

## **ENFP405 Structural Fire Protection**

*Credits:* Three (3)

*Contact hours:* Two lectures per week, 75 minutes each.

*Table 5-1 category:* engineering topic

*Instructor:* Ni

*Textbook:* Buchanan, A., Structural Design for Fire Safety, NY, John Wiley, 2001.

*Other supplemental materials:*

SFPE Handbook of Fire Protection Engineering, 5<sup>th</sup> Edition, M. Hurley (ed), New York: Springer, 2015.

ASCE/SFPE 29, Standard Calculation Methods for Structural Fire Protection, Reston, VA, ASCE, 2005

*Catalog description:*

Effects of elevated temperature on structural materials; steel, concrete, wood, gypsum, glass and reinforced plastics. Experimental evaluation of fire resistance of building assemblies. Analytical methods to evaluate fire resistance of structural members.

*Prerequisites and Corequisites:*

Prerequisite: ENES220. Restriction: Must be in Engineering: Fire Protection program; and permission of ENGR-Fire Protection Engineering department.

*Table 5-1 Course Type:* Required

*Specific outcomes of instruction:*

Upon completion of this course the students should be able to:

- Interpret the intentions of code requirements for fire safety
- Explain the concept of fire resistance
- Develop time-temperature curves for fully developed compartment fires
- Quantify the effects of fire on material properties and on forces in structural systems
- Analyze/design simple steel, concrete, timber and masonry elements in the fire situation

*Student outcomes assessed:* SO2\*, SO10\*, SO1, SO2.4, SO6.3

*Brief list of topics covered:*

- Fire Endurance Requirements for Construction Assemblies.
- Fire Endurance Tests: building construction assemblies, protection of wall openings, overview of standard test methods, performance criteria, and non-standard evaluations
- Review of Mechanics: applied loads, load combinations, beam analysis, stability/buckling analysis
- Thermal actions: nominal fire curves and physics-based fire models (parametric fire model and localized fire models)

- Performance-based design and prescriptive design in structural fire protection: differences, advantages, and disadvantages
- Evaluating the Fire Resistance of Timber Structural Elements: material properties, effect of fire exposure, glue-laminated members, and critical char depth
- Evaluating the Fire Resistance of Steel Structural Elements: material properties, empirical correlations for columns, beams and trusses, thermal response, mechanics-based approach, response of structural frames
- Evaluating the Fire Resistance of Concrete & Masonry Assemblies: material properties, empirical correlations, thermal analysis via graphs/tables, moment-bearing capacity analysis