Master technology, create technology
Toyohashi Tech

Last updated in November 2026

Course description at Toyohashi University of Technology
- 3rd semester -

■ Compulsory Courses

Ethics for Researchers (2 ECTS)

Course instructor: e-learning and Supervisors at TUT

Aims:

To support graduate students in their research activities and to promote understanding of the ethical problems involved; to lead students to independent thinking and normative awareness of research ethics through ethics education in research, in accordance with the goals of scientific education and research and the characteristics of individual research specialties.

Content:

1st - 6th week: Modules in e-learning
- Research Misconduct
- Ethical Issues in the Management of Data in Engineering Research
- Responsible Authorship
- Ethical Issues in the Peer Review and Publication of Engineering Research
- Collaborative Research in Engineering Fields
- Whistleblowing and the Obligation to Protect the Public
- Managing Public Research Funds

After completing the e-learning course, students must submit the e-learning Certificate.
7th week: Discussion with the supervisor
8th week: Report writing

Link:

https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=D5002001c&je_cd=1

Japanese Communication Theory (4 ECTS)
(Non-TUT students)

Course instructor: Tomoe YOKOZAWA

Aims: The purpose of this course is to learn new Japanese grammar/expression and how to use them to communicate with Japanese people in Japanese. After having successfully taken this course, the student can give a simple presentation in Japanese.

Content:

Week 1. Introduction
Week 2. Starter Lesson 1〜5 Review of Vocabulary, Grammar and Conversation
Week 3. Starter Lesson 6〜10 Review of Vocabulary, Grammar and Conversation
Week 4. Starter Lesson 11〜14 Review of Vocabulary, Grammar and Conversation
Week 5. Starter Lesson 15〜18 Review of Vocabulary, Grammar and Conversation
Week 6. Elementary 1 Lesson 1〜5 Review of Vocabulary, Grammar and Conversation
Week 7. Presentation & Discussion
Week 8. Presentation & Discussion
Week 9. Elementary 1 Lesson 6〜10 Review of Vocabulary, Grammar and Conversation

Week10. Elementary 1 Lesson 11〜14 Review of Vocabulary, Grammar and Conversation
Week11. Elementary 1 Lesson 15〜18 Review of Vocabulary, Grammar and Conversation
Week12. Elementary 2 Lesson 1〜3 Review of Vocabulary, Grammar and Conversation
Week13. Elementary 2 Lesson 4〜6 Review of Vocabulary, Grammar and Conversation
Week14. Presentation & Discussion
Week15. Presentation & Discussion
Week16. Review

Course material:

You can download the textbooks from the URL below.

Irodori: Japanese for Life in Japan Starter (A1)
https://www.irodori.jpf.go.jp/starter/pdf.html

Irodori: Japanese for Life in Japan Elementary 1 (A2)
https://www.irodori.jpf.go.jp/elementary01/pdf.html

Irodori: Japanese for Life in Japan Elementary 2 (A2)
https://www.irodori.jpf.go.jp/elementary02/pdf.html

Data Science and Analysis (4 ECTS)

1st quarter

Course instructor: Prof. Tomoyoshi AKIBA

Aims:

Important topics on statistical natural language processing will be discussed by focusing on statistical machine translation.

Content:

1. Introduction
2. Lecture (Basic of Probability and Statistics, Recent Trends in Machine Translation)
3. Presentation & Discussion (Statistical Method for Machine Translation)
4. Presentation & Discussion (Language Models)
5. Presentation & Discussion (Translation Models)
6. Presentation & Discussion (Parameter Estimation)
7. Presentation & Discussion (EM Algorithm)
8. Presentation & Discussion (Advanced methods in SMT)

Link:

https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M43610080&je_cd=1

2nd quarter

Course instructor: Assoc. Prof. Hideki TAMURA

Aims:

This course develops the ability to select, conduct, and interpret statistical analyses for experimental data in psychology, cognitive science, information science, and computer science. Students learn to connect a research question to the data-generating process, identify independent observational units and hierarchical structure, select an appropriate analytical method, conduct the analysis in R, and interpret effect sizes, uncertainty, assumptions, and limitations. Classical analyses and hierarchical analyses are compared using the

same research questions and datasets whenever appropriate. By the end of the course, students will have acquired the essential statistical skills needed to analyze data from human participants and computational models and to report the results in scientific papers.

