

NUCLEAR POWER TECHNOLOGY (NUPT)

NUPT 101. Overview of Nuclear Energy

Credits: 2

Typically Offered: FALL

In this course the student will study the history of nuclear power, the basic principles of reactor design and operation at commercial nuclear electrical generating facilities. It includes an examination of nuclear waste issues, a study of important events which occurred at commercial nuclear plants, and a look towards the future of the electrical generating industry.

NUPT 103. Nuclear Mathematical Fundamentals

Credits: 3

Typically Offered: FALL

This course will review basic math, including basic arithmetic functions, fractions and decimals. The course will continue by covering scientific notation, dimensional analysis, algebra, basic geometry and trigonometry. Control charts and graphs, logarithms and exponential functions, and rate concepts will also be covered.

NUPT 104. Nuclear Math and Physics

Credits: 5

Prerequisite: Admitted into Nuclear Power Technology program or departmental approval.

Typically Offered: FALLSPR

This course provides a comprehensive introduction to the fundamental principles of mathematics and physics. Students will develop a strong foundation in basic math concepts, including algebra, geometry, trigonometry, and statistics. Students will also explore the core principles of physics, such as mechanics, energy, and motion.

NUPT 105. Classical Physics

Credits: 4

Prerequisite: NUPT 103.

Typically Offered: FALL

This course is designed to introduce students to classical physics. Topics covered include: units of measurement, kinetics, force, energy, momentum, work, fluids, and mechanical principles.

NUPT 107. Engineering Drawings, Diagrams and Schematics

Credits: 3

Typically Offered: FALL

This course will introduce students to engineering drawings, diagrams, and schematics that are used in nuclear operations. Students will learn how to read and decipher the various nuclear symbols, components, systems, and legends found on diagrams, drawings, and schematics.

NUPT 109. Electrical Science

Credits: 4

Prerequisite: NUPT 103.

Typically Offered: SPRING

This course begins with the study of basic electrical fundamentals, theory, laws, and magnetism. Direct current and alternating current electrical circuits, generators, motors, and other components along with their applications will be covered. Single-phase AC circuits and three-phase AC circuits will be discussed. Inductance, capacitance, impedance, and resonance will be covered along with construction of conductors, insulators, and relays.

NUPT 111. Instrumentation and Control

Credits: 4

Prerequisites: NUPT 109 and NUPT 217.

Typically Offered: FALL

This course will cover the construction, operation, and failure modes of basic sensors and detectors used in nuclear generation. Included in this are gamma and neutron core power detector construction, operation and effects. Various control systems will be covered including failure symptoms and troubleshooting techniques from an operational perspective.

NUPT 113. Mechanical Science

Credits: 3

Typically Offered: SPRING

This course will cover the basic function, design, and operation of mechanical components and equipment which are an integral part of nuclear facilities. Pumps, heat exchangers, valves, diesel engines, compressors, and filters will be included as well as some mechanical systems such as cooling towers and refrigeration.

NUPT 114. Material and Radiological Concepts

Credits: 5

Prerequisite: Admitted into Nuclear Power Technology program or departmental approval.

Typically Offered: FALLSPR

This comprehensive course provides future nuclear power plant operators with a fundamental understanding of materials science and radiation protection principles essential for safe and efficient plant operation. Students will explore the properties and behaviors of materials used in nuclear power plants, as well as the principles of radiation protection, detection, and control. Through a combination of lectures, discussions, and hands on activities, students will gain practical knowledge and skills necessary to ensure the safe and reliable operation of nuclear power plants.

NUPT 213. Nuclear Physics

Credits: 3

Prerequisite: NUPT 105.

Typically Offered: SPRING

This course will tour the topics that comprise the fundamentals of nuclear science, giving the students an appreciation of theory and principles that govern nuclear processes involved in an operating reactor. This course covers the fundamental atomic structures, nuclear nomenclature, binding energy and nuclear decay reactions. Other topics such as the famous $E=mc^2$ equation, neutron interaction with matter, the fission process and decay heat will be related to the everyday operation of a nuclear power plant.

NUPT 215. Nuclear Plant Chemistry

Credits: 3

Prerequisite: NUPT 103.

Typically Offered: SPRING

This course covers basic chemistry fundamentals relating to maintaining water purity in primary and secondary systems. This course also covers chemistry concepts for both pressurized water reactors and boiling water reactors. Principles of water treatment, hazards and safety requirements will also be contained in the course.

NUPT 217. Heat Transfer, Fluid Flow and Thermodynamics

Credits: 4

Prerequisite: NUPT 105.

