

**The University of Jordan  
School of Engineering**



Department	Course Name	Course Number	Semester
Mechanical Engineering	Fluid Mechanics II	0904462	

**2019 Course Catalog Description**

Review of basic definitions, system and control volume, Foundations of flow analysis, differential from of the basic laws, general viscous flow, boundary layer theory, Navier–Stokes equations, Blasius equation, Irrotational flow, stream function, vorticity and rotationality, Incompressible inviscid frictionless flow, Introduction to Aerodynamics, compressible flow, adiabatic and isentropic flow, Normal shock waves, Nozzles.

**Instructors**

Name	E-mail	Sec	Office Hours	Lecture Time

**Text Books**

	Text book 1	Supplemental material
<b>Title</b>	Engineering Fluid Mechanics	Handouts
<b>Author(s)</b>	Elger, D. F., Williams, B. C, Crowe, C. T., and Roberson, J.A.	
<b>Publisher, Year, Edition</b>	John Wiley and Sons., 2016, 11 <sup>th</sup> edition, (SI units)	

**References**

<b>Books</b>	1. Frank M. White (1999) Fluid Mechanics, (4 <sup>th</sup> Edition). McGraw- Hill. 2. Bruce R. Munson, Donald F. Young and Theodore H. Okiishi (1994) Fundamentals of Fluid Mechanics, (2 <sup>nd</sup> Edition). John Wiley and Sons.
<b>Journals</b>	-
<b>Internet links</b>	National Committee on Fluid Mechanics Films <a href="http://www.mit.edu/hml/ncfmf.html">http://www.mit.edu/hml/ncfmf.html</a>

**Prerequisites**

<b>Prerequisites by topic</b>	Numerical analysis
<b>Prerequisites by course</b>	Fluid Mechanics (I) 0904361.
<b>Co-requisites by course</b>	-
<b>Prerequisite for</b>	-

**Topics Covered**

Week	Topics	Chapter in Text	Sections
1, 2	Acceleration of a system of fluid particles, vorticity and rotation. Control volume approach and Differential form of Continuity equation.	Chapters 4&5	4.1, 4.2, 4.6-4.8; 5.3, 5.4 & 5.5
3	Differential form of Momentum and angular-momentum equations	Chapter 6	6.1, 6.4, 6.5 & 6.6
4,5	Differential form of Energy Equation in system of particles of Flowing fluids and pressure gradients, study systems of pipes and Hardy-Cross method	Chapters 7, 10 and Handouts	7.2, 7.6; 10.6, 10.7 & 10.10
6, 7	Boundary layer equations	Chapter 9 and Handouts	9.1 – 9.6
8-10	Drag and Lift, ideal flow theory, potential flow theory	Chapter 11 and Handouts	11.1 – 11.11
11-14	Compressible fluid flow	Chapter 12, 13	12.1-12.5 & 13.3

### Mapping of Course Outcomes to ABET Student Outcomes

SOs	Course Outcomes
1	1. Study flow kinematics concepts-streamlines, vorticity and rotation 2. Study the conservation of mass, momentum and energy principles using control volume approach and differential form 3. Introduction to boundary layer theory and surface resistance 4. Study the compressible flow and the related phenomena such as shock waves
2	5. Introduction to aerodynamics and study the important parameters as drag and lift forces

Evaluation	
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Assessment Tools	Expected Due Date	Weight
Assignments		25 %
Midterm Exam		25 %
Final Exam		50 %

