ENAE683 – High-Temperature Gas Dynamics

**Description:** This course deals with flows in which the local temperature becomes sufficiently high that the perfect-gas approximation no longer holds. Topics to be covered include:
- Introductory kinetic theory, chemical thermodynamics and statistical mechanics
- The ideal dissociating gas (IDG): equilibrium and nonequilibrium
- Vibrational nonequilibrium
- Normal and oblique shocks, expansions
- Propagation of sound waves
- Nozzle flows
- Curved shocks/blunt-body flows
- Viscous flows/chemically reacting boundary layers
- Radiative gas dynamics
- Facilities for simulating high-temperature flows

**Instructor:** Dr. Stuart Laurence, Glenn L. Martin Hall 3184
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**Class Schedule:** Tuesdays and Thursdays, 12:30 – 1:45, EGR 3102

**Office hours:** Wednesdays, 1pm or by appointment

**Prerequisites:** Graduate or advanced undergraduate course in compressible flow (ENAE674 or equivalent)

**Coursework:** Coursework will consist of biweekly homework assignments (~65% of grade) and one final project/exam (35%)

**Textbooks:** None required. The following may be helpful:

1. J. Anderson, Hypersonic and High-Temperature Gas Dynamics: modern text, conversational in style; covers numerical techniques but not all the theoretical aspects we will be considering (e.g., IDG).
2. W. G. Vincenti & C. H. Kruger, Introduction to Physical Gas Dynamics: classic text on subject, doesn’t cover modern numerical techniques
3. J. F. Clarke & M. McChesney, The Dynamics of Real Gases
4. W. H. Dorrance, Viscous Hypersonic Flow: covers reacting boundary-layer theory