Fall 2021

FED 101-007: Fundamentals of Engineering Design

Irina Molodetsky

Fundamentals of Engineering Design
FED 101
2 credits

Class meetings: FED 101-L53 Monday 8:30 am -11:20 am
FED 101-007 Wednesday 8:30 am -11:20 am

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

Instructor: Dr. Irina Molodetsky
Room 350 Tiernan Hall
Office hours: Wednesday, 1-5:00pm;
Please, contact by email for additional meeting
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FED 101 is an introduction to a chemical engineering process design. The course combines engineering science and elements of the engineering design cycle that the teams of students use to build a laboratory model of a mini-plant prototype.

At the end of this course, the successful students will:

- Know main steps of the engineering design
- Design and build a scale-down lab prototype of a mini-plant
- Know relationship between the flowrates and average flow velocity
- Measure flowrates and static pressure in the flow systems
- Know relationship between energy and pressure in the fluid
- Manipulate different units of pressure and flowrates
- Predict and measure pressure drops in the flow system
- Analyze and present experimental data
- Work in a team of peers, assess and improve collaborative environment

Details about assignments and grading policies are discussed in the "Introduction" lecture.

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 Schedule

W1	Course Introduction. Schedule and grading policy Engineering Design Cycle: problem identification Engineering Science: • Average fluid velocity, $\bar{v}$ • Volumetric flow rate, Q • Mass flow rate, $\dot{m}$ **Instruments and engineering measurements** • Flowmeters **Design of the experiment** • Flowmeter Calibration FED **Laboratory orientation**

	10 minutes quiz #1
W2	Data analysis • Working with Excel. • Statistical errors. Accuracy. Precision. • Making graphs in Excel **Lab**: Construction and measurements **Manual for the lab experiment and Template for the Lab report are uploaded.**

	10 minutes quiz #2
W3	**Units and Units Conversion** • Primary units, SI, English. Dimension units **Concepts** • Pressure. Hydrostatic pressure **Instruments and engineering measurements** • How to measure static pressure in the fluid • Bourdon gauge. Absolute pressure and gauge pressure **Lab: Completion of "Flowmeter calibration"**

	10 minutes quiz #3
W4	**Concepts** • Pressure-Energy relationship **Instruments and engineering measurements** • Centrifugal pump Design of Experiment: Exploration of Pressure drops in a flow system **Lab**: Construction and measurements **Manual for the lab experiment and Template for the Lab report are uploaded.**

	10 minutes quiz #4
W5	**Exercises and problems solving** Estimates and Analogy **Lab**: Exploration of Pressure drops in a flow system ("Pressure Drops")

	10 minutes quiz #6
W6	**Concepts** • Single flow through a packed column • Laminar and turbulent flows. **Modeling** • **Ergun equation**: **pressure drop** calculations (discussion of parameters: effective particle size; void fraction, surface area, g_c conversion factor) **Lab: Completion**: **"Pressure Drops"**

	10 minutes quiz #7
	Exercises and problems solving.
W7	Estimates and Analogy
	Lab demo: Packed Column

	TEST
W8	Discussion of the **application** of spray column and packed columns **Final design**: **discussion of requirements** Requirements for final design are uploaded. Work on the final design (Visio)

	10 minutes quiz #7

W9	Test –lessons learned **Modeling** • **Ergun equation** **Lab**: construction

	10 minutes quiz #8
W10	 **Lab**: construction and measurements.

	10 minutes quiz #9
W11	**Concepts** • Ergun equation –Viscosity (dynamic and kinematic) • Demo (class) **Lab:** construction and measurements Requirements for final presentation -uploaded

	10 minutes quiz #10
W12	Work on electronic design notebook Work on final presentation

W13	Review Lecture "300-500 words" assignment Meeting with individual teams to give a feedback for submitted ppt slides; **Final report "Pressure Drop measurements" is due** **Peers evaluation form is due**

W14	Prep for Final demo and ppt presentations (see final exam schedule)

Grading (changes may apply)

A	90 and above
B+	85 and above
B	80 and above
C+	70 and above
C	60 and above
D	50 and above
F	below 50