Approval: 3rd Senate Meeting

ME614 Compressible Flow and Gas Dynamics

Credit: 3

Prerequisites: Fluid Mechanics, Thermodynamics, Conservation Laws

Students intended for: MS/PhD

Elective or Core: Elective Semester: Odd/Even

Course objective: The course aims to provide students understanding in compressible flow problems commonly encountered in basic engineering applications, including, but not limited to, nozzle flows, shock wave motion, moving and oblique shocks, natural gas flow in pipelines, Prandtl-Meyer Flow, Fanno Flow, Rayleigh Flow, and reaction propulsion systems. etc. The course builds on previous concepts learned in basic courses in thermodynamics and fluid mechanics.

Course content:

- **Introduction: G**as dynamics, review of basic mass, momentum and energy conservation lass for compressible flows, speed of sound, wave equation, regimes of mach number, shocks , wave propagation, sound speed, Mach number, isentropic flow, static and stagnation properties, [6]
- **One Dimensional Flow:** Converging-diverging nozzles, shock waves, moving and reflected waves, blast waves, wind tunnels, supersonic engines [8]
- **Two Dimensional Flow:** Oblique shock wave theory, conical oblique shock waves, Prandtl-Mayer expansion Fans, supersonic inlets and diffusers. [8]
- **Compressible Pipe Flow:** Fanno-Line flow, Rayleigh pipe flow, natural gas flow in pipelines [3]
- **Compressible Potential Flow:** Method of characteristics, supersonics nozzle design [6]

Suggested Books:

J.D. Anderson, Modern Compressible Flow (With Historical Perspective), McGraw-Hill (2nd-Edition), 1990

S M Yahya , Fundamentals of Compressible Flow, New Age International 2010

Shapiro, Ascher H., Dynamics and thermodynamics of compressible fluid flow, John Wiley 1953