

ENFP - ENGINEERING, FIRE PROTECTION

ENFP405 Structural Fire Protection (3 Credits)

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.

Prerequisite: ENES220.

Jointly offered with: ENFP621.

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

Credit Only Granted for: ENFP405 or ENFP621.

ENFP410 Special Hazard Suppression Systems (3 Credits)

Analysis of application and theory of fire suppression systems. The key elements of fire suppression systems will be discussed along with how they interact for effective fire suppression design. Physical mechanisms for a variety of fire suppression approaches will be discussed including hose streams, sprinklers, water mist, foam, clean agents, and chemical agents.

Prerequisite: ENFP310 and ENFP312.

Jointly offered with: ENFP610.

Restriction: Permission of ENGR-Fire Protection Engineering department.

Credit Only Granted for: ENFP410, ENFP610 or ENFP653.

ENFP411 Risk-Informed Performance Based Design (3 Credits)

Appraisal and measurement of fire safety. Application of systems analysis, probability theory, engineering economy and risk management in the identification and synthesis of components of fire protection engineering. Methods for the development of criteria for the design, evaluation and assessment of fire safety or component hazards.

Restriction: Senior standing; or permission of ENGR-Fire Protection Engineering department.

ENFP413 Human Response to Fire (3 Credits)

Fractional effective dose (FED) methods for predicting time to incapacitation and death of fires for use in fire safety calculations. Physiology and toxicology of the fire effluent components, decomposition chemistry of common materials, standard experimental approaches. Predictive models of material production rates. People movement characteristics related to building evacuation. Formulation and application of evacuation models. Human behavior factors affecting response of people to fire situations.

Prerequisite: ENFP250.

Restriction: Permission of ENGR-Fire Protection Engineering department. Jointly offered with ENFP613.

Credit Only Granted for: ENFP413 or ENFP613.

ENFP415 Fire Dynamics (3 Credits)

Designed to give students a quantitative understanding of fire behavior. The fundamentals of physics and chemistry of combustion are presented and used to derive key analytical relationships that describe fire growth. Application of these relationships to the analysis of common fire scenarios is emphasized.

Prerequisite: ENFP312.

Restriction: Permission of ENGR-Fire Protection Engineering department. Jointly offered with ENFP651.

Credit Only Granted for: ENFP415 or ENFP651.

ENFP420 Fire Assessment Methods and Laboratory (4 Credits)

Experimental evaluation of ignition, flame spread, rate of heat release and smoke production of flammable gases, liquids, solids, and interior finish materials. Analytical and computer methods for the design, performance, and analysis of fire experiments. Preparation of laboratory reports.

Prerequisite: Student must have senior standing; and minimum grade of C- in ENFP312.

Restriction: Must be in Engineering: Fire Protection program.

Credit Only Granted for: ENFP320 or ENFP420.

Formerly: ENFP320.

ENFP425 Enclosure Fire Modeling (3 Credits)

An introduction to enclosure fire dynamics through the development of fire modeling algorithms and the application of computer-based fire modeling techniques. The objectives of the course are: to provide a basic understanding of enclosure fire dynamics with an emphasis on a system-level viewpoint (i.e., a global description of the coupling between combustion dynamics, smoke filling, vent flows and heat transfer); and to provide an introduction to the zone modeling approach. Topics covered include a review of the mathematical formulation of zone models, a discussion of numerical integration of the zone modeling equations (using MATLAB), and an introduction to zone modeling software used by professional engineers (e.g., CFAST).

Prerequisite: ENES232, ENFP300, and ENFP312.

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

ENFP426 Computational Methods in Fire Protection (3 Credits)

Introduction to computer-based fire modeling: zone modeling and Computational Fluid Dynamics (CFD); documentation of input data, validation and verification tests.

Recommended: ENFP425.

Restriction: Permission of ENGR-Fire Protection Engineering department.

ENFP429 Independent Studies (1-3 Credits)

For students who have definite plans for individual study of approved problems, or study of an advanced topic selected in conjunction with the faculty.

Prerequisite: Permission of ENGR-Fire Protection Engineering department.

Restriction: Must be in Engineering: Fire Protection program.

Repeatable to: 6 credits if content differs.

ENFP440 Smoke Management and Fire Alarm Systems (3 Credits)

Analysis of hazard posed by smoke in buildings. Performance characteristics of smoke management systems. Review of analytical design aids. Functional analysis and design of fire detection and alerting systems. Examination and evaluation of code criteria, performance specifications and research.

