



# Syllabus

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## Mathematics

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**Program** Master's Program

### Title **Mathematical Science IIIA**

(in Japanese) 数理科学IIIA

**Students recommended** Students in 1st to 2nd year **Number of credits** 1.5 [Optional] [Specialized subject]

**to study this course**

Teacher

Lecture number	Available term	Available day and period	Classroom	Name of teacher (in Japanese)	Teacher's room	Telephone number or E-mail	Office hour
01BB605	Spring ABC	Tuesday, 3	1E502	Hirokazu Nishimura (西村泰一)	Natural Science Bldg. B804	logic@math.tsukuba.ac.jp	

#### Objective of coursework

We will discuss Homotopy Type Theory.

#### Overview of coursework

Homotopy Type Theory lies at the crossroads of computer science, mathematical logic and homotopy theory. It was found out in this century that dependent type theory is no other than the internal language for (abstract) homotopy theory, just as the Mitchell-Benabou language is the internal language for topos theory. It is pleasing to note that the Freudenthal suspension theorem, Blakers-Massey theorem, Whitehead's principle for n-types, van Kampen theorem, and some other famous theorems are given new proofs within homotopy type theory.

#### Keywords of coursework

homotopy type theory, homotopy theory, model category, dependent type theory, category theory, fibered category theory, comprehension category, n-types, n-connectedness

#### Plan of coursework

After providing preliminary courses on category theory and homotopy theory, we will give elements of homotopy theory theory.

#### Method for evaluating learning results

By occasional reports

#### Educational materials, reference documents, and documents distributed, etc.

MacLane, Categories for the Working Mathematician  
 Voevodsky et al., Homotopy Type Theory  
 Jacobs, Categorical Logic and Type Theory  
 Hirschhorn, Model Categories and Their Localizations  
 Whitehead, Elements of Homotopy Theory  
 Goerss and Jardine, Simplicial Homotopy Theory  
 Lurie, Higher Topos Theory  
 Simpson, Homotopy Theory of Higher Categories

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