concept worksheet required.

Exercise in the good practice of graphing experimental data (with microcomputer and graphing software package). Table of data and professional-quality graph required.

Exercise on instrument performance characteristics using deadweight tester and *Bourdon* tube pressure gauge as examples. Concept worksheet required.

Exercise in the identification of various types of valves, flow meters, and pumps. Concept worksheet required.

Exercise on *Bernoulli* equation and its suitability for determining the velocity of a liquid discharge from tank with falling head. Concept worksheet required.

Field trip to water channel test facility on campus. Concept worksheet required.

Oral and Written Communication Requirements:

Students engage in discussions (led by instructor) during prelab and lab exercise sessions to share recommended techniques and procedures for relevant lab exercise. All lab exercises require a laboratory exercise documentation sheet and a memorandum report.

Prepared by: Craig Ricketts **Date**: 12/19/10