Prerequisite: Must have completed with a C- or better or concurrently be enrolled in ENFP300.

Jointly offered with: ENFP627.

Restriction: Permission of ENGR-Fire Protection Engineering department.

Credit Only Granted for: ENFP440 or ENFP627.

ENFP461 Think Tank (3 Credits)

Designed to have the student apply critical thinking in both engineering and business terms through a unique combination of student-driven, competition-based, long-term, targeted learning.

Recommended: Junior standing in fire protection engineering.

Restriction: Permission of ENGR-Fire Protection Engineering department.

ENFP464 Industrial Fire Safety (3 Credits)

Designed to introduce students to the basics of process safety with a focus on the methods and techniques that may be utilized when evaluating the existing or proposed safety protection solutions in industrial facilities. An emphasis is placed on properly identifying the hazards that are present, the risk exposure, and how best to address the risk. The foundation is laid by presenting the necessary background information on industrial processes and integrating this information with applicable fire/explosion safety science.

Prerequisite: Students must be of senior standing.

Restriction: Permission of ENGR-Fire Protection Engineering department. Also offered as: ENFP664.

Credit Only Granted for: ENFP464, ENFP489I, ENFP629I OR ENFP664.

Formerly: ENFP489I.

Additional Information: The course will be taught as a dual senior-level undergraduate course and graduate course.

ENFP465 Fire and Explosion Investigations (3 Credits)

This course covers many aspects of fire and explosion investigation and reconstruction. Information on field techniques, applicable standards, and best practices are presented with an emphasis on how fire science and fire dynamics can be applied to forensic analysis. Experiments are performed and analyzed to demonstrate the concepts.

Prerequisite: Student should have senior standing.

Jointly offered with: ENFP665.

Restriction: Permission of ENGR-Fire Protection Engineering department.

Credit Only Granted for: ENFP489N, ENFP629N, ENFP465 OR ENFP665.

Formerly: ENFP489N.

ENFP467 Wildland Fires: Science and Applications (3 Credits)

Introduction to the global problem of wildland fires with an overview of the social, political and environmental issues posed as well as detailed coverage of the science, technology and applications used to predict, prevent and suppress wildland fires.

Prerequisite: ENFP312.

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

Credit Only Granted for: ENFP489W, ENFP629W, or ENFP667.

Formerly: ENFP489W.

ENFP489 Special Topics (3 Credits)

Selected topics of current importance to fire protection.

Prerequisite: Permission of ENGR-Fire Protection Engineering department.

Repeatable to: 6 credits.

ENFP601 Introduction to Fire Protection Engineering (3 Credits)

The basic concepts of life safety, water-based fire protection systems, building construction, codes and standards along with tenability, fire behavior, and human behavior are introduced along with traditional and performance-based approaches for analyzing human response to fire. Students learn to analyze the egress systems and design basic water-based fire suppression systems.

Additional Information: Highly recommended to incoming graduate students to Fire Protection Engineering who have not earned a Bachelor's Degree in Fire Protection Engineering.

ENFP610 Advanced Special Hazard Suppression Systems (3 Credits)

Issues related to the suppression of fires and the design of fire suppression systems. Theoretical aspects of fire suppression and extinction are considered to provide the foundation for the practical design of different types of fire suppression systems. Focus on water-based and "clean agent" fire suppression systems, with emphasis on high challenge and special hazard applications. Systems using other agents are introduced, but are not addressed in detail.

Jointly offered with: ENFP410.

Credit Only Granted for: ENFP410, ENFP610 or ENFP653.

ENFP613 Advanced Life Safety Analysis (3 Credits)

Fractional effective dose (FED) methods for predicting time to incapacitation and death of fires for use in fire safety engineering calculations. Physiology and toxicology of fire effluent components, decomposition chemistry of common materials, standard experimental approaches. Predictive models of material production rates. People movement characteristics related to building evacuation. Formulation and application of evacuation models. Human behavior factors affecting response of people to fire situations.

Restriction: Permission of ENGR-Fire Protection Engineering department.

Credit Only Granted for: ENFP413 or ENFP613.

ENFP619 Graduate Seminar (1-3 Credits)

Prerequisite: Permission of ENGR-Fire Protection Engineering department.

Restriction: Must be in ENGR: MS Only-Fire Protection Engineering (Master's) program.

Repeatable to: 3 credits.

