The Jordan University

School of Engineering
Chemical Engineering Department
BSc in Chemical Engineering
Academic Year: (2020/2021)**Semester:** Second Semester

Fluid Mechanics (0905241)

Credit hours	**Three**	**Level**	**2nd yr**	**Pre-requisite**	**0905211, 0904131**
Lecturer	**Prof.**	**Office Number**		**Office phone**	

Office hours					
Day	**Sunday**	**Monday**	**Tuesday**	**Wednesday**	**Thursday**
Time					

Course Description

This course is intended for engineering students at the Department of Chemical Engineering at the Jordan University. It includes an Introduction to fluid mechanics. Fluid properties, Newton's Law of Viscosity, types of fluids. Hydrostatics, the hydrostatic equation for incompressible Fluids, manometers, pressure distribution on submerged surfaces, the center of pressure, buoyancy. Bernoulli's equation. Fluid flow measurements. Laminar and turbulent flows, fluid friction and pressure drop through pipes and fittings. Macroscopic momentum balances. Dimensional analysis, dynamics similitude. Pumps and pumping of liquids, types of pumps and their performance curves.

Intended Learning Outcomes for the course:

Upon successful completion of the course the student should be able to:

Outcome	1 to 7
1. Understand the definition of fluid mechanics and its relation to other fields of science and outline the basic ideas that form the basics of fluid mechanics.	1
2. Define and use basic properties and terminology most relevant to fluid mechanics: shear and normal stresses.	1
3. Understand the essential difference between solids and fluids in terms of their behavior under the influence of external forces.	1
4. Define viscosity and relate it to Newton's law and understand the analogy between this law and Hook's law for solids. Understand that velocity gradient is an expression of the rate of shear deformation or rate of strain.	1,2
5. Formulate force balances in static fluids and derive the basic fluid static equation relating pressure to depth. Use this equationto solve simple fluid statics problems.	1
6. Handle problems involving pressure measurements.	1
7. Apply the basic fluid static equation in handling problems involving buoyant force calculations.	1
8. Formulate the general conservation principle and apply this knowledge to formulate mass, momentum, and energy balances.	1
9. Apply the general conservation principle to obtain the continuity equation	1
10. Apply the general conservation principle to obtain Bernoulli's equation. Recognize that this equation is a special case of the energy conservation equation.	1
11. Apply Bernoulli's equation in frictionless flow problems including contractions and sudden expansions, discharge through orifices, and flow measuring devices.	1,2,6
12. Apply Bernoulli's equation in friction flow problems for incompressible fluids. Understand the meaning of friction heating and its relation to various flow situations. Distinguish the different natures of fluid flow: laminar and turbulent, and use Reynolds number as a criterion for defining the limits for these flows.	1,2
13. Determine relation for pressure drop in laminar flow and show how velocity profiles can be obtained and how they can be used to obtain average velocities and volumetric flow rates (Hagen equation). Also determine pressure drop relations for turbulent flow using charts (Moody diagram) and empirical correlations to find friction factors used in Fanning equation.	1

14. Obtain solutions for fluid flow problems in various piping systems knowing how to account for friction losses due to pipe friction, fittings and other causes.	1,2
15. Distinguish between different types of pumps (positive displacement and centrifugal). Calculate different types of heads for a centrifugal pump. Select pumps based on system requirements (system head, NPSH). Determine conditions for cavitation.	1,2
16. Apply momentum balances in one dimension to certain systems in order to obtain solutions involving forces between systems and fluids flowing through them.	1

Course Content:

Topic	Hours
1. Introduction to Fluid Mechanics	1
2. Fluid Properties	2
3. Types of Fluids	1
4. Fluid Statics	6
5. The Conservation Equation : Mass Balance (Continuity Equation)	2
6. First Law of Thermodynamics. Review and applications	2
7. Bernoulli's Equation	6
8. Fluid Flow Measurements	7
9. Fluid Flow with Friction in Steady One Dimensional Systems	10
10. Pumping of Fluids	3
11. Momentum Balance	2
12. Open Channel Flow	2

Attendance Policy:

Class attendance and participation is mandatory. University regulations will be applied.Regular attendance is essential for satisfactory completion of this course. The course is acumulative subject and each day builds on the previous day's material. If you have too many absences, you cannot develop to your fullest potential in the course.

Makeup Policy:

Any student who misses any exam will receive a failing grade. Permission for makeup will be granted only if the student notifies the instructor in due time and presents evidence of an officially excused absence.

Mobile Policy:

Cell phones ringing in class will be confiscated until the end of the semester.

Academic Honesty Policy:

Each student is expected to be honest in his/her class work or in the submission of information to the Department. Dishonesty in classroom, on assignments and examinations, and the submission of false and misleading information is considered as a serious offense. A student who cheats, plagiarizes, or furnishes false, misleading information is subject to disciplinary action according to University rules and regulations.

Learning Methodology

Formal lecturing covering the course content will be adopted. Discussion, problem solving, activities, student questions and student participation will enhance the conveying of knowledge to students. Drop quizzes are to be expected during the course.

In case where online or hybrid teaching is required, the material will be delivered to students through Zoom meetings which will be recorded and made available to students together with the lecture material itself on the e-learning platform adopted by the university at the following URL: elearning.ju.edu.jo/moodle10/

Assessment

Assessment Method	Points %
Quize	5
Midterm Exam	30
Exam	10
Other Activities	5
Final Exam	50

TEXTBOOK:

Noel de Nevers.Fluid Mechanics for Chemical Engineers, Latest Edition, McGraw-Hill International Edition.

REFERENCES:

1. James E. A. John & William L. Haberman, Introduction to Fluid Mechanics, Prentice Hall
2. V. L. Streeter & E. B. Wylie, Fluid Mechanics, McGraw-Hill.
3. F. A. Holland, Fluid Flow for Chemical Engineers, Arnold.
4. J. M. Coulson & J. F. Richardson, Chemical Engineering, Volume One, Pergamon Press.
5. Perry and Chilton, Chemical Engineers' Handbook, McGraw-Hill.

Intended Grading Scale:(May change slightly according to final class performance)

F	0 – 39
D$^-$	40 – 46
D	47 – 50
D+	51 – 54
C$^-$	55 – 58
C	59 – 62
C+	63 – 66
B$^-$	67 – 70
B	71 – 74
B+	75 – 79
A$^-$	80 – 84
A	85 – 100

- For more details on University regulations please visit: http://www.ju.edu.jo/rules/index.htm

- University Student Conduct Policy
  http://www.ju.edu.jo/Documents/%D9%85%D8%AF%D9%88%D9%86%D8%A9%20%D8%B3%D9%84%D9%88%D9%83%20%D8%A7%D9%84%D8%B7%D9%84%D8%A8%D8%A9%20.pdf

Date 20-9-2025