



**THE OHIO STATE UNIVERSITY**  
COLLEGE OF ENGINEERING

# One Dimensional Gas Dynamics

## AEROENG 3570

**Credit Hours:**

3.00

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**Course Levels:**

Undergraduate (1000-5000 level)

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**Course Components:**

Lecture

Lab

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**Course Description:**

Continuation of viscous flows and boundary layers. One-dimensional gas dynamics including shocks, waves, supersonic, and transonic flow.

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**Prerequisites and Co-requisites:**

Prereq: 3560 (560 and 570), and enrollment as AeroEng-BS student (No pre-majors can enroll in this class).

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**Course Goals / Objectives:**

- Educate students in the physical principles, concepts and mathematical analysis that are unique to fluid flow of compressible media
  - Enable students to analyze, develop models for, and to compute solutions for problems encountered in aeronautical and astronautical applications
  - Develop understanding of the societal, government, and industrial significance of their work so that they can plan their work to effect the most desirable solutions of problems
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**Course Topics:**

- Compressibility, review of thermodynamics
  - Conservation of mass, momentum, energy
  - One-dimensional flow, speed of sound, isentropic flow relations Quasi-one-dimensional flow, normal shock waves, Rankine-Hugoniot relations, nozzles
  - Oblique shock waves, Prandtl-Meyer function
  - Wave reflections: walls, free flows
  - Adiabatic flow with friction Fanno Line
  - Frictionless flow with heat addition, Rayleigh line
  - Flow in a variable area duct with friction Flow in a variable area duct with heat addition
  - Combustion; combustion waves
  - Diffusers and wind tunnels
  - Moving shock waves, expansions, x-t diagrams Sound waves and x-t diagrams
  - The shock tube problem
  - Travelling and standing waves
  - Design example, Diamond airfoil
  - Linear and nonlinear waves Supersonic wind tunnels
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**Designation:**

Required