ENFP620 Fire Dynamics Laboratory (3 Credits)

Laboratory experiments are designed to illustrate fire phenomena and test theoretical models. Diffusion flames, ignition and flame spread on solids, liquid pool fires, wood crib fires, fire plumes, compartment fires.

Recommended: ENFP415.

ENFP621 Analytical Procedures of Structural Fire Protection (3 Credits)

Analysis procedures for structural components of wood, steel, concrete, composites. Structural capabilities, modifications under fire induced exposures. Calculations, computer models for predicting fire resistance ratings of structural components.

Prerequisite: ENFP312. Cross-listed with ENFP621.

Credit Only Granted for: ENFP405 or ENFP621.

ENFP625 Advanced Fire Modeling (3 Credits)

Validity, utility, reliability of current computer models. Applications of models in risk assessment, underwriting, loss prediction, hazard analysis. Development and validation of specific application models.

Prerequisite: Permission of ENGR-Fire Protection Engineering department.

ENFP626 Computational Fire Modeling (3 Credits)

Introduction to Computational Fluid Dynamics (CFD)-based fire modeling; governing equations of turbulent reacting flows; numerical approaches to the treatment of turbulence (DNS, LES, RANS); numerical methods for partial differential equations; physical modeling of enclosure fires (turbulence, combustion, thermal radiation, pyrolysis, suppression). Development of sample programs (Matlab) and use of current CFD-based fire models (FDS).

Prerequisite: ENFP300 and ENFP312.

Restriction: Permission of ENGR-Fire Protection Engineering department.

ENFP627 Advanced Smoke Management and Fire Alarm Systems (3 Credits)

Analysis of hazard smoke. Response analysis of smoke detectors based on characteristics of detectors and properties of smoke. Performance characteristics and limitations of smoke management systems. Capabilities and limitations of analytical design aids.

Prerequisite: ENFP300.

Jointly offered with: ENFP440.

Credit Only Granted for: ENFP627 or ENFP440.

ENFP629 Selected Topics (3-6 Credits)

Current research, studies in fire protection engineering. Future trends and significant changes in research, professional areas. The professional standards process.

Prerequisite: Permission of ENGR-Fire Protection Engineering department.

Restriction: Must be in ENGR: MS Only-Fire Protection Engineering (Master's) program.

Repeatable to: 6 credits.

ENFP630 Diffusion Flames and Burning Rate Theory (3 Credits)

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

Prerequisite: ENFP312.

ENFP649 Special Problems (1-3 Credits)

Advanced topics selected by the faculty from the current literature to suit the special needs and background of students, or for individual students who have definite plans of individual study.

Restriction: Must be in ENGR: MS Only-Fire Protection Engineering (Master's) program; and permission of instructor; and permission of ENGR-Fire Protection Engineering department.

Repeatable to: 6 credits if content differs.

ENFP651 Advanced Fire Dynamics (3 Credits)

A review of the basic chemistry and physics necessary to understanding fire dynamics; and of the physics of heat transfer and turbulent fluid flow will be given. The nature and structure of premixed and diffusion flames will be presented.

Prerequisite: ENFP312.

Jointly offered with: ENFP415.

Credit Only Granted for: ENFP629A, ENFP651 or ENFP415.

Formerly: ENFP629A.

ENFP652 Fire Assessment Methods (3 Credits)

This on-line course offers a comprehensive review of experimental techniques to assess fire performance characteristics of materials, products and assemblies.

Credit Only Granted for: ENFP629B or ENFP652.

Formerly: ENFP629B.

ENFP653 Advanced Fire Suppression (3 Credits)

Issues related to the suppression of fires and the design of fire suppression systems. Theoretical aspects of fire suppression and extinction are considered to provide the foundation for the practical design of different types of fire suppression systems. Focus on water-based and "clean agent" fire suppression systems, with emphasis on high challenge and special hazard applications. Systems using other agents are introduced, but are not addressed in detail.

Restriction: Permission of ENGR-Fire Protection Engineering department.

Credit Only Granted for: ENFP410, ENFP610, or ENFP653.

ENFP655 Smoke Control (3 Credits)

Introduces the student to smoke control needs, design approaches and analytical methods. Students should develop an understanding of the performance characteristics and limitations of smoke control systems and the capabilities and limitations of analytical design aids. This course gives students an opportunity to integrate a broad range of information from previous courses with material from this course, such as fluid mechanics, heat transfer, and fire dynamics, and fire modeling. Students will review data from past experimental programs and apply computer model(s).

Restriction: Permission of Maryland Applied Graduate Engineering.

