THE OHIO STATE UNIVERSITY COLLEGE OF ENGINEERING

One Dimensional Gas Dynamics

AEROENG 3570

Credit Hours:

3.00

Course Levels:

Undergraduate (1000-5000 level)

Course Components:

Lecture Lab

Course Description:

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

Prerequisites and Co-requisites:

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

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

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

Designation:

Required