Subject						
Technology for Advanced Measurement (i)						
Category	Credit	Course	Lecture/ Laboratory work	Subject NO.	Subject Period	Room
Specialized	1	Elective	Lecture	332255	Autumn	TBA

1. Outline

【Lecturers in charge】

Takayuki Yanagida (Noriaki Kawaguchi, Go Okada), Masakazu Nakamura

【Subject Aims】

This lecture explains the technologies used for measurement and characterization of materials/structures from basic principles to advanced research topics. Ionizing radiation detectors used in medical, security, oil-logging, high energy physics and environmental monitoring, precise electrical measurements for very low current or extremely high resistance in semiconductor materials/devices, scanning probe techniques for nanometer-scale characterizations, etc. will be the selected topics.

【Course Guidelines】

Students attend lectures, and deepen their understanding through exercises and reports assigned in the class.

2. Syllabus Planning

class	【Topics】	【Contents】
1	Ionizing radiation detection methodologies	Overviews of radiation detectors, basic principles and basic physics of inorganic luminescent materials
2	Scintillation detectors	Theory of scintillators, examples of scintillation detectors, detection techniques and recent progress of this field
3	Dosimeters	Theory of dosimeters, examples of practical dosimeters, detection techniques and recent progress of this field
4	Medical and security applications	Medical (X-ray CT, SPECT, PET, IP, radiation therapy) and security applications
5	Precise electrical measurements	Basics of circuit theory, variation of instruments for electrical measurements, and examples of precise electrical measurements
6	Characterization of semiconductor materials	Theory and techniques for conductivity, carrier (doping) density, mobility, contact property, and trap density in semiconductors
7	Scanning Probe Microscopy I	Mechanisms, instruments and applications of Scanning Tunneling Microscopy, Atomic Force Microscopy, and Frictional Force
8	Scanning Probe Microscopy II	Mechanisms, instruments and applications of AFM current imaging, Kelvin Probe Force Microscopy, and AFM Potentiometry

【Textbooks】

During the lecture, the teachers will hand out materials accordingly.

【Supplementary Textbooks/Workbooks】

R. Wiesendanger: Scanning Probe Microscopy and Spectroscopy (Cambridge University Press); Low Level Measurements Handbook (Keithley Instruments Inc.); D. K. Schroder: Semiconductor Material and Device Characterization (Wiley-IEEE Press); G. F. Knoll; Radiation Detection and Measurement (Wiley)

3. Others

【Requirements for registration】

None

【Office Hours】

Not specified. (Available as much as time allows.)

【Method of Evaluation】

Based on attendance including classroom participation (40%) and report (60%), students will be graded A (excellent), B (above average), C (average), or D (below average).

【Related Subjects】

Photon and Condensed Matters I and II, Information Device Science, Advanced Photonic Devices

【Important notes】

None