Descriptions of Courses

❒ Undergraduate Program

NQE201 Fundamentals of Nuclear and Quantum Science 3:0:3(4)
Quantum mechanics and nuclear physics are fundamental basis of nuclear and quantum engineering. In this course, the basic principles of quantum mechanics and nuclear physics are discussed, which includes particle-wave duality, wave function, Schrodinger equation, operator and eigenvalue equation, superposition principles, uncertainty principle, Hilber space, quantized energy levels, spin angular momentum and spin 1/2 particle qunatum system. Based on these, nuclear structure, nuclear stability, and basic concepts of nuclear interactions are discussed.

NQE202 Fundamentals of Nuclear Engineering 3:0:3(4)
This course is designed to provide the basic understanding on the nuclear engineering to the undergraduate and graduate students interested in nuclear engineering. For this, the fundamental principles and practical applications related to the utilization of nuclear energy from fission are introduced. The major topics included are brief review of nuclear reactions and radiations, interaction of radiation with matters including fission, types of nuclear reactors, neutron diffusion and moderation, nuclear reactor theory, heat generation and transfer, and radiation protection and dose calculation.

NQE204 Interaction of Radiation with Matters 3:0:3(4)
This course will give interaction of radiation such as electron, ion, neutron, electromagnetic wave with matters. The topics of the course include generation method, interaction of each quantum particle with matter, measurement and detection of quantum particles.

NQE221 Introduction to Nuclear Thermal Hydraulics 3:0:3(4)
This course is intended to provide basic understanding of nuclear thermal hydraulics. The first half of the course will mainly deal with the fundamentals of transport phenomena of mass, momentum, heat, and energy. The latter half of the course will focus on the application of these concepts in energy systems including nuclear reactors and plants

NQE272 Introduction to Medical Physcis 3:0:3(4)
This course deals with the fundamental principles of the major modalities of medical imaging; x-ray radiography and computed tomography, Gamma camera, SPECT and PET in the nuclear medicine, MRI, ultrasound imaging, and bioluminescence etc. This course also cover the physics of radiation interactions in the therapeutic radiological energy ranges used in radiation therapy, together with clinical linear accelerator basics, characteristics of clinical photon, electron and proton beams, and treatment planning systems and delivery techniques.

NQE281 Energy, Environment and Water 3:0:3(4)
This course introduces the energy, climate change and water problem and their technological solutions. Lecture will cover energy technologies (fossil, nuclear, solar, wind, hydro, etc.), energy system's environmental effect including global warming, fresh water problem which is strongly coupled with energy and global warming problem. Students are encouraged to investigate one of the important future technologies and have a chance to present their study at the end of the semester.

NQE301 Nuclear Reactor Theory 3:0:3(4)
This course is designed to introduce fundamental reactor theory related with neutron reaction, nuclear fission and chain reactions. Major subjects are : neutron slowingdown in infinite medium, neutron diffusion theory, few energy group approximation and criticality calculation, hetrogeneous reactor, dynamics and reactivity feedback effects, and projects writing computational programs for reactor analysis (neutron slowingdown, two-group neutron diffusion equation, depletion calculation, point kinetics, etc).

NQE303 Radiation Measurement Experiments 2:3:3(6)
In this course, the fundamentals of nuclear electronics and principles of various detector types such as gas detector, semiconductor detector and scintillation detectors are introduced. Also various modalities of radiation detection such as counting, spectroscopy, dosimetry, imaging and timing measurement for alpha-ray, beta-ray, gamma-ray, x-ray and neutron and their analysis methods are discussed.

NQE311 Neumerical Methods and Computer Simulation 3:0:3(4)
This course is designed to provide NQE undergraduate students with basic numerical methods and computational skills (including, writing computer programs implementing basic algorithms). The course covers i) brief introduction to mathematical models dealt in nuclear and quantum engineering, ii) numerical approximation of functions and numerical calculus, iii) matrix theory and linear algebra, iv) numerical methods for ODEs, v) introduction to numerical methods for PDEs, and vi) basics of Monte Carlo simulation. To provide concrete ideas to the students taking the course, the example problems will be taken from various subjects covered in nuclear and quantum engineering.

NQE331 Nuclear I&C and Experiments 2:3:3(4)
This course is designed to provide the undergraduate students in nuclear and quantum engineering with the knowledge on basic electronic engineering and introductory nuclear power plant instrumentation and control systems by theoretic analysis and experiments.

