❒ **Undergraduate Program**

The undergraduate program in the department provides students with basic principles of engineering and sciences related to the nuclear energy, radiation and quantum technologies and their engineering applications. The overall courses in the department are well suited for any student who has taken freshman- and sophomore-year courses in engineering or science.

All the students in the department actively participate in various departmental activities such as seminars and individual research courses, and develop their relationships with faculty members and graduate students in the department.

❒ **Graduate Program**

The graduate program provides Master's and Doctoral degrees in a broad spectrum of research areas including nuclear energy, environment, biomedical imaging, industrial applications of radiations, and quantum beam science and quantum technology. Accordingly the graduate program of Nuclear and Quantum Engineering at KAIST is widely open to students who have any engineering or science background. With the goal of "Better Life through Nuclear and Quantum Technology", all the graduate students work on their own research and also actively participate in interdepartmental research and international academic activities. All graduate course lectures in the Department of Nuclear and Quantum Engineering are given in English.

Academic Activity and Research Areas

The academic activity and research areas of nuclear and quantum engineering, that are currently ongoing, are as follows:

❒ **Nuclear Reactor Physics and Computational Particle Transport**

The interests of this research field are focused on the investigations of neutron and radiation particle transport and their interactions with matter for engineering applications. The area includes studies of space-energy-time distributions of neutrons in nuclear reactors and of neutral and charged particle transport in various media, based on reactor physics, atomistic and molecular simulations and computational science. These are then applied to reactor core design, reactor control, in-core fuel management, nuclear imaging, radiation therapy planning, and radiation shielding in the design of various such nuclear systems. The research activities involve large-scale computation and simulations using high-performance parallel, distributed, and cluster computers.

❒ **Nuclear Thermal-hydraulics and Nuclear Reactor Safety**

This field covers the education of nuclear thermal-hydraulics and nuclear reactor safety, fundamental thermal-hydraulic experiments, thermal-hydraulic verification tests, and the development of software for core thermal design and safety analysis.

❒ **Nuclear Instrumentation, Control and Information Engineering**

This area is related to the education and researches for the safety and optimized operation of nuclear power plants, and mainly deals with the process instrumentation and control of nuclear power plants. This area also includes the development of software tools for assisting the verification and validation (V&V) of safety-critical software, the reliability assessment of digital systems, the analysis of the man-machine interface system (MMIS) design, and the computer simulation for safe operation of nuclear

power plants.

❒ **Nuclear Environmental Engineering and Radioactive Waste Management**

The fields of nuclear environmental engineering and radioactive waste management include the education and research on nuclear chemical engineering, radioactive management and health physics, that is, nuclear fuel cycle, radioactive waste management and disposal, performance assessment of waste disposal site, spent fuel technology and interim storage, water chemistry and isotope separation.

❒ **Nuclear Materials**

Better reliability and longer life of nuclear structural materials and fuels are sought through continuously improving fabrication and test methods. They are based on microstructure and property relationship, evaluation of fracture, fatigue, corrosion, and their synergistic effects under nuclear environments. Current research activities are concerned with microstructural change under irradiation, crack formation and propagation under stress corrosion condition, and hydrogen behavior in materials at elevated temperatures.

❒ **Radiation Detection and Medical Imaging**

Based on the knowledge of behavior of ionizing radiation in materials, research on the simulation of radiation transport, the new radiation sensor material, the radiation imaging detectors, the signal processing electronic circuits, and the image processing electronics are performed for the applications in radiation protection and dosimetry, non-destructive test and security monitoring, medical diagnostic imaging.

❒ **Neutron Scattering and Nanoscale Materials**

Neutron scattering is a very powerful technique to investigate structures and dynamics of nanoscale materials. The fundamental phenomena and technical applications of nanoscale materials such as molecular self-assembly, carbon nanotubes, nanoparticles and their self-assembled superstructures, biomembrane-protein complex, magnetic and superconducting materials are studied using neutron scattering.

❒ **Quantum Beam Engineering**

Main research in quantum beam engineering include generation and utilization of both the photon beam and the charged-particle beams such as electron beam, proton beam, and positron beam. This field has close relations with particle accelerators and the advanced photon sources. Applications of the quantum beams to the nanotechnology, materials, environment, biotechnology, and basic science are also studied.

❒ **Nuclear Energy Policy**

In this course, the focus is on technological comparisons, the economical and environmental analysis and the policies of various energy sources such as nuclear fission, thermonuclear fusion, solar energy and the other alternative energy sources together with key energy conversion systems.

❒ **Engineering of Nuclear Fusion Reactor**

Fundamental theories and engineering problems related to nuclear fusion reactors are studied. Educational and research topics include principle of nuclear fusion reactions, plasma behavior in fusion reactors, energy balance in fusion reactors and several other important engineering problems in fusion reactor systems.