Content:
Week 1: Understanding Data Before Analysis
Week 2: Two-Condition Comparisons - t-tests and Linear Mixed-Effects Models
Week 3: Three-or-More-Condition Comparisons - ANOVA and Linear Mixed-Effects Models
Week 4: Correlation, Simple Regression, and Multiple Regression
Week 5: Evidence for Absence and Multivariate Summaries
Week 6: Evaluating Machine-Learning Model Performance
Week 7: Comparing Humans and Computational Models using Representational Similarity Analysis
Week 8: Course Synthesis and Final Examination

Link:
https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M23610070&je_cd=1

Advanced Research Methods (4 ECTS)

Course instructor: Supervisors at TUT (literature review at lab)
Aims:
The course is intended for students to study basic materials in depth, related to his/her research topics through the lab works. It is also aimed for students to acquire various skills, required in general research work, such as those for literature review, oral presentation, and technical discussion and writing.
Content:
While specific contents depend on the research topics students are involved in, it is usually the case for students to read relevant textbooks/research papers and report on them, as well as to present and discuss on the research work of their own.

Link:
https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/SyllabusSearchStart.aspx?lct_year=2024&lct_cd=M43610070&je_cd=1

Case Study in Imaging and Light and XR (8 ECTS)

Course instructor: Assoc. Prof. Hideki TAMURA
Aims:
As a steppingstone to master's research, after acquiring basic skills in constructing VR environments using headsets, conduct behavioral measurement experiments using them. In addition, as an advanced form of activities, students will develop XR systems or conduct measurement experiments utilizing Computer Vision, Psychophysics, and XR technologies. All activities will be conducted as a small team in order to learn about team building and task assignment. The final activity will be presented and the results will be discussed. By the end of the course, students will have acquired the essential skills needed to design and conduct psychophysical experiments with human participants using XR technology.

Content:
The project theme is initially presented as a candidate and is finally decided through discussion with the students.

In case of any changes to the course content and evaluation of achievement or the class format, it will be informed via Google Classroom or KYOMU JOHO SYSTEM.

Link:
https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M23610080&je_cd=1

■ Elective Courses

Note: From starting with 2025 intake, students are able to choose 8ECTS from the following 4 classes. This change is due to the integration of lighting and Imaging courses from 2025 onwards.

Human Sensation & Perception (4 ECTS)

1st quarter
Course instructor: Prof. Shigeki NAKAUCHI
Aims:
This course is designed to introduce you to the scientific study of human nature. You will learn why and how scientists ask questions about the sensation and perception and the relation of brain and behavior. You will also learn about the research methods to measure the perception and cognition used in the field of psychology and cognitive science. Finally, you will be able to create your own experiments using the software for creating experiments for psychology, psychophysics or cognitive science.

Content:
1. Introduction to “Science of Human Sensation and Perception” 1
2. Introduction to “Science of Human Sensation and Perception” 2
3. Measuring Perception – research methodology 1
4. Measuring Perception – research methodology 2
5. Measuring Perception – research methodology 3
6. Creating online experiments using software 1
7. Creating online experiments using software 2
8. Wrap up the course

Link:
https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M23620090&je_cd=1

2nd quarter
Course instructor: Assoc. Prof. Kyoko HINE
Aims:
The aim of this course is to acquire techniques for measuring human sensation and perception, as well as methods for evaluating these measurements. Specifically, students will plan experiments, conduct practical sessions, and perform data analysis through field work, and will present their outcomes in the form of presentations and written reports.

Content:
Week 1: Experimental planning
Week 2: Experimental preparation
Week 3: Experimental preparation

Week 4: Experiment execution
Week 5: Data analysis
Week 6: Presentation preparation
Week 7: Presentations
Week 8: Review

Link:
https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M23630370&je_cd=1

X Reality and Psychology (4 ECTS)

1st quarter
Course instructor: Prof. Michiteru KITAZAKI
Aims:
Upon completion of the course, students will demonstrate an understanding of the principles of X reality (cross reality or extended reality: XR), including Virtual Reality (VR), Mixed Reality (MR), and Augmented Reality (AR), at the psychological, physiological, and functional levels. Additionally, they will be able to evaluate the potential benefits and challenges of VR/MR/AR/XR on future societies.