ENFP656 Fire and Explosion Hazards of Battery Energy Storage Systems (3 Credits)

An overview of fire and explosion hazards related to Battery Energy Storage Systems (BESS). Current testing standards and methodologies will be discussed to understand how to quantify the expected hazards. Information on existing and evolving codes and standards will be provided to understand the associated risk and mitigation strategies using both prescriptive and performance-based methodologies. Public information from historic incidents involving BESS will be reviewed to understand the failure modes at the system level. Practical guidance will be provided for forensics analysis of fire and explosion incidents involving BESS.

Restriction: Restricted to students in ENFP, PMFP, ENGF, Z049 and Maryland Applied Graduate Engineering programs.

ENFP661 Forensic Fire Analysis (3 Credits)

This on-line course addresses the forensic analysis of structural fire incidents in terms of enclosure fire dynamics and the impact of fire safety subsystems used to prevent or mitigate the consequences of fire. These subsystems include: ignition prevention, material flammability and flame spread, fire detection and alarm, fire suppression, smoke movement and management, structural fire protection and egress systems. Failures in these subsystems are addressed in terms of differences between expected and observed performance.

Credit Only Granted for: ENFP629D or ENFP661.

Formerly: ENFP629D.

ENFP662 Performance Based Design (3 Credits)

The development of fire protection solutions can involve methods to comply with prescriptive requirements in codes or may incorporate some aspects which follow a performance-based approach. Following a description of the codes and standards process in the U.S., a review of the requirements for structural fire protection are discussed as an example, beginning with prescriptive approaches and ending with performance-based alternatives. The latter half of the course describes the methodology and motivation for performance-based design solutions. Case studies are presented to illustrate the design solutions achieved following the two approaches.

Credit Only Granted for: ENFP629E or ENFP662.

Formerly: ENFP629E.

ENFP663 Advanced Fire Risk Modeling (3 Credits)

This on-line course addresses the fundamentals of fire risk modeling from both theoretical and applied perspectives.

Credit Only Granted for: ENFP629R or ENFP663.

Formerly: ENFP629R.

ENFP664 Advanced Industrial Fire Safety (3 Credits)

This class is designed to introduce students to the basics of process safety with a focus on the methods and techniques that may be utilized when evaluating the existing or proposed safety protection solutions in industrial facilities. An emphasis is placed on properly identifying the hazards that are present, the risk exposure, and how best to address the risk. The foundation is laid by presenting the necessary background information on industrial processes and integrating this information with applicable fire/explosion safety science. Jointly offered with ENFP464.

Credit Only Granted for: ENFP489I, ENFP629I, ENFP464, or ENFP664.

Formerly: ENFP489I and ENFP629I.

ENFP665 Advanced Fire and Explosion Investigations (3 Credits)

This course covers many advanced aspects of fire and explosion investigation and reconstruction. Information on field techniques, applicable standards, and best practices are presented with an emphasis on how advanced fire science and fire dynamics can be applied to forensic analysis. Experiments are performed and analyzed to demonstrate the concepts.

Jointly offered with: ENFP465.

Restriction: Permission of the Fire Protection Engineering department.

Credit Only Granted for: ENFP629N, ENFP489N, ENFP465, or ENFP665.

Formerly: ENFP629N.

ENFP667 Advanced Wildland Fires: Science and Applications (3 Credits)

Introduction to the global problem of wildland fires with an overview of the social, political and environmental issues posed as well as detailed coverage of the science, technology and applications used to predict, prevent and suppress wildland fires.

Prerequisite: ENFP312.

Restriction: Permission of ENGR-Fire Protection Engineering department.

Credit Only Granted for: ENFP489W, ENFP629W, or ENFP467.

Formerly: ENFP629W.

ENFP671 Material Flammability (3 Credits)

Introduction to the science and technology of polymeric materials. Standard methods for assessment of fire hazards associated with these materials are reviewed. Fundamental mechanisms defining polymer combustion in various scenarios are elucidated.

Recommended: Completion of ENFP415 or ENFP651 and ENFP320 or ENFP420 recommended.

Restriction: Permission of ENGR-Fire Protection Engineering department.

Credit Only Granted for: ENFP629M or ENFP671.

Formerly: ENFP629M.

ENFP799 Master's Thesis Research (1-6 Credits)

Development and completion of Master's Thesis.

Prerequisite: Permission of ENGR-Fire Protection Engineering department.

Recommended: Completion of ENFP graduate requirements.

Repeatable to: 6 credits.