



## MATH2392 Theory of categories (Second part)

[22.5h] 2.5 credits

This course is taught in the 2nd semester

**Teacher(s):** Francis Borceux, Enrico Vitale (coord.)  
**Language:** French  
**Level:** Second cycle

### Aims

This is an option course in first and second masters' year. It can be taken in both of them as the content will change every year.

### Main themes

One or more arguments in the following list:

- Category theory and commutative algebra: classification of module categories, faithfully projective modules, Eilenberg-Watts theorem, Morita theorem; exact categories, regular projective objects, equivalence between exact categories with enough regular projective objects.
- Category theory and universal algebra: monads, algebras for a monad; monads over Set, finitary monads, algebraic categories, characterization of varieties and quasi-varieties.
- Category theory and algebraic geometry: sheaves on a topological space; Grothendieck topos, elementary topos.
- Category theory and homological algebra: exact and abelian categories, localisations; monoidal categories, categorical groups, group extensions.
- Category theory, knot theory and quantum groups: monoidal categories, braid groups, braided categories, Hopf algebras, invariants.
- Category theory and algebraic topology: groups, groupoids and fundamental groups of a topological space, exact sequence of groups and groupoids associated with a fibration, Van Kampen theorem.

### Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

References:

- H. Bass: Algebraic K-theory, Benjamin Inc. 1968;
- F. Borceux: Handbook of categorical algebra, Cambridge University Press 1994;
- Ch. Kassel: Quantum groups, Springer-Verlag 1995;
- S. Mac Lane: Categories for the working mathematician, Springer-Verlag 1972;
- S. Mac Lane, I. Moerdijk: Sheaves in geometry and logic, Springer-Verlag 1992;
- R. Piccinini: Lectures on Homotopy Theory, North-Holland 1992.

Prerequisites: course MATH 2391 and the Categories Theory, first part.

Organization mode: to be discussed with students.

### Other credits in programs

<b>MAP22</b>	Deuxième année du programme conduisant au grade d'ingénieur civil en mathématiques appliquées	(2.5 credits)
<b>MATH21/G</b>	Première licence en sciences mathématiques (Général)	(2.5 credits)
<b>MATH22/G</b>	Deuxième licence en sciences mathématiques	(2.5 credits)