

**Mechanical and Aerospace Engineering**  
**MAE 3420**  
**Fluid Mechanics**

**Syllabus**

**Course Description:**

MAE 3420 – Application of fluid dynamic theory to inviscid and viscous, incompressible and compressible, external and internal fluid flows with an emphasis on laminar and turbulent boundary layers. 3 credits, F

**Prerequisites:** ENGR 2030, MAE 2200, 2300 (MAE 2200 may be taken concurrently)

**Textbooks:** The text is **Fluid Mechanics – Fundamentals and Applications**, 1<sup>st</sup> edition, by Yunus A. Cengel and John M. Cimbala.

**Course Objectives:**

To study fluid dynamic theory with application to inviscid and viscous, incompressible and compressible, external and internal flow problems.

**Topics Covered:**

<ul style="list-style-type: none"><li>➤ Definition of a fluid, dimension and units</li><li>➤ Properties of a fluid</li><li>➤ Flow analysis techniques</li><li>➤ Pressure, pressure gradient, equilibrium of a fluid element</li><li>➤ Hydrostatics</li><li>➤ Buoyancy and stability</li><li>➤ Rigid body motion</li><li>➤ Reynolds transport theorem</li><li>➤ Conservation equations</li><li>➤ Bernoulli's equation</li><li>➤ Differential form of conservation equations</li><li>➤ Vorticity and irrotationality</li></ul>	<ul style="list-style-type: none"><li>➤ Potential flows</li><li>➤ Incompressible viscous flows</li><li>➤ Dimensional analysis and similarity</li><li>➤ Non-dimensionalization of basic equations</li><li>➤ Reynolds number regimes, internal and external flows</li><li>➤ Turbulence and turbulent shear correlations</li><li>➤ Flow in a circular pipe</li><li>➤ Flow in non-circular ducts</li><li>➤ Minor losses</li><li>➤ Boundary layer equations</li><li>➤ Experimental external flows</li></ul>
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**Class Schedule:**

Three 50 minute classes, M-W-F

**Contribution of course to meeting the professional component:**

This course covers the basic principles and applications of fluid flow theory appropriate for a student in the aerospace or thermal sciences field of study. Contributes toward the 1.5 year engineering topic requirement.

**Relationship of course to program objectives:**

The students will be exposed to concepts in the areas of:

- 1) Multi-variable calculus
- 2) Differential equations
- 3) Calculus-based physics
- 4) Fluid mechanics
- 5) Thermal sciences.

Knowledge in these topics contributes to the students understanding of the basic engineering sciences necessary to succeed in graduate school or in the work force.