# Description of Courses

## ▣ Master's·Doctoral Programs

**BCE500    Brain and Cognitive Engineering I**                                                   3:0:3(6)

This course is designed to provide the students with opportunities to deepen their learning in neurobiology and cognitive neuroscience ranging from neurons to whole-brain activity, and to understand engineering applications in these fields. First, students learn the information processing at the neuron level, and then are introduced to the applications for therapeutic or diagnostic purposes. This course offers an opportunity to learn knowledge required for engineering applications of neuroscience knowledge. It covers the basic principles and applications of various topics such as brain-based artificial intelligence, brain-machine interface, brain reverse engineering, neuroprosthetics and cognitive robot.

**BCE501    Brain and Cognitive Engineering II**                                                  3:0:3(6)

The course covers the brain-mechanical connection system, neural system, neural function control technology, information processing process, brain imaging, brain connectivity extraction and cognitive modeling which are currently in use or being studied for use in brain science, cognitive science and clinical medicine, in order to identify the problems of brain and cognitive engineering.

**BCE550    Neuroinformatics**                                                                   3:0:3(6)

Various engineering methodologies for analysis of information of genomes, proteomes and connectives related to neurobiology are explained to help students acquire knowledge for the applications to brain cognitive engineering research.

**BCE630    Advanced Computational Neuroscience**                                                3:0:3(6)

A theoretical and mathematical model approach is essential to explore and understand the complex operating principles of various brain and nervous systems. This course introduces useful knowledge and techniques for computational research approaches to various research topics of the nervous system ranging from analysis of activity of single neurons to simulation of large neural networks.

**BCE670    Neural Tissue Engineering**                                                          3:0:3(6)

Recent advances in neuroscience, cell culture, genes, and nanotechnology have contributed to understanding mechanical/physical deformations of nerve damage and, moreover, to providing optimism about the treatment of nerve damage using functional biomaterials. This course covers latest technologies for nerve regeneration and recovery of injured spinal cord through various materials and engineering approaches.

**BCE770   Brain-Machine Interface**                                                             3:0:3(6)

This course looks at invasive and non-invasive approaches for the implementation of brain machine

access system, and software and hardware technologies for the implementation of each  approach are explained.

**BCE772    Brain-Inspired Artificial Intelligence**                                            3:0:3(6)

Thus far, artificial intelligence has been developed in a way based on expert system, pattern recognition and artificial neural network. Although it showed an ability surpassing human being in procedural calculation, learning, memory, exercise, etc. on this basis, it has failed to work properly in emotion, sociality, decision making, judgment, and consciousness. This course introduces the history of artificial intelligence and its achievements based on the working principles of brain, and the breakthroughs of artificial intelligence are discussed as well.

**BCE800    Special Topics in Brain and Cognitive Engineering**                          3:0:3(6)

Recent research trends and new research topics are examined in the field of brain and cognitive engineering. The topic may be different for each course offering, and the topic is used as the course subtitle.  Lecture format is adopted to teach professional knowledge and techniques on specific topic, and  latest papers and reference books are used as teaching materials.

**BCE801   Recent Trends in Brain and Cognitive Engineering(1)**                          1:0:1(2)

This course is designed to introduce the latest research trends, emerging research fields and advanced technologies in the field of brain and cognitive engineering. The topic may be different for each course offering, and the topic is used as the course subtitle. Class is conducted centering around expert seminar.

**BCE802    Recent Trends in Brain and Cognitive Engineering (2)**                        2:0:2(4)

This course is designed to introduce the latest research trends, emerging research fields and advanced technologies in the field of brain and cognitive engineering. The topic may be different for each course offering, and the topic is used as the course subtitle. Class is conducted centering around expert seminar and discussions.

**BCE960    Thesis/Dissertation Research(Master)**
**BCE980    Thesis/Dissertation Research(Doctoral)**

Based on a thesis research topic approved by the thesis advisor, students prepare theses for the master's degree through study in their field of research.

**BCE966    (Seminar(Master))**                                                          1:0:1
**BCE986    (Seminar(Doctoral))**                                                        1:0:1

Internal and external experts will be invited to give lectures on recent research activities and future research directions in the fields of biotechnology, brain engineering and biomedical engineering, which are followed by in-depth discussions on relevant issues.