Content:
The course will provide an in-depth examination of the mechanisms and functions of X Reality, including Virtual Reality, Mixed Reality, and Augmented Reality. This will be achieved by adopting a multi-disciplinary approach, integrating insights from engineering and psychology. The final component of the course is a student-led presentation of an original application, device, or concept related to X Reality, followed by a discussion.

1. Introduction to XR and Psychology
2. Two Components of Reality
3. Virtual Reality, Mixed Reality, and Augmented Reality
4. Multi- and Cross-modality Phenomena
5. Embodied Cognition and Augmented Human
6. Exploring Metaverse
7. Student Presentations and Discussion
8. Student Presentations and Discussion

Link:
https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M23630360&je_cd=1

2nd quarter
Course instructor: Prof. Kazumasa UEHARA

Aims:
After the course, students will understand the principles of virtual reality (VR), mixed reality (MR), augmented reality (AR), and X reality (cross reality: XR), on psychological, physiological, and functional levels. They will also be able to understand the benefits and challenges of VR/MR/AR/XR on the future society.

Content:
Lectures and exercises on related topics including visual and other modalities of cognition, cross-modal cognition, VR, MR, and AR, as studied in X reality and Psychology I (first quarter).

Week 1. Introduction
Week 2. Methods of X reality and psychology
Week 3. Sensation and perception
Week 4. Object recognition
Week 5. Motor control
Week 6. Emotion
Week 7. Non-invasive measurements of human brain function
Week 8. Exercise in EEG analysis

Link:
https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M23630400&je_cd=1

Robotic Perception and Human-Robot Interaction (4 ECTS)

1st quarter
Course instructor: Prof. Jun MIURA
Aims:
Fundamental and advanced issues in intelligent robotics will be discussed. Topics included are statistical sensor fusion with Bayes filters, object tracking and identification, robotic mapping and localization, observation planning, human detection and identification, and task-oriented human-robot interaction.
Content:
Week 1: Introduction, probability basics, and sensor fusion by Bayesian inference.
Week 2: Object tracking by Bayesian filters.
Week 3: Mobile robot localization.
Week 4: Mapping and SLAM (simultaneous localization and mapping)
Week 5: Observation planning.
Week 6: Human recognition and human-robot interaction
Week 7: Presentation of assignment (1)
Week 8: Presentation of assignment (2)

Link:
https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M43630480&je_cd=1

2nd quarter
Course instructor: Assoc. Prof. Ren OMURA
Aims:
The aim of this course is to utilize tools and platforms to construct human-robot affective communication in a real-world scenario.

Content:
Week 1: Building interactive sociable robots of the future
Week 2: Real-time multi-modal processing for constructing a sociable robot's conversation system
Week 3: Network services for sociable robot manipulation
Week 4: 3D robot printing technology
Week 5-7: Final assignment (project work: proposing and prototyping sociable robots of the future), evaluation and review

Link:
https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M23630410&je_cd=1

3D Vision Computation (4 ECTS)

1st quarter

Course instructor: Assoc. Prof. Yasushi KANAZAWA

Aims:

This course involves fundamentals and advanced issues on 3D reconstruction from images based on geometry.

Content:

1. Introduction and Projective Geometry
2. Epipolar Geometry
3. 3D reconstruction from Two Views
4. Affine Projection
5. Uncalibrated Stereo
6. Structure from Motion
7. Robust Estimation in Computer Vision
8. Presentation and Discussion

Link:

https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M23620170&je_cd=1

2nd quarter

Course instructor: Assoc. Prof. Yasuyuki SUGAYA

Aims:

This course will introduce camera calibration methods and AR applications with various markers, including a famous AR marker, a circular marker, and natural points and lines features. Students develop an AR application based on the studied knowledge and discuss the performance of it.

Content:

1. Introduction and camera projection and Fundamental of camera calibration
2. AR applications
3. Camera pose estimation by a rectangular marker and Camera pose estimation by a circular maker
4. Experiment and discussion
5. Camera pose estimation by 2-D textures
6. Camera pose estimation by lines
7. Experiment and discussion
8. Experiment and discussion

Link:

https://kyomu.office.tut.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2026&lct_cd=M23620180&je_cd=1