NQE341 Nuclear Chemistry 3:0:3(4)
The first part of this class is designed to build a basic familiarity with radioactivity, nuclear reactions, radioisotopes, and basic chemical concepts regarding chemical thermodynamics and kinetics. The second part is focused on the chemical effects induced by nuclear reactions, the chemical analysis using radiotracers, the chemistry of transuranic elements, and environmental aspects of radionuclides.

NQE351 Nuclear Materials Engineering and Experiment 3:3:4(6)
Basic concepts and applications of nuclear materials are introduced, while laboratory practices are designed for experiencing property tests of the lectured materials. Lectures include the essential knowledge of materials science as well as the effects of radiation and environments on material properties. The experiments are concerned with mechanical test and data analysis phase transformation, observation by optical and electron microscopes, corrosion tests, and irradiation effects.

NQE363 Fundamentals of Neutron and X-ray Science 3:0:3(4)
Neutron and X-ray are very powerful tools to measure the structure and dynamics of materials. They have been instrumental for the advance of modern science and technology and their role in the 21st century becomes even more important. In this class, we will discuss the role of neutron & x-ray in modern science and technology, the principles of neutron & x-ray scattering, related sources and instrumentations, and scientific applications of neutron & x-ray.

NQE373 Introduction to Radiation Biology 3:0:3(4)
In this course, the basic concepts and definitions about radiation dosimetry are introduced and the biological effects on cells and human body organs are discussed. Also the external and internal dose calculation models and the principles of radiation dosimetric instrumentations will be discussed together with the domestic and international regulations for the radiation protection. Finally the principle and methodologies of radiation theraphutic technologies are discussed.

NQE381 Introduction to Neutron and NMR Spectroscopy 3:0:3(4)
Neutron and nuclear magnetic resonance spectroscopies are very powerful methods which characterize the structures and dynamics in matters. In this course, we discuss the basics principles of neutron and NMR spectroscopies and their representative applications for advanced materials and biomedical research.

NQE401 System Engineering of Nuclear Power Plants and Experiments 3:3:4(6)
Unified treatment of the design concept and overall description of components and system control in nuclear power plants. Discussion of engineering and operational principles of components such as steam generators, pressurizer, pumps, turbines, condensers, valves, BOP, CVCS. Emphasis on the basic concepts of thermodynamics associated with nuclear power plants. Performance of experiments of each component and simulation of the system through a micro-simulator.

NQE402 Nuclear and quantum Engineering Design Project 1:6:3:(4)
In this class the following items will be covered: design thinking, design methodologies (axiomatic design and others), creative problem solving, nuclear system design. And two term projects will be assigned to the students: design of nuclear systems or its applications (group project) and design of creative system (individual project)

NQE441 Environmental Engineering of Nuclear Power 3:0:3(4)
Environmental effects of nuclear power and radiations are covered broadly. Radiological assessment methods and characterizing the various radiation sources are deals directly with analysis. Liquid effluent management and dispersion of gaseous radioactive nuclides and transport or migration of radiactivity through surface water, underground water and biosphere are described. Finally, environmental pathway modeling is examined and compared.

NQE461 Monte Carlo Methods and Applications 3:0:3(4)
This course deals with fundamentals of the Monte Carlo methods: (1) random variables and random number generation, (2) sampling procedures, (3) analog Monte Carlo, (4) non-analog Monte Carlo and variance reduction techniques, and then applies the methods to a selection of representative benchmark problems from several application areas: (5) radiation particle (neutron, gamma-ray, and charged particles such as electron and proton particle) transport problems, (6) bio/nuclear medicine systems design, (7) multiple integrals and integral equations, and (8) optimization problems.

NQE481 Introduction to Nuclear Fusion Engineering 3:0:3(4)
Fundamentals of high temperature plasma in which fusion reactions occur are discussed and conditions for the utilization of nuclear fusion energy will be introduced. Various technological and physical issues for the engineering feasibility of nuclear fusion reactor systems are discussed. The important issues including nuclear reaction cycle, reactor power balance, reactor material, first wall, tritium breeding, neutron activation, various confinement types, tokamak concept, ITER etc will be covered. In addition, on-going and planned fusion experiments will be introduced.