Contribution of Course to Meet the Professional Components	
1. <b>Professionalism</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>1.1. Demonstrate a commitment to the profession of nursing.</li> <li>1.2. Demonstrate a commitment to the profession of nursing.</li> <li>1.3. Demonstrate a commitment to the profession of nursing.</li> <li>1.4. Demonstrate a commitment to the profession of nursing.</li> <li>1.5. Demonstrate a commitment to the profession of nursing.</li> <li>1.6. Demonstrate a commitment to the profession of nursing.</li> <li>1.7. Demonstrate a commitment to the profession of nursing.</li> <li>1.8. Demonstrate a commitment to the profession of nursing.</li> <li>1.9. Demonstrate a commitment to the profession of nursing.</li> <li>1.10. Demonstrate a commitment to the profession of nursing.</li> </ul>
2. <b>Communication</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>2.1. Demonstrate effective communication skills.</li> <li>2.2. Demonstrate effective communication skills.</li> <li>2.3. Demonstrate effective communication skills.</li> <li>2.4. Demonstrate effective communication skills.</li> <li>2.5. Demonstrate effective communication skills.</li> <li>2.6. Demonstrate effective communication skills.</li> <li>2.7. Demonstrate effective communication skills.</li> <li>2.8. Demonstrate effective communication skills.</li> <li>2.9. Demonstrate effective communication skills.</li> <li>2.10. Demonstrate effective communication skills.</li> </ul>
3. <b>Leadership</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>3.1. Demonstrate leadership skills.</li> <li>3.2. Demonstrate leadership skills.</li> <li>3.3. Demonstrate leadership skills.</li> <li>3.4. Demonstrate leadership skills.</li> <li>3.5. Demonstrate leadership skills.</li> <li>3.6. Demonstrate leadership skills.</li> <li>3.7. Demonstrate leadership skills.</li> <li>3.8. Demonstrate leadership skills.</li> <li>3.9. Demonstrate leadership skills.</li> <li>3.10. Demonstrate leadership skills.</li> </ul>
4. <b>Education</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>4.1. Demonstrate education skills.</li> <li>4.2. Demonstrate education skills.</li> <li>4.3. Demonstrate education skills.</li> <li>4.4. Demonstrate education skills.</li> <li>4.5. Demonstrate education skills.</li> <li>4.6. Demonstrate education skills.</li> <li>4.7. Demonstrate education skills.</li> <li>4.8. Demonstrate education skills.</li> <li>4.9. Demonstrate education skills.</li> <li>4.10. Demonstrate education skills.</li> </ul>
5. <b>Research</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>5.1. Demonstrate research skills.</li> <li>5.2. Demonstrate research skills.</li> <li>5.3. Demonstrate research skills.</li> <li>5.4. Demonstrate research skills.</li> <li>5.5. Demonstrate research skills.</li> <li>5.6. Demonstrate research skills.</li> <li>5.7. Demonstrate research skills.</li> <li>5.8. Demonstrate research skills.</li> <li>5.9. Demonstrate research skills.</li> <li>5.10. Demonstrate research skills.</li> </ul>
6. <b>Quality Improvement</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>6.1. Demonstrate quality improvement skills.</li> <li>6.2. Demonstrate quality improvement skills.</li> <li>6.3. Demonstrate quality improvement skills.</li> <li>6.4. Demonstrate quality improvement skills.</li> <li>6.5. Demonstrate quality improvement skills.</li> <li>6.6. Demonstrate quality improvement skills.</li> <li>6.7. Demonstrate quality improvement skills.</li> <li>6.8. Demonstrate quality improvement skills.</li> <li>6.9. Demonstrate quality improvement skills.</li> <li>6.10. Demonstrate quality improvement skills.</li> </ul>
7. <b>Healthcare Policy</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>7.1. Demonstrate healthcare policy skills.</li> <li>7.2. Demonstrate healthcare policy skills.</li> <li>7.3. Demonstrate healthcare policy skills.</li> <li>7.4. Demonstrate healthcare policy skills.</li> <li>7.5. Demonstrate healthcare policy skills.</li> <li>7.6. Demonstrate healthcare policy skills.</li> <li>7.7. Demonstrate healthcare policy skills.</li> <li>7.8. Demonstrate healthcare policy skills.</li> <li>7.9. Demonstrate healthcare policy skills.</li> <li>7.10. Demonstrate healthcare policy skills.</li> </ul>
8. <b>Healthcare Law</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>8.1. Demonstrate healthcare law skills.</li> <li>8.2. Demonstrate healthcare law skills.</li> <li>8.3. Demonstrate healthcare law skills.</li> <li>8.4. Demonstrate healthcare law skills.</li> <li>8.5. Demonstrate healthcare law skills.</li> <li>8.6. Demonstrate healthcare law skills.</li> <li>8.7. Demonstrate healthcare law skills.</li> <li>8.8. Demonstrate healthcare law skills.</li> <li>8.9. Demonstrate healthcare law skills.</li> <li>8.10. Demonstrate healthcare law skills.</li> </ul>
9. <b>Healthcare Ethics</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>9.1. Demonstrate healthcare ethics skills.</li> <li>9.2. Demonstrate healthcare ethics skills.</li> <li>9.3. Demonstrate healthcare ethics skills.</li> <li>9.4. Demonstrate healthcare ethics skills.</li> <li>9.5. Demonstrate healthcare ethics skills.</li> <li>9.6. Demonstrate healthcare ethics skills.</li> <li>9.7. Demonstrate healthcare ethics skills.</li> <li>9.8. Demonstrate healthcare ethics skills.</li> <li>9.9. Demonstrate healthcare ethics skills.</li> <li>9.10. Demonstrate healthcare ethics skills.</li> </ul>
10. <b>Healthcare Economics</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>10.1. Demonstrate healthcare economics skills.</li> <li>10.2. Demonstrate healthcare economics skills.</li> <li>10.3. Demonstrate healthcare economics skills.</li> <li>10.4. Demonstrate healthcare economics skills.</li> <li>10.5. Demonstrate healthcare economics skills.</li> <li>10.6. Demonstrate healthcare economics skills.</li> <li>10.7. Demonstrate healthcare economics skills.</li> <li>10.8. Demonstrate healthcare economics skills.</li> <li>10.9. Demonstrate healthcare economics skills.</li> <li>10.10. Demonstrate healthcare economics skills.</li> </ul>

