

**The Islamic University of Gaza**  
**Civil Engineering Department**  
**First Semester**



**Course Title:** Fluid Mechanics, ECIV 3321

**Text Book:** *Fluid Mechanics*, by Douglas, J.F., Gasiorek, J. M., Swaffield, J. A., Jack, L.B.

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**OBJECTIVES:**

Introduce the engineering students to the principles of fluid mechanics and the application of theories to typical engineering problems such as flow in pipes, fluid measurement, and calculation of fluid forces. Students completing this course should have the tools necessary for the analysis of field problems in fluid mechanics.

**COURSE CONTENT:**

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**PART1: ELEMENTS OF FLUID MECHANICS**

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**Chapter 1: Fluid and Their Properties**

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|------------|---------------------------------------|
| 1.1        | Fluids                                |
| 1.2        | Shear stress in a moving fluid.       |
| 1.3        | Difference between solids and fluids. |
| 1.4        | Newtonian and non-Newtonian fluids    |
| 1.5        | Liquids and gases                     |
| 1.8, 1.9   | Density, Viscosity                    |
| 1.12, 1.13 | Surface tension, Capillarity          |
| 1.16       | Compressibility and the bulk modulus  |
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**Chapter 2: Pressure and Head.**

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| 2.1        | Static of fluid systems                                                                             |
| 2.2        | Pressure                                                                                            |
| 2.3        | Pascal's law of pressure at a point                                                                 |
| 2.4        | Variation of pressure vertically in a fluid under gravity                                           |
| 2.5        | Equation of pressure at same level in static fluid                                                  |
| 2.6        | General equation for the variation of pressure due to gravity from point to point in a static fluid |
| 2.7        | Variation of pressure with altitude in a fluid of constant density                                  |
| 2.13, 2.14 | Pressure and Head, The hydrostatic paradox                                                          |
| 2.15       | Pressure measurements by manometer                                                                  |
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**Chapter 3: Static Forces on Surfaces – Buoyancy.**

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|----------|-----------------------------------------------------------------------------------|
| 3.1      | Action of fluid pressure on a surface.                                            |
| 3.2      | Resultant force and center of pressure on a plane surface under uniform pressure. |
| 3.3      | Resultant force and center of pressure on a plane surface immersed in a liquid.   |
| 3.4      | Pressure diagram.                                                                 |
| 3.5      | Force on a curved surface due to hydrostatic pressure                             |
| 3.6, 3.7 | Buoyancy, Equilibrium of floating bodies                                          |
| 3.8, 3.9 | Stability of submerged bodies, Stability of floating bodies                       |
| 3.10     | Determination of metacentric height                                               |
| 3.11     | Determination of the position of metacentric relative to the center of buoyancy.  |
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**PART2: CONCEPTS OF FLUID FLOW**

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**Chapter 4: Motion of Fluid Particles and Streams.**

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| 4.1  | Fluid flow                           |
| 4.2  | Uniform flow and steady flow.        |
| 4.4  | Real and ideal fluids                |
| 4.5  | Compressible and incompressible flow |
| 4.6  | One, two, and three dimensional flow |
| 4.10 | Laminar and turbulent flow           |
| 4.11 | Discharge and mean velocity          |
| 4.12 | Continuity of flow                   |

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**Chapter 5: The momentum Equation and its Applications.**

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| 5.1 | Momentum and fluid flow                                                 |
| 5.2 | Momentum equation for two and three dimensional flow along a streamline |
| 5.5 | Force exerted by a jet striking a flat plate                            |
| 5.6 | Force due to the deflection of a jet by curved vane                     |
| 5.8 | Force on pipe bends and closed conduits                                 |
| 5.9 | Reaction of jet                                                         |

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**Chapter 6: The energy Equation and its Application.**

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|------------|-------------------------------------------------------------------------------|
| 6.1        | Mechanical energy of flowing fluid.                                           |
| 6.2        | Steady flow energy equation.                                                  |
| 6.4        | Application of the steady flow energy equation.                               |
| 6.5        | Representation of energy changes in a fluid system.                           |
| 6.6        | The Pitot tube.                                                               |
| 6.9        | Changes of pressure in a tapering pipe.                                       |
| 6.10       | Principle of the venturi meter.                                               |
| 6.11       | Pipe orifices.                                                                |
| 6.12       | Limitation on the velocity of flow in a pipeline.                             |
| 6.13, 6.14 | Theory of small orifices discharging to atmosphere, Theory of large orifices. |
| 6.15       | Elementary theory of notch and weirs.                                         |
| 6.16       | The power of a stream of fluid.                                               |

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**Chapter 7 (Optional): Water Flow in Pipes**

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**References:**

1. Mechanics of Fluids, Massey B S., Van Nostrand Reinhold.
2. Civil Engineering Hydraulics, Featherstone R E and Nalluri C, Blackwell Science.