

Fall 2021

FED 101-L53: Fundamentals of Engineering Design

Irina Molodetsky

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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

Email: Irina.Molodetsky@njit.edu

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	<p>Course Introduction. Schedule and grading policy</p> <p>Engineering Design Cycle: problem identification</p> <p>Engineering Science:</p> <ul style="list-style-type: none"> • Average fluid velocity, \bar{v} • Volumetric flow rate, Q • Mass flow rate, \dot{m} <p>Instruments and engineering measurements</p> <ul style="list-style-type: none"> • Flowmeters <p>Design of the experiment</p> <ul style="list-style-type: none"> • Flowmeter Calibration <p>FED Laboratory orientation</p>
W2	<p>10 minutes quiz #1</p> <p>Data analysis</p> <ul style="list-style-type: none"> • Working with Excel. • Statistical errors. Accuracy. Precision. • Making graphs in Excel <p>Lab: Construction and measurements Manual for the lab experiment and Template for the Lab report are uploaded.</p>
W3	<p>10 minutes quiz #2</p> <p>Units and Units Conversion</p> <ul style="list-style-type: none"> • Primary units, SI, English. Dimension units <p>Concepts</p> <ul style="list-style-type: none"> • Pressure. Hydrostatic pressure <p>Instruments and engineering measurements</p> <ul style="list-style-type: none"> • How to measure static pressure in the fluid • Bourdon gauge. Absolute pressure and gauge pressure <p>Lab: Completion of “Flowmeter calibration”</p>

	10 minutes quiz #3
W4	<p>Concepts</p> <ul style="list-style-type: none"> • Pressure-Energy relationship <p>Instruments and engineering measurements</p> <ul style="list-style-type: none"> • Centrifugal pump <p>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.</p>

	10 minutes quiz #4
W5	<p>Exercises and problems solving</p> <p>Estimates and Analogy Lab: Exploration of Pressure drops in a flow system (“Pressure Drops”)</p>

	10 minutes quiz #6
W6	<p>Concepts</p> <ul style="list-style-type: none"> • Single flow through a packed column • Laminar and turbulent flows. <p>Modeling</p> <ul style="list-style-type: none"> • Ergun equation: pressure drop calculations (discussion of parameters: effective particle size; void fraction, surface area, g_c conversion factor) <p>Lab: Completion: “Pressure Drops”</p>

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

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

	10 minutes quiz #7
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W9	Test –lessons learned Modeling <ul style="list-style-type: none"> • Ergun equation Lab: construction
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	10 minutes quiz #8
W10	Lab: construction and measurements.

	10 minutes quiz #9
W11	Concepts <ul style="list-style-type: none"> • 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
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W14	Prep for Final demo and ppt presentations (see final exam schedule)
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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