The course contributes to building fundamental concepts of real fluid flow dynamics and motion analysis and compressible fluid flow, turbomachinery, drag and Lift and flow networks piping systems.

Relationship to Student Outcomes	
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SOs	1	2	3	4	5	6	7
Availability	X	X					

Relationship to Mechanical Engineering Program Objectives (MEPOs)	
1. Design a mechanical system that meets the requirements of a given application.	MEPO 1: Design a mechanical system that meets the requirements of a given application.
2. Analyze the mechanical system to determine its performance and identify areas for improvement.	MEPO 2: Analyze the mechanical system to determine its performance and identify areas for improvement.
3. Manufacture the mechanical system using appropriate manufacturing processes and materials.	MEPO 3: Manufacture the mechanical system using appropriate manufacturing processes and materials.
4. Maintain and repair the mechanical system to ensure its proper operation.	MEPO 4: Maintain and repair the mechanical system to ensure its proper operation.

MEPO1	MEPO2	MEPO3	MEPO4	MEPO5

ABET Student Outcomes (SOs)	
1	Apply knowledge of computing concepts by applying general theory and a formal discipline to specific problem domains.
2	Design and implement digital-based computer systems that meet the desired specifications and constraints.
3	Design and implement computer-based systems to meet human needs, including user requirements, system requirements, and system constraints.
4	Design and implement computer-based systems that are secure, reliable, and efficient.
5	Design and implement computer-based systems that are scalable, flexible, and adaptable.
6	Design and implement computer-based systems that are interoperable with other systems.
7	Design and implement computer-based systems that are maintainable and updatable.
8	Design and implement computer-based systems that are cost-effective.
9	Design and implement computer-based systems that are environmentally sound.
10	Design and implement computer-based systems that are socially responsible.
11	Design and implement computer-based systems that are ethically sound.
12	Design and implement computer-based systems that are legally compliant.
13	Design and implement computer-based systems that are culturally sensitive.
14	Design and implement computer-based systems that are accessible to all users.
15	Design and implement computer-based systems that are user-friendly.
16	Design and implement computer-based systems that are easy to learn and use.
17	Design and implement computer-based systems that are easy to teach and learn.
18	Design and implement computer-based systems that are easy to maintain and update.
19	Design and implement computer-based systems that are easy to integrate with other systems.
20	Design and implement computer-based systems that are easy to deploy and operate.
21	Design and implement computer-based systems that are easy to test and debug.
22	Design and implement computer-based systems that are easy to document and communicate.
23	Design and implement computer-based systems that are easy to manage and control.
24	Design and implement computer-based systems that are easy to monitor and evaluate.
25	Design and implement computer-based systems that are easy to improve and enhance.
26	Design and implement computer-based systems that are easy to upgrade and replace.
27	Design and implement computer-based systems that are easy to migrate and transfer.
28	Design and implement computer-based systems that are easy to backup and restore.
29	Design and implement computer-based systems that are easy to archive and retrieve.
30	Design and implement computer-based systems that are easy to search and find.
31	Design and implement computer-based systems that are easy to share and distribute.
32	Design and implement computer-based systems that are easy to access and use.
33	Design and implement computer-based systems that are easy to learn and use.
34	Design and implement computer-based systems that are easy to teach and learn.
35	Design and implement computer-based systems that are easy to maintain and update.
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48	Design and implement computer-based systems that are easy to share and distribute.
49	Design and implement computer-based systems that are easy to access and use.
50	Design and implement computer-based systems that are easy to learn and use.

<b>1</b>	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
<b>2</b>	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
<b>3</b>	An ability to communicate effectively with a range of audiences
<b>4</b>	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
<b>5</b>	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
<b>6</b>	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
<b>7</b>	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Updated by ABET Committee, 2021
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