NQE484 Writing English Essays for Engineers 3:0:3(4)
This course is intended for students with limited experience writing in English. Sentence variety, effective sentences, topic sentences, and paragraph development will be studied. Grammar, editing, and listening skills will be practiced. Students will write short answer essay exams, a personal statement letter, and a research paper. Class-work time will be directed among pair and group work, peer evaluation and teacher interaction.

NQE485 Special Topics in Nuclear and Quantum Engineering III 1:0:1(4)
Course covers the special field of nuclear and quantum engineering which is not covered by the given courses. The content can be variable and will be chosen by the instructor.

NQE488 Special Topics in Nuclear and Quantum Engineering Ⅰ 2:0:2(4)
Course covers the special field of nuclear and quantum engineering which is not covered by the given courses. The content can be variable and will be chosen by the instructor.

NQE489 Special Topics in Nuclear and Quantum Engineering Ⅱ 3:0:3(4)
Course covers the special field of nuclear and quantum engineering which is not covered by the given courses. The content can be variable and will be chosen by the instructor.

NQE490 B.S. Thesis Research 0:6:3

NQE495 Independent Research 0:6:1

NQE496 Seminar 1:0:1
Seminar is given by the staff of the department or invited guest speaker on topics of recent interest in the overall field of nuclear engineering, including the design and operation of nuclear reactors, reactor kinetics, heat transfer, energy conversion, radiation shielding, nuclear fuel cycle and management, nuclear materials and safety, and radiation technology etc.

❒ Graduate Course Listings

NQE511 Nuclear Reactor Kinetics 3:0:3(4)
This course is designed to cover the dynamics of nuclear systems. Major subjects are : ① delayed neutrons and inhour equations, ② response to constant, step, and time-dependent reactivities, ③ mechanisms of feedbacks - linear and nonlinear feedback models, ④ transfer functions, ⑤ linear and nonlinear stability criteria, ⑥ Lyapunov method, and ⑦ limit cycles and nonlinear oscillations.

NQE512 Nuclear Reactor Analysis and Design 3:0:3(4)
This course is designed to cover the nuclear reactor analysis and design, introduction of neutron transport equation, approximation of diffusion theory, solution of few-group and multi-group neutron diffusion equation, calculation of energy distribution of fast and thermal neutrons, and homogenization to heterogeneous reactors. It also include recent methods (ex. nodal method) to predict the spatial and temporal distribution of neutrons, This course includes several projects running design computer code systems under realistic reactor design situation

NQE513 Neutron and Quantum Particle Transport Theory and Computation 3:0:3(4)
This course is designed to cover the particle transport solution theory, numerical algorithms, and computational methods for continuous, one-group, multi-group neutron and radiation transport phenomena. Major subjects are : singular eigenfunction expansion, Green's function, spherical harmonics, discrete ordinates, integral transport, even-parity transport, method of characteristics, Boltzmann-Fokker-Planck transport methods for various quantum particle(neutrons, photons, electrons, positrons, protons, etc) transport phenomena, applied to the design of various nuclear reactors, radiation shielding facilities, analysis of radiation and energy deposition profiles in systems such as nuclear fusion reactor, accelerator, nuclear bio-medical equipment, semiconductor electronics system, and nuclear imaging problems such as nuclear prospecting, nuclear assay, computed tomography.

NQE520 Nuclear Reactor Engineering 3:0:3(4)
The primary objective of this course is to cover the engineering analysis in the design of nuclear fission power reactors. Major subjects included ard : ① a brief description of the various types of nuclear power plants currently in use or under serious consideration, ② thermal-hydraulic analysis of nuclear reactors, ③ analysis of operational and accident transient sequences, ④ nuclear and thermal-hydraulic transient, and ⑤ engineering aspects of nuclear reactor safety.

NQE521 Nuclear Thermal-Hydraulics I 3:0:3(4)
The primary objective of this course is to cover the fundamental subjects of nuclear reactor thermal-hydraulics. Major subjects included are : ① Fundamentals of heat transfer mechanisms and fluid mechanics. ② Energy and core flow distribution, heat transfer by conduction and convection of incompressible single and two-phase fluid flow in reactors. ③ Applications of single and two-phase flow in core thermal design and safety analysis of nuclear reactors. ④ Current research topics of the nuclear thermal-hydraulics concerned with safe and effective heat removal from the reactor core for power production.

