

## **Advanced Technology in Emerging Fields 1: 2 credits**

This course introduces the student to cutting-edge scientific and technological research conducted in emerging fields in Asia, especially China, Korea, and Japan. Students can engage in a variety of activities, including expert-led lectures, thought-provoking seminars, research laboratory visits, and interactive group discussions with the opportunity to reconsider the contributing role science and technology can play in society as well as a platform to think about what kinds of science and technology are needed today. Students will visit private enterprises and research institutions in order to exchange opinions with researchers engaged in interdisciplinary research and development.

### **Site Visit and Lab Tours**

July 3 Thu, O-okayama Campus

July 4 Fri, Suzukake-dai Campus

July 11 Fri, SONY in Tokyo

July 18 Fri, RIKEN in Wako

July 25 Fri, Keiyo JCT Construction Site and NIMS-MANA in Tsukuba

### **Lectures**

July 3 Thu

"New Approach to Mechanical Engineering"

This lecture provides the constructive approach to identify algorithms in animals. We focused on a silkworm moth, which is known as a domestic animal for 5,000 years. A male adult silkworm moth can locate a female according to special chemicals, called pheromone, released by a female. The ability to trace chemicals is quite useful for engineering applications but is difficult for artificial distributed systems. We have introduced some novel experimental systems including the brain-machine hybrid system, optogenetic animals, and combination with a virtual field and a living moth. We will discuss the performance and the results of the constructive approach with those systems.

July 10 Thu and 11 Fri

"Human Machine Interactions"

This course introduces the student to recent achievements in physical human machine

interactions (pHRI), which has been increasingly important in robotics and human interface research. First, I am going to start from haptics, which is a study of touch in real, virtual and tele-environments. Second, I am also going to teach surface electromyography (sEMG) for human-augmented devices. After these lectures, student will learn basic aspects of touch and biosignal processing techniques in physical human-robot interactions, which covers from assistive devices, virtual reality, exoskeleton robots to brain-machine interfaces.

#### July 17 Thu and 18 Fri

##### "Life-Inspired Integrative Biotechnology for Bioeconomy"

Evolutionary biology is becoming important for understanding the mechanism of mutation-based life evolution, which will provide useful information for biotechnology. Industrial biotechnology is playing essential roles for the development of green and sustainable industry to form the so called bioeconomy society. This lecture will introduce integrative biotechnology approaches needed for bioeconomy society to the students. It will include the following topics: 1) life principles and brief introduction of the life-inspired integrative biotechnology; 2) directed evolutionary breeding technologies for evolutionary biology and industrial biotechnology.

#### July 24 Thu

##### "An Innovative Nuclear Transmutation Method in Condensed Matter"

In the field of physics, it has been always known as a matter-of-course that it is necessary to use a nuclear reactor or an accelerator in order to nuclear transmutation. In this seminar, a simple and compact nuclear transmutation method will be introduced. Nuclear transmutation reactions in nano-structured material have been observed in nano-structured Pd multilayer thin film which are composed of Pd and CaO thin film and Pd substrate, induced by 1atm D<sub>2</sub>gas permeation at about 70 C. We observed transmutation reactions of Cs into Pr, Ba into Sm, W into Pt up to now. Replication experiments have been performed by some researchers and similar results have been obtained. Potential applications for the transmutation of radioactive waste and a new energy source would be expected using this method.