Typically Offered: FALL

This course covers heat transfer, fluid flow fundamentals, and the basics of thermodynamics. It begins with a discussion of temperature and heat, and progresses into heat capacities, sensible and latent heats. The laws of thermodynamics and related terms are introduced. The student will learn to perform energy balances, and understand thermodynamic processes and cycles. Properties of fluids and descriptions of their behavior are discussed. Topics covered include density, static head, hydraulics, buoyancy, and fluid flow. Centrifugal pumps are studied as well as closed system operation.

NUPT 219. Material Science

Credits: 3

Typically Offered: FALL

This course provides the student with a basic understanding of the structure of metals and how those structures are affected by various processes. The properties of metals and their applications are also covered along with thermal stress and shock. Ductile and brittle fractures will also be covered along with selecting materials for specific use in the industry. Lastly, students will discuss how important pressure and temperature curves are and why they are used when heating up and cooling down plant equipment.

NUPT 220. Reactor Theory

Credits: 2

Prerequisite: NUPT 213.

Typically Offered: SPRING

This course will tour the topics that comprise the fundamentals of how reactors are built and operated, giving the student understanding and appreciation of the theory and principles that govern control room operation and activities outside the control room and how they/could they affect the reactor. This course starts with classification of the types of neutrons, and the neutron life cycle. Other topics include reactivity which provides an understanding of what criticality means in terms of reactor operation. Lastly, a discussion of reactor shutdown operation and decay heat removal and significant reactor events.

NUPT 221. Science of Radiological Protection

Credits: 3

Typically Offered: FALL

This course will provide the student with a broad, in-depth knowledge of radiological protection principles.

NUPT 222. Nuclear Industry Science

Credits: 4

Prerequisite: Admitted into Nuclear Power Technology program and successful completion of ENRT 119 or departmental approval.

Typically Offered: FALLSPR

This comprehensive course provides a detailed exploration of the fundamental principles and applications of thermal systems, fluid flow, thermodynamics, plant equipment, and electrical systems. Students will gain a deep understanding of the underlying principles and concepts, as well as practical knowledge of plant operations and equipment.

NUPT 223. Reactor Safety Design

Credits: 3

Typically Offered: SPRING

This course will provide the student with a broad, in-depth knowledge of reactor safety design and protection principles.

NUPT 224. Nuclear Safety and Protection

Credits: 5

Prerequisite: Admitted into Nuclear Power Technology program or departmental approval.

Typically Offered: FALLSPR

This course provides students with a comprehensive understanding of safety topics and emergency procedures in a nuclear facility. Students will learn about the potential hazards associated with nuclear facilities, including radiation exposure, chemical hazards, and industrial accidents. The course will also cover emergency procedures, particularly in the event of a nuclear accident.

NUPT 225. Nuclear Plant System Component Design and Function

Credits: 4

Prerequisites: NUPT 219, NUPT 220 and NUPT 223.

Typically Offered: SPRING

This course will provide the student with a broad, in-depth knowledge of nuclear plant Reactor, Reactor Auxiliaries, Secondary Plant and Electrical Systems.

NUPT 226. Nuclear Plant Equipment

Credits: 3

Prerequisite: Admitted into Nuclear Power Technology program and successful completion of ENRT 109 Equipment and Systems or departmental approval.

Typically Offered: FALLSPR

This course provides a comprehensive overview of the equipment and systems found in pressurized water reactors (PWRs) and boiling water reactors (BWRs). Students will learn about the design, operation, and maintenance of equipment exclusive to nuclear facilities, including reactor coolant systems, steam generators, and containment structures. The course will also cover the unique safety features and systems that distinguish nuclear power plants from other industrial facilities.

NUPT 227. Conduct of Facility Operations

Credits: 4

Typically Offered: SPRING

This course will provide the student with a broad-brush knowledge of the Conduct of Operations as set forth by the Department of Energy (DOE Order 5480.19, Conduct of Operations). This document contains best operating practices found in the commercial nuclear fleet, and as such can be looked at as a summary document for candidate utility workers.

NUPT 229. Instrumentation & Control II

Credits: 4

Typically Offered: SPRING

In this course, the student will be exposed to advanced instrumentation and control concepts pertinent to technicians working in the nuclear industry. The course will delve into the theory of operation for a number of digital components and systems, and explain important systems common to all nuclear power plants that employ these concepts. The course will also delve into the certain mechanical and electrical processes to demonstrate how these relate to the instrumentation and control systems governing them.