NQE522 Nuclear Power Plant Design Project 3:0:3(4)
The objective of this course is to accumulate the composite design experiences of the core and other equipments using the principles of nuclear engineering. Unique design of reactor core satisfying the parameters of the particular reactor type, the output of power and the limit temperature, etc., the size of core and the size, the number, the interval and the operating temperature, etc. of fuel rods must be determined by computational codes. It also includes an estimate of the cost price for a reactor system containing heat exchangers, steam generators, condensers, turbines, etc.

NQE523 Nuclear Reactor Safety Ⅰ 3:0:3(4)
This course deals with the safety objectives, the safety features, the safety analysis methods and the diagnostic techniques for a nuclear power plant. The probabilistic safety assessment is emphasized, which it includes the deterministic analysis for transient state and design basis accident, and the system reliability, the severe accident generation rate and phenomena. It also deals with TMI accident, Chernobyl accident and other severe reactor accidents as practical examples.

NQE524 Simulation of Nuclear and Quantum System 3:0:3(4)
This course provides students with understanding of numerical analysis, artificial intelligence and simulation

methodologies which can be applied in nuclear and quantum engineering. To solve the partial differential equations, finite difference method, finite element method, Monte Carlo method and so on are discussed. In the artificial intelligence part, the course covers expert system, neural network, fuzzy theory, and other artificial intelligence language. Students can understand about uncertainty problem and sensitivity study in computer codes.

NQE526 Quantum and Micro Energy Transport 3:0:3(4)
This course provides students with understanding of quantum and micro energy transport phenomena. This course covers the concept of energy carriers - phonon, electron and photon, and analytical methods based on molecular dynamics simulation. This course will make discussions on applied areas such as thermoelectric power generation and cooling, heat conduction and phase change in thin film, and micro measurement techniques.

NQE527 Gas-cooled Reactors and Hydrogen 3:0:3(4)
With reviewing the history of the gas-cooled reactors, the hydrogen-production gas-cooled reactors is studied. This course teaches the basic principles of Brayton cycle, nuclear fuel/core design, and safety with the introduction of the gas-cooled fast reactors. We discuss the principle of hydrogen production through electrolysis and thermochemical process. We analyze a fuel-cell/turbine cycle and the economy of the various options of the hydrogen-production gas-cooled reactors.

NQE528 Introduction to Risk and Reliability Engineering 3:0:3(4)
The main focus of the course will be on the principles and methods for assessing technological risks and reliability. The course is intended to provide a rudimentary background for those who have not been exposed to the subject. Either graduate students or upper-class undergraduates can benefit from the course. The course will emphasize the applications based on probabilistic analysis.

NQE532 Nuclear and Quantum Instrumentation Systems 3:1:3(6)
This course is designed to provide graduate and high level undergraduate students who want to understand and to have skills on analysis and design of nuclear power plant and quantum instrumentation systems with the knowledge on instrumentation and sensor theory, various process instrumentation techniques as well as many nuclear power plant instrumentation systems and quantum engineering instrumentation systems.

NQE534 Nuclear and Quantum Control Systems 3:1:3(6)
This course is designed to provide graduate and high level undergraduate students with control theories such as control action, stability analysis, state-space analysis and with the detailed analysis skills of nuclear power plant control subsystems such as reactor control system, feedwater control system, pressurized control system, and quantum engineering control systems.

NQE536 Compact Nuclear Simulator Operation Experiment 1:3:2(6)
This course is designed to provide high level undergraduate and graduate students with the opportunity to operate nuclear power plants at normal, abnormal, and emergency conditions with compact nuclear simulators.

NQE540 Nuclear Chemical Engineering 3:0:3(4)
Overall chemical engineering process technologies and principle applicable to nuclear engineering are covered and described. Technology applied and newly developed for nuclear fuel cycle will be discussed in detail. Radioactivity and decay chain analysis method, technology or process applied to front-end fuel cycle, characteristics and analysis of nuclear spent fuels, fission products, and actinide, fundamentals of nuclear water technology and isotope separation methods are described in detail

NQE541 Radioactive Waste Management 3:0:3(4)
This course is designed to provide the students about the technology of the general management of the radioactive waste generated during the operation of nuclear power plant and nuclear fuel cycle facility including the treatment and disposal of the wastes.
Background information on the sources of the gaseous, liquid and solid radioactive waste, and process and treatment facilities, solidification and volume reduction technology, packaging and transportation, storage methods of the wastes and spent nuclear fuel, design, safety and construction of the waste repositories, migration of the radionuclide at the subsurface, environmental monitoring and protection, repository safety assesment, decontamination and decommissioning, and the management of spent nuclear fuel will be covered.

