Seminar Overview: International students from TTI's partner universities select up to five laboratories based on their academic interests and experiences. TTI will assign each student to one of the laboratories of their choice.
Participants are expected to have basic background knowledge and English proficiency to actively engage in the laboratory program of their choice.
Please note that the international students may not be assigned to their preferred laboratory, in case other applicants fill in the posts.
For information on the laboratories, please visit our website.

	Laboratory	Supervisor(s) Main supervisor in bold	Maximum Number of Students Allocated	Program Theme	Program Summary
A	Micro-Nano Mechatronics Laboratory	**Prof.Minoru SASAKI**	1	Vibration measurement (aiming applications of micro-resonators)	Mechanical resonator has the higher Q value compared to the electrical one.Taking this advantage, the mechanical micro-resonators are used in many sensors and actuators. Students are going to observe the vibration of the relatively large cantilever-type resonator visually, and then measure the vibration of the micro-resonator using the equipment.From both experiments, students will understand the characteristics of the vibration.
B	Fluid Engineering Laboratory	**Prof. Taro HANDA**	1	Flow measurement and visualization using pressure-sensitive paint	Pressure sensitive paint (PSP) has become a powerful tool for the surface pressure measurements in wind tunnel testing. This approach uses the luminescent molecules that emit luminescence whose intensity increases with decrease in the partial pressure of oxygen. By using PSP, we can measure the surface pressure with a high spatial resolution in wind tunnel testing. In this laboratory, a method using PSP are introduced as a method to measure and visualize the flows, and students will learn how to measure the flows using the sensors.
C	Design Engineering Laboratory	**Associate Prof. Masakazu KOBAYASHI**	2	Introduction to digital engineering	Recently, computers are used at every stage of product development such as design, analysis, manufacturing and test. Product development using computers is commonly called “Digital engineering.” Digital engineering enables design of more superior products in addition to efficiency enhancement of product development, and that leads to reduce environmental problems. In this theme, in order to learn the basics of digital engineering, students will design items using 3D CAD “SolidWorks”, analyze them using FEM software “ANSYS” and produce them using a 3D printer.
D	Semiconductor Laboratory	Prof. Yoshio OHSHITA **Assistant Prof. Nobuaki KOJIMA**	1	Solar cell fabrication and characterization of electrical properties	The solar power generation as the leading renewable energy source greatly expands in recent years. To achieve low cost and high efficiency in crystalline Si solar cells and III-V compound solar cells, we are developing the various advanced technologies. In this course, students will learn how to fabricate solar cells and characterize the electrical properties. Through the experiments, students can imagine the next generation solar cells.
E	Memory Engineering Laboratory	**Prof. Hiroyuki AWANO** Associate Prof. Kenji TANABE	2	Spin Electronics	In order to realize the 4th Industrial Revolution, innovative power saving and cost reduction of IoT (Internet of Things), Big Data and AI (Artificial Intelligence) thechnologies are required. Currently, these technologies are operated by semiconductor devices. In semiconductors, data is handled by charge of electrons. However, semiconductors consume a large amount of power to maintain those data, because the charge, which is data, spontaneously discharges and disappears when the power supply stops. Therefore, the realization of the Fourth Industrial Revolution requires the creation of new innovative power-saving information processing technology. Therefore, spin electronics technology that does not require power to maintain information attracts attention. Electrons have two properties, charge and spin, and in the past electronics have used only the charge of electrons. However, the spin, which is the source of the permanent magnet, can maintain data without power supply. In this laboratory, using this property, we are trying to study spin sensors for IoT, spin memories for big data, spin logic for artificial intelligence, etc.
F	Intelligent Information Media Laboratory	**Prof.Norimichi UKITA**	1	3D computer graphics model generation and its application to image recognition	In this theme, students will learn two biggest topics in computer vision, namely, 3D shape reconstruction and image recognition. For 3D shape reconstruction, a target object is captured from multiple view points. These images are used for reconstructing the 3D shape of the object based on multi-vew geometry. By projecting the texture images observed in the images onto the surface of the reconstructed shape, we can acquire the 3D computer graphics model of the object. In image recognition, the pixelwise region of a target object is extracted and its object class (e.g., dog, cat, human) is classified by employing deep learning. The aforementioned technologies are implemeted with Python.
G	Polymeric Nanocomposites Laboratory	**Associate Prof. Masami OKAMOTO**	1	Evaluation of cellular motility of breast cancer cells incubated on viscoelastic polymeric gel scaffolds	Cancer ranks as the leading causes of mortality in Japan. Despite the increase in life expectancy by advances in therapy with anticancer drug, about 90% of the death is caused by cancer invasion and metastasis. Aligned and hard extra cellular matrix, hypoxic condition and lower pH are observed around tumors, those are called as niches. In our laboratory, students will have experience to prepare the viscoelastic polymeric gel scaffolds as a niche and evaluation of the cellular motility of breast cancer cells incubated on the scaffolds using a fluorescent microscope. The niches are able to elicit epithelial-mesenchymal transition (EMT), where an epigenic program that leads epithelial cells to lose their cell-cell and cell-ECM interactions to undergo cytoskeleton reorganization and to gain morphological and functional characteristics to mesenchymal cells. EMT is at the forefront of cancer metastasis research.
H	Surface Science Laboratory	Prof. Masamichi YOSHIMURA **Associate Prof. Masanori HARA**	2	Fabrication of capacitor with carbon-nanotube-modified electrodes	Electric double-layer capacitor (EDCL) with fast response and high power density has attracted attention as an electric power storage system to smooth the fluctuation of electric power from renewable energy sources. However, charging capacity of EDLC is lower than that of other rechargeable battery such as Li-ion battery. To improve capacity of EDLC, the fabrication of EDCL with high surface area is required because the capacitance of EDCL depends on a surface area of the electrode. Recently, the electrode composed of highly oriented carbon nanotube (CNT) has been developed because of its high specific surface and high capacity. In this theme, we synthesize vertical-aligned CNT on a substrate electrode and evaluate the morphology and performance of the electrode as a novel electrode material for EDCL.
I	Quantum Interface Laboratory	**Prof. Itaru KAMIYA** Associate Prof. Akira YAMAKATA	2	Molecular beam epitaxial growth of quantum structures and their physical properties	Quantum structures that are used for various electronic devices involve one of the most advanced technologies in the semiconductor industries. In this program, the participant will have the opportunity to prepare quantum structures by molecular beam epitaxy (MBE), and measure their physical properties to recognize the potential of quantum mechanics into the real world.
J	Energy Materials Laboratory	**Prof. Tsunehiro TAKEUCHI** Associate Prof. Masaharu MATSUNAMI	2	Electron and thermal transport properties of thermoelectric materials and superconductors	Thermoelectric materials are used for generating electricity power from heat. Superconductors are characterized by zero-resistivity and Meissner effect, the latter of which is known as a phenomenon to the expulsion of a magnetic field. Proper understanding of the behaviors of physical properties, such as electrical resistivity, Seebeck coefficient, and thermal conductivity, helps us to know underlying physics and to improve their functions. In this summer seminar, students will make measurements of these physical properties over a wide temperature range from 2 K to 1000 K for studying advanced technologies and techniques that are the necessities of measurements. Students also study the physics determining the functions.