Course number	U-LAS70 10002 SE50				
Course title (and course title in English)	ILAS Seminar-E2 :How to make nano-machines（ナノマシンの作り方） ILAS Seminar-E2 :How to make nano-machines	**Instructor's name, job title, and department of affiliation**	Graduate School of Engineering Senior Lecturer,BANERJEE, Amit		
Group	Seminars in Liberal Arts and Sciences	**Number of credits**	2	**Number of weekly time blocks**	1
Class style	seminar (Face-to-face course)	**Year/semesters**	2024・First semester	**Quota (Freshman)**	15 (15)
Target year	Mainly 1st year students	**Eligible students**	For all majors	**Days and periods**	Fri.5
Classroom	03, Yoshida-South Campus Academic Center Bldg. West Wing			**Language of instruction**	English
Keyword	Nano / Nano-machine / Nano-technology / Internet of Things (IoT) / Artificial Intelligence (AI)				

[Overview and purpose of the course]

Nanotechnology is revolutionizing human society. If you are curious how nano-machines are being developed, this seminar course will be very informative.

One of the greatest technological achievements of past few decades is our ability to make micro-meter scale ' machines'. These machines have become ubiquitous in our daily life, giving functional capabilities to our smart-phones, cars, digital projectors, medical devices, etc. In this technological revolution of extreme ' shrinking' of machines, we have entered an era where machines of only a few hundreds atoms wide can be built.

Have you ever wondered how do we build such small machines and make them function desirably in such small scale?

In this seminar course, I will reveal the tricks of the trade of fabricating micro / nanoscale machines. I will also elaborate the underlying physics (working principles) of micro / nano machines. This seminar course is based on my own research area, so I can show you pictures and videos of actual micro / nano machine fabrication and operation that I collect during my own research in Kyoto University.

[Course objectives]

Students will learn about nano-scale machines: how they work, how they are made, and their amazing applications.

[Course schedule and contents)]

1. Why do we want to make nano-machines?
Introduction to nano-machines and their advantages, examples of micro/ Nano-machines and their applications. (2 weeks)

2.How can we controllably create and sense motion at nanoscale?
Building blocks of nano-machines: actuators, motion sensors, etc. (3 week)

3. How do nano-machines work?

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Working principles of nano-machines: accelerometers, gyroscopes, pressure-sensors, ultra-sensitive mass and gas sensors, AI computing devices. (2 weeks)

4. How do we create nano-machines?
Material and methods for creating nano-machines: silicon, diamond, graphene, etc.; lithography, reactive-ion-etching, chemical-vapor-deposition, electron and ion-beam methods, etc. (5 weeks)

5. Discussion on current trends and future potentials of this research area. (2 weeks)

6. Feedback (1 week)

[Course requirements]

None

[Evaluation methods and policy]

Active participation (10%), submission of a final report (topics will be discussed during the lecture) (90%)

[Textbooks]

Instructed during class

[References, etc.]

（References, etc.）
Introduced during class

[Study outside of class (preparation and review)]

Following lecture materials and reading recommended articles

[Other information (office hours, etc.)]

To be decided during lecture