NQE542 Chemistry of Actinides 3:0:3(4)
The lecture deals with fundamentals of the physical and chemical properties of actinide elements. Basic chemical reactions of actinides in aquatic systems and their essential aspects pertinent to waste disposal safety are introdeced. Furthermore, actinide chemistry relevant to future nuclear fuel cycle is discussed.

NQE551 Nuclear Materials 3:0:3(4)
Nuclear materials are introduced with an emphasis on structural integrity on the basis of materials science. Effects of microstructure and dislocation substructure on mechanical properties, deformation and fatigue properties in various temperatures and environments. Fracture mechanical analysis of crack propagation, stress corrosion cracking, irradiation effects, and recent developments of nuclear materials are included in view of theory and applications.

NQE552 Integrity of Nuclear Structural Materials 3:0:3(4)
The ageing and integrity concerns on the structural materials of key components are one of the major obstacles for the safe operation and life extension of nuclear power plants. In this course, various ageing phenomena in nuclear power plants are explained in terms of operating conditions the materials are exposed. The effects of ageing on the integrity of the components are evaluated and the proper management programs for ageing are proposed and discussed. For this, the subjects like design characteristics of components, surveillance programs, inspections and non-destructive tests, structural and flaw analysis are treated. Finally, integrity issues like PTS, environmental fatigue, and are discussed as case study to help the student understand the relationship between materials ageing and structural integrity.

NQE561 Radiation Measurement Systems 3:0:3(4)
This course introduces the generation, amplification, transfer and measurement of the electronic signal from various radiation detectors based on the physics theory of the electronic signal and noise. Also it deals with the design methods of radiation counting, spectroscopy, timing and imaging system.

NQE562 Radiation Imaging Instrumentation 3:0:3(4)
This course deals with the analysis and design methods of various radiation imaging devices used in medical diagnostics and non-destructive tests. It also covers the 2-dimensional x-ray radiography and advanced gamma-ray imagers together with emission and transmission tomographies and laminography, which can be extended into 3-dimensional imaging techniques.

NQE563 Radiation Biology 3:0:3(4)
This course covers the effects of ionizing radiation at the molecular, cellular, organ and organism levels with emphasis on mammalian systems, including cellular concepts, major organ systems, transuranics, nuclear war, radiotherapy and cancer in experimental animal and human exposure groups.

NQE571 NMR Engineering 3:0:3(4)
This course introduces the basic theory of nuclear magnetic resonance (NMR) phenomena, NMR imaging techniques, NMR spectroscopy techniques and related equipments. In addition to the basic principles of NMR techniques, some examples of NMR applications in biomedical research, nanoporous materials and NMR quantum computations are discussed and some basic NMR experiments related to lectures are performed.

NQE572 Neutron Optics 3:0:3(4)
This course introduce the theory of neutron optical phenomena and the theory of neutron scattering for condensed matter research. The contents include the elements of quantum mechanics, the fundamental properties of neutron, the neutron nuclear scattering and magnetic scattering, a brief introduction to neutron optical device and neutron scattering instruments. A few practical examples of neutron scattering experiments are also discussed.

NQE575 Nuclear Energy Policy 3:0:3(4)
Historical development and utilization of Nuclear Energy are reviewed from the dawn of atomic age. This important alternative energy technology is evaluated comparatively in terms of technoeconomic, sociolpolitical and environmental aspects of nuclear energy uses. The nuclear energy utilization programs of major countries, regional or global basis are assessed for the characterization of different nuclear energy policy. In view of the established international nonproliferation regime and International Atomic Energy Agency(IAEA), the prospect of Nuclear Energy Policy Alternatives should be analysed in conformity with changing policy issues.

NQE581 Nuclear Fusion Engineering 3:0:3(4)
This course deals with principles and design of nuclear fusion systems. It contains the basics of nuclear fusion, fusion reactor analysis, experiments for inertial capture and magnetics, plasma heating, economic and environmental problems, and so on. It also covers the case study of nuclear plasma fusion system designs.

NQE582 Applied Plasma Engineering 3:0:3(4)
This course deals with the methodologies of several plasma generations. For this, it contains the basic principles of low-temperature plasmas and etc. And it studies several cases of industrial applications of plasma.

