Master of Engineering in Nuclear Engineering

Course

Title	Description	Credits
Nuclear and Radiochemistry	Theory of radioactive decay processes, nuclear properties and structure, nuclear reactions, interactions of radiation with matter, biological effects of radiation.	3 credits
Introduction to Statistical Thermodynamics	Statistical description of systems composed of large numbers of particles in the context of classical and quantum mechanics; basic concepts of probability theory and thermodynamics as they relate to statistical mechanics.	3 credits
Nuclear Materials	Nuclear reactor materials: relationship between changes in material properties and microstructural evolution of nuclear cladding and fuel under irradiation.	3 credits
Radiological Safety	Ionizing radiation, biological effects, radiation measurement, dose computational techniques, local and federal regulations, exposure control.	3 credits
Radioactive Waste Control	Nature, sources, and control of radioactive wastes; theory and practice of disposal processes.	3 credits
Design Principles of Reactor Systems	Nuclear power cycles; heat removal problems; kinetic behavior of nuclear systems; material and structural design problems.	3 credits
Power Plant Simulation	Basic knowledge necessary for intelligent simulation and interpretation of simulations of transients in nuclear power plants.	3 credits
Radiation and Measurement Detection Lab	Laboratory experience in radiation detection and measurement. *This course is required for* students *who do not have a baccalaureate degree in nuclear engineering and have not fulfilled an equivalent course requirement. Students who do not have an undergraduate degree in nuclear engineering should consult with the Department of Mechanical and Nuclear Engineering to determine if they need to complete this course.*	1 credits
Reactor Engineering	Thermal hydraulic fundamentals applied to power reactors, thermal analysis of fuel elements and two-phase heat transfer in heated channels.	3 credits

Reactor Core Thermal–Hydraulics	In-depth analysis of the reactor core thermal hydraulics; computational methods and practical applications.	3 credits
Nuclear Reactor Kinetics and Dynamics	Analytical kinetics and dynamics modeling for reactivity-induced transients; reactor accident kinetics methods for simple and complex geometries; experimental methods.	3 credits
Nuclear Fuel Management	Nuclear fuel inventory determination and economic value through the fuel cycle. Emphasis on calculational techniques in reactor, optimization, and design.	3 credits
Neutron Transport Theory	Derivation of Boltzmann equation for neutron transport; techniques of approximate and exact solution for the monoenergetic and spectrum regenerating cases.	3 credits
Environmental Degradation of Materials in Nuclear Power Plants	Degradation of materials performance when exposed to the combination of high temperature, neutron irradiation, and aggressive electrochemistry found in nuclear reactors.	3 credits
Monte Carlo Methods	Fundamentals of the probability theory and statistics, analog and non-analog Monte Carlo methods and their applications, random processes, and numbers.	3 credits
Individual Studies – Professional Topics in Nuclear Engineering	Creative projects, including nonthesis research, which are supervised on an individual basis and which fall outside the scope of formal courses.	3 credits
Advanced Engineering Economy	Concepts and techniques of analyses useful in evaluating engineering projects under deterministic and uncertain conditions.	3 credits
Heat Transfer	Thermal energy transfer mechanisms: conduction (steady, transient), convection (internal, external), radiation; lumped parameter method; heat exchangers; introduction to numerical methods.	3 credits
Finite Elements in Engineering	Computer modeling and fundamental analysis of solid, fluid, and heat flow problems using existing computer codes.	3 credits
Heat Transfer—Convection	Laminar and turbulent flow heat transfer in natural and forced convection systems.	3 credits
Foundations of Fluid Mechanics II	Second semester of core sequence in fluid mechanics; continuation of boundry layers, stability, transition, turbulence, turbulent boundry layers, turbulence models.	3 credits
Numerical Solutions Applied to Heat Transfer	Application of finite difference methods to the study of potential and viscous flows and conduction and convection heat transfer	3 credits

and Fluid Mechanics Problems		
Simulation of Mechanical Systems	Introduces computational fundamentals, including digital logic; programming language, basic numerical analysis and data processing, as applied to mechanical simulation techniques.	3 credits