Fundamentals of Engineering Design
FED 101
2 credits

Class meetings: Thursday, 10:00 am -12:55 pm

Room 411 Tiernan Hall (Computer Lab)\Room 206 Tiernan Hall (FED Lab)

Instructor: Dr. Irina Molodetsky
Room 350 Tiernan Hall
Office hours: Monday, 1-2:30pm; Thursday: 3-5:00 pm
Please, contact by email for additional meeting
Email: Irina.Molodetsky@njit.edu

TA: Chris Dobrzanski
Room 321A Tiernan Hall
Email: cdd23@njit.edu

What you will learn from taking this course:

- Conceptual understanding of relationship between energy, pressure and fluid flow
- Elements of the flow system design
- How to measure the flow rate and relationship between the mass flowrate, volumetric flow rate and average flow velocity
- How to measure static pressure in the fluid
- How to design and build a model flow system
- How to predict and measure energy losses in a single flow system
- Different unit systems and how to perform unit conversion
- Introduction to measurements, data analysis and data reporting
- Working as a team

If you need accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services, Fenster Hall Room 260 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

Course Syllabus and Schedule

W1	Course Introduction. Instruments and engineering measurements • How to measure pressure in the gas, in liquid • How to quantify/measure fluid flow • How to control fluid flow Energy-Pressure relationship in the fluid • Pressure (gas, liquid, solid) . Static pressure. Pascal law

W2	10 minutes quiz #1 Bernoulli equation. Fluid flow characteristics • Average fluid velocity, $\bar{v}$ • Volumetric flow rate, Q • Mass flow rate, $\dot{m}$ Flowmeters • How to measure the flow rate • Principle of the rotameter (one of the types of flowmeters) • How to measure the gas (air) flowrate (air) • What are STP conditions in Engineering and SI unit systems Excel. Statistical errors. Accuracy. Precision. Design of the experiment: calibration of the flowmeter Safety lecture. Lab: Construction and measurements: calibration of flowmeter

W3	10 minutes quiz #2 Units. Primary units, SI, English. Dimension units Exercises Centrifugal pump. • Energy conversions in the flow system with a pump. • Head (units conversions) Introduction to Visio Design of the experiment: centrifugal pump Lab: construction of the experiment

W4	10 minutes quiz #3 Problem solving session (unit conversions) Lab: centrifugal pump Final report “Calibration of Flowmeter” is due

	10 minutes quiz #4
W5	Exercises and problems solving (Static, hydrostatic and dynamic pressure; ideal gas eq.of state -units) Study guide for the test

	10 minutes quiz #5
W6	Problem solving session (Bernoulli equation) Single flow through a packed column Laminar and turbulent flows. Re number. Introduction to a final design project. Design of the experiment Practice test #1 – homework

	10 minutes quiz #6
W7	Single flow through a packed column Laminar and turbulent flows. Re number. Ergun equation Ergun equation: pressure drop calculations (discussion of parameters: effective particle size; void fraction, surface area, g_c conversion factor) Practice test #2 - homework

	TEST
W8	Work on the final design (Visio) Discussion of the application of spray column, packed columns

	10 minutes quiz #7
W9	Test –lessons learned, unit conversions Ergun equation (Excel) Analysis of the final design: discussion of requirements Lab: construction

	10 minutes quiz #8
W10	Lab: construction and measurements

	10 minutes quiz #9
W11	S.Ergun paper –discussion of the concepts – Viscosity (dynamic and kinematic) Two-phase flows in the packed column – Demo in the lab Lab: construction and measurements Requirements for final presentation -uploaded

	10 minutes quiz #10
W12	Review lecture and “300 words” assignment Individual final reports are due Work on final presentation (data analysis)

W13	Meeting with individual teams to give a feedback for submitted ppt slides;

W14	Final demo and ppt presentations