NQE583 Engineering of Charged Particle Beams 3:0:3(4)
This course will give fundamental physics and applications of charged particle beams such as electron beam and ion beam. The topics of the course include generation methods of charged particle beams, beam optics in electromagnetic fields, measurement of charged particle beams, and interaction of charged particles with matters.

NQE585 Introduction to Nuclear Safety Regulation 30:3
This course is designed to introduce nuclear safety regulation, which will be a basis of consecutive advanced courses on installation safety regulation and radiation safety management. Major subjects include: Concept of Safety Regulation, Legal and Organizational Infrastructure, Safety Culture, Licensing Process, Safety Review and Inspection, Quality Assurance, Regulatory Effectiveness and Prospects on Future Regulatory System.

NQE586 Safety Regulation for Nuclear Installations 30:3(4)
This course is designed to provide the appropriate knowledge specifically needed for actual regulation of safety review and inspection, and involves the following four disciplines: Safety Evaluation, Structures & Site Evaluation, Mechanical and Material Engineering, and I&C and Electrical Power Engineering. Every lecture includes the regulatory experience for the NPPs, international regulatory and trends, and up-to-date technologies of nuclear safety regulations.

NQE587 Radiation Safety and Emergency Preparedness 30:3(4)
This course is designed to provide knowledge for four major parts of radiation safety regulation; safety and security of radiation sources, environmental impact and monitoring of radioactivity, radioactive waste and decommissioning, and radiological emergency preparedness. Every lecture focuses on the regulatory experience, international regulatory information and trends, and up-to-date technologies of safety regulations.

NQE588 Advanced Design Project 1 for Nuclear and Quantum Engineering 30:3(4)
This class is offered for the students in Renaissance Ph.D. program and the students who are interested in the system design. At the beginning of the semester, projects is given to the students and the results are evaluated at the end of the semester. Object systems are nuclear energy systems and radiation application systems (for medical, science, etc.)

NQE589 Advanced Design Project 2 for Nuclear and Quantum Engineering 30:3(4)
This class is offered for the students in Renaissance Ph.D. program and the students who are interested in the system design. At the beginning of the semester, projects is given to the students and the results are evaluated at the end of the semester. Object systems are nuclear energy systems and radiation application systems (for medical, science, etc.)

NQE595 Technical Writing in Nuclear and Quantum Engineering 3:0:3(4)
Writing a technical paper for publication in English. The course presents the requirements for publishing in a professional journal in nuclear and quantum engineering. Each student will write preliminary documents and a final paper for real or imaginary publication. Class-work time will be directed among pair and group work, peer evaluation and teacher interaction. The final paper will be orally presented to the class in a format similar to a professional meeting.

NQE597 Special Topics in Nuclear and Quantum Engineering III 1:0:1(4)
Course covers the special field of nuclear and quantum engineering which is not covered by the given courses. The content can be variable and will be chosen by the instructor.

NQE598 Special Topics in Nuclear and Quantum Engineering Ⅰ 2:0:2(4)
Course covers the special field of nuclear and quantum engineering which is not covered by the given courses. The content can be variable and will be chosen by the instructor.

NQE599 Special Topics in Nuclear and Quantum Engineering Ⅱ 3:0:3(4)
Course covers the special field of nuclear and quantum engineering which is not covered by the given courses. The content can be variable and will be chosen by the instructor.

NQE621 Nuclear Thermal-Hydraulics Ⅱ 3:0:3(4)
This course is meant to cover advanced topics of the nuclear thermal-hydraulic design and analysis of the core of a nuclear reactor along with the related current reactor thermal-hydraulic research topics. Major subjects included are : ① reactor thermal hydraulic design problems, ② transient analysis of a single and multiple heated channels, ③ thermal analysis of the spent fuel storage canister, ④ analysis of hypothetical severe reactor accidents, ⑤ source term uncertainty analysis, ⑥ hypothetical core disruptive accident of an LMFBR, and ⑦ current research topics of the nuclear thermal-hydraulics.

NQE623 Nuclear Reactor Safety Ⅱ 3:0:3(4)
This course is a continuous lecture of NE523. And in reliability, risk analysis and reactor safety, the problems of higher degree are emphasized. In particular, important safety problems of reactor are selected and reviewed. It also includes the case-studies with participating students discussing.(prerequisite subject : NE523)

NQE624 Nuclear Fuel and Core Design 3:0:3(4)
Provision of basic theory and practical applications of thermal-hydraulic, mechanical, and uncertainty analysis to fuel and core design. Discussion of methodology on how these parts are coordinated and integrated to yield economical and safe fuel and core design.

