Course Code and Title: ENFP630, *Diffusion Flames and Burning Rate Theory*

Credits: 3

Contact hours: Two meetings weekly, 75 minutes each

Instructor, term: Peter Sunderland, Spring 2026

Textbook: S.R. Turns, D.C. Haworth, *An Introduction to Combustion Concepts and Applications*, McGraw Hill, New York, (4th edition, 2021, preferred) $50.

Catalog description: *Basic principles of diffusion flames for gaseous, liquid, and solid fuels. Droplet burning, B number, jet combustion, boundary layer combustion, generalized methods.*

Prerequisite: ENFP312

Upon completion of this course, students should be able to demonstrate the following sspecific outcomes of instruction.

- An understanding of advanced diffusion flame theory, including thermodynamics, transport, heat transfer, and chemistry.
- The ability to apply advanced mathematics and physics to solve complex problems in reacting flows for the below list of topics.
- The ability to study and summarize important research papers.
- The ability to use Cantera to perform detailed simulations of reacting flows.

ABET student outcomes assessed: Not applicable

The brief list of topics covered is as follows.

- Ideal gases, stoichiometry, and mixture fraction.
- First Law of Thermodynamics for reacting flows.
- Equilibrium, Law of Mass Action, and Arrhenius reactions.
- Conservation of mass, species, and energy.
- Laminar and turbulent jet diffusion flames and fires.
- State relationships.
- Droplet evaporation and burning. Particle combustion. Stagnant-film fires.
- Cantera python simulations.