

**Double Master's Degrees programme between MSc. in Numerical Methods in Engineering (MNME) at Barcelona School of civil Engineering (UPC) and Computational Mechanics of Materials and Structures (COMMAS) at University of Stuttgart.**

Semester 1 (Q1)		Semester 2 (Q2)		Semester 3 (Q3)		Semester 4 (Q4)	
UPC Students at UPC	U Stuttgart Students at U Stuttgart	UPC Students at UPC	U Stuttgart Students at U Stuttgart	UPC Students at U Stuttgart	U Stuttgart Students at UPC	UPC Students at U Stuttgart	U Stuttgart Students at UPC
<b>Compulsory Modules:</b> Numerical Methods for Partial Differential Equations (5 ECTS) Finite Element Method (5 ECTS) Continuum Mechanics (5 ECTS) Advanced Fluid Mechanics (5 ECTS) Computational Mechanics Tools (5 ECTS) <b>Transversal mandatory modules:</b> Communication Skills 1 (5 ECTS) Entrepreneurship (5 ECTS)	<b>Compulsory Modules:</b> Continuum Mechanics (6 ECTS) Computational Mechanics of Materials (6 ECTS) Computational Mechanics of Structures (6 ECTS) Discretization Methods and Scientific Programming (6 ECTS) Optimization of Mechanical Systems (3 ECTS) Engineering Materials I: Metals, Concrete, Soils (3 ECTS)	<b>Compulsory Modules:</b> Computational Solid Mechanics (5 ECTS) Computational Structural Mechanics and Dynamics (5 ECTS) Finite Elements in Fluids (5 ECTS) Industrial training (15 ECTS)	<b>Compulsory Module:</b> Communication oriented modules from Language Center (6 ECTS) <b>Elective Modules<sup>1</sup></b> (24 ECTS)	<b>Compulsory Modules:</b> Implementation and Algorithms for Finite Elements (6 ECTS) (=Domain Descomposition and Large Scale Scientific Computing, 5 ECTS) <b>Transversal mandatory modules:</b> Communication oriented modules from Language Center (6 ECTS) <b>Elective Modules</b> (18 ECTS)	<b>Compulsory Modules:</b> Industrial training (15 ECTS) Communication Skills 2 (5 ECTS) Entrepreneurship (5 ECTS) Advanced Fluid Mechanics (5 ECTS)	<b>Master's Thesis<sup>2</sup></b> (30 ECTS)	<b>Master's Thesis</b> (30 ECTS)
ECTS = 35	ECTS = 30	ECTS = 30	ECTS = 30	ECTS = 30	ECTS = 30	ECTS = 30	ECTS = 30

1) Academic Board will review and guarantee the equivalence of elective modules with MNME study plan compulsory courses.

2) Master Thesis defence will meet the UPC rules.

<b>List of elective modules at the University of Stuttgart</b>	<b>ECTS</b>
Selected Topics in the Theories of Plasticity and Viscoelasticity	6
Elements of non-linear Continuum Thermodynamics	6
Introduction to Continuum Mechanics of Polyphase Materials	6
Geometrical Methods of Non-Linear Continuum Mechanics and Continuum Thermodynamics	6
Micromechanics of Smart and Multifunctional Materials	6
Theoretical and Computer-Oriented Materials Theory	6
Optimal Control	6
Continuum Biomechanics	6
Non-linear Dynamics	6
Fuzzy Methods	6
Advanced Numerics of Partial Differential Equations	6
Simulation Methods in Physics for SimTech I	6
Simulation Methods in Physics for SimTech II	6
Multiphase Modeling in Porous Media	6
Numerical Methods for Differential Equations	6
Nonlinear Methods for Differential Equations	6
Nonlinear Dynamics of Mechanics Systems	6
Nonsmooth Dynamics	6
Implementation and Algorithms for Finite Elements	6
Introduction to model order reduction of mechanical systems	6
Non-linear Computational Mechanics of Structures	6
Computational Methods for Shell Analysis	6
Micromechanics of Materials and Homogenization Methods	6
Numerical Modeling of Soils and Concrete Structures	6
Visualization in Science and Engineering	6
Foundation of Continuum Thermodynamics for Single- and Multiphase Materials	6
Computational Contact Mechanics	6
Computational Dynamics for Robotics	6
Metals and Computational Materials Science	6
Simulation of multi-phase and multi-scale materials with homogenization approaches	6
Simulation of coupled problems with the Finite Element Methods	6
Variational methods in Structural Dynamics	6
Data Processing for Engineers and Scientists	6

**UPC students** (First year at **UPC**, second year at **Stuttgart**)

	Courses actually taken by student	ECTS	Equivalent course at MMNE (UPC)	ECTS
Q1	Numerical Methods for Partial Differential Equations	5		
	Finite Element Method	5		
	Continuum Mechanics	5		
	Advanced Fluid Mechanics	5		
	Computational Mechanics Tools	5		
	Communication Skills 1	5		
	Entrepreneurship	5		
Q2	Computational Solid Mechanics	5		
	Computational Structural Mechanics and Dynamics	5		
	Finite Elements in Fluids	5		
	Industrial Training	15		
Q3 (* )	Implementation and Algorithms for Finite Elements	6	Domain Decomposition and Large Scale Scientific Computing	5
	Communication oriented modules from Language Center	6	Communication Skills 2	5
	<