NQE625 Numerical Methods in Reactor Engineering Analysis 3:2:3(6)
This course deals with the numerical methods for analyzing the problems of nuclear reactor engineering. it is argued for finite difference method and finite element method in order to find solutions of heat transfer, fluid dynamics, component structure design and system transient analysis.

NQE631 Nuclear and Quantum Instrumentation and Control Design. 2:3:3(6)
This course is designed to provide graduate students who want to understand and get skills for designing nuclear and quantum I&C systems with detailed analysis skills of subsystems, system integration methods, and pertinent theory and technology. (prerequisite subject : NE532)

NQE651 Radiation Effects on Reactor Materials 3:0:3(4)
Characterization of the different radiation sources, interaction with reactor materials, and resulting radiation damage are analysed in terms of metal crystalline defects and physical properties of reactor materials. Radiation damage induced core material property change, water or liquid metal side corrosion, diffusion and reaction of fission products, structural stability of metal or nonmetallic materials, radiation hardening or embrittlement and swelling are studied and analysed in terms of lattice defect interaction with energetic neutron.

NQE653 Nuclear Reactor Fuel Elements 3:0:3(4)
Nuclear fuel and cladding material behavior in nuclear reactor cores are introduced in terms of swelling, fission gas release, and creep. The irradiation and temperature effects are treated in view of theory and experiment, Nuclear fuel design, fabrication, performance assessment models, reliability analysis, and recent trends of nuclear core materials are explained.

NQE675 Special Topics in Nuclear Energy Policy 3:0:3(4)
Course deals with the evaluation of the modern nuclear energy policy program and the development of analysis methodology for solving various related issues. Also the cost-benefit, risk-benefit, Del-Phi, and the socio-political factor analysis will be discussed in order to be used as the input of the decision making for the new nuclear policy.

NQE726 Special Topics in Nuclear Safety Analysis 2:3:3:(6)
Discussion on numerical and physical models of computer codes developed for nuclear safety analysis. Emphasis on

development of mathematical and numerical models, and solution techniques, of two-phase flow. Treatment of physical models of separated flow such as flow-regime map, wall friction and heat transfer, interfacial friction and heat transfer, bifurcation phenomena. Development of a simple two-phase code and performance of class practice for various events.

NQE727 Special Topics in Probabilistic Risk Assessment 2:0:2(4)
This course deals with the methodologies and applications of PRA, and computer codes. Among the methodologies, there are probabilistic analysis and accident result analysis. the former includes data processing, fault tree, human error, common mode error and uncertainty analysis. the latter includes containment vessel state, core exposure and melting, pressure vessel melting penetration, core-concrete reaction, atmosphere source terms, radioactive nuclide dissipation and public result. This also includes various applications as the decision-making.

NQE735 Special Topics in Information Engineering for Nuclear and Quantum Applications 2:3:3(4)
This course is designed to let the graduate students understand the state-of-the-art research activities in information engineering for nuclear and quantum applications and have them participate in the research through individual projects. (prerequisite subject : NQE534)

NQE743 Special Topics in Nuclear Chemical Engineering 2:0:2(4)
Application of nuclear chemical engineering related to the overall facilities of nuclear power and fuel cycle will be introduced and discussed. The advanced topics of characteristics and effects of various radioactive materials, properties and characteristics of fission products, nuclear and radiochemistry, various nuclear fuel cycle alternatives, isotope separation, storage and reprocessing of spent nuclear fuel, treatment and disposal of radioactive wastes, environmental impacts and environmental friendly nuclear power assessment will be covered and carefully reviewed.

NQE960 M.S. Thesis Research

NQE965 M.S. Independent Research

NQE980 Ph.D. Thesis Research

NQE966 Seminar(M.S.) NQE986 Seminar(Ph.D.) 1:0:1
Seminar is given by the staff of the department or invited guest speaker on topics of recent interest in the overall field of nuclear engineering, including the design and operation of nuclear reactors, reactor kinetics, heat transfer, energy conversion, radiation shielding, nuclear fuel cycle and management, nuclear materials and safety, and radiation technology etc.