March 5, 2025

Keio University Faculty of Economics

DEEP Enrollment Requirements

1. DEEP Overview

DEEP (Data-driven Economics and Econometrics Program) is a data science program administered by the Faculty of Economics which aims to equip students with both the knowledge and technical skills needed when conducting data-driven research about economics. At DEEP, our students are taught not only a theoretical understanding of data science, but also how it can be practically applied. Throughout DEEP's coursework, students will get hands-on experience in programming, analyze real-world data, compile their research into academic papers, and implement their findings into developing products that can tackle challenging issues in everyday society. Students will acquire a firm grasp of the fundamental skills necessary to make a future career as a data scientist.

2. Curriculum and Program Completion Requirements

The DEEP curriculum consists of the following three types of courses.

1. Core Courses (Offered at Hiyoshi, 10 credits or more)
   Linear Algebra、Advanced Linear Algebra、Introduction to Calculus、Calculus、Statistics Ⅰ、Statistics Ⅱ、Introduction to Econometrics (The underlined courses are required subjects)
2. Research Courses (Offered at Mita, 16 credits or more)
   Probability and Statistics a・b、Econometrics a・b、Advanced Econometrics a・b、Time Series Analysis a・b、Bayesian Statistics a・b、Introduction to Artificial Intelligence a・b、定量的マクロ経済学 a、経済地理 a・b、AI 産業論
3. Problem-Based Learning Courses (PBL)
   i. PBL course deliverables in a specialized area
      Theory and Practice of Token Economies b、データ駆動型ファイナンス入門 b、データサイエンス・コンサルティング
   ii. Research Seminar Thesis
   iii. Independent Research Project "C" Thesis

Students are awarded a certificate of completion upon submission of final deliverables from 3., after earning credits from completing the courses listed under items 1. and 2. Guidelines related to the final deliverables will be outlined below.

The program begins with students taking 2 years of “Core Courses” in mathematics and statistics at the Hiyoshi campus in order to facilitate a fundamental grasp of data science. Comprehensive mathematical knowledge is indispensable to developing a proper understanding of the theoretical aspects of data science. Additionally, while they are not considered “Core Courses,” students will expand their expertise in practical data science at the Mita Campus by taking courses in mathematics (確率論入門, etc.) and courses in information processing to learn about programming languages. Students are also strongly encouraged to join training seminars offered by the AI & Advanced Programming Consortium (AIC, https://aic.keio.ac.jp) in order to further deepen their understanding of data science.

During the program’s two years at the Mita Campus, students enroll in “Research Courses” in order to learn advanced data science techniques and applications. The skills and theoretical framework that students acquire during this phase of their studies will allow them to expertly use data science to help solve sociological issues and correctly discern which methods are effective when dealing with different types of real-world data. In the more advanced research courses, students will also develop a working knowledge of data analysis.

At the conclusion of DEEP, students will submit final deliverables obtained from practical applications of their research in data science. This is the “Problem-Based Learning” (PBL) portion of the program. PBL refers to first-hand practical experience gained from trying to solve a given problem. DEEP's PBL courses can include creating apps, etc., to help confront problems in specific areas. However, research theses written for Research Seminars or Independent Research Projects on diverse topics that use data science to analyze policy effectiveness and theoretical validity may also fulfill this program requirement.

Please contact the DEEP coordinator for information on the eligibility of research topics for DEEP final deliverables.

Guidelines for Final Deliverables

For a research seminar thesis or independent research project thesis to be recognized as a final deliverable in DEEP, it must belong to one of the following categories.

Type

1. Theoretical Research

Researching the mathematical aspects of models and methods used in econometrics, statistics, machine learning, etc.

2. Empirical Research

Analyzing real-world data using models and methods that are the subject of theoretical research.

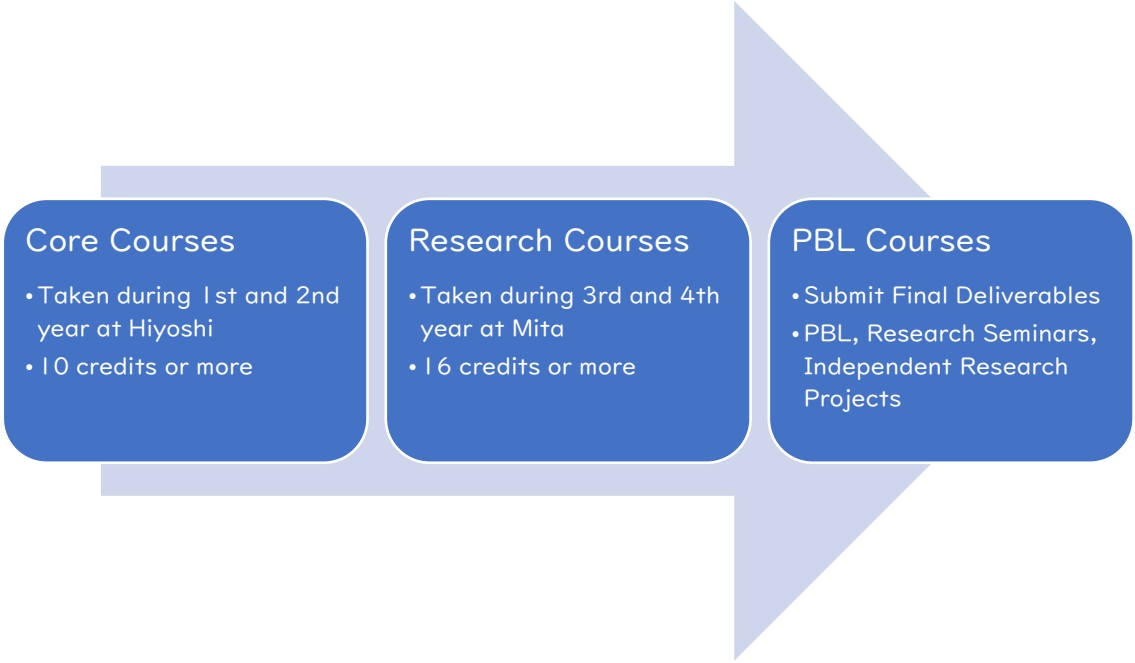
3. Numerical Simulations

Verifying the effectiveness of models and methods by conducting Monte Carlo simulations or other numerical analyses.

Examples of models and methods to be studied when conducting theoretical research

1. Statistical Models and Methods
   - -Regression models
   - -Generalized linear models
   - -Time series models
   - -Spatial models
   - -Causal inference
   - -Bayesian inference
2. Machine Learning
   - -Decision trees
   - -Deep learning
   - -Reinforcement learning

Flowchart for DEEP



3. Eligible Students

Both Type AB students and PEARL students may apply.

4. Application Guidelines

- Application period: In principle, an application should be submitted as soon as a student satisfies the DEEP completion requirements once final grades have been announced. However, if a student does not submit an application after completing all relevant coursework in their 3rd year, they may apply at the end of their 4th year. Likewise, we accept applications from students at the end of their 4th year even if they are not yet graduating from Keio provided that they satisfy DEEP program completion requirements.

- Application method: via prescribed form on K-Support (details to be posted when Grade Reports are published)
- Documents to be submitted: Academic transcripts and deliverables

5. Inquiries

DEEP Coordinator deep-group (at) keio.jp
For questions related to curriculum, program requirements, etc.
* Avoiding junk emails, please replace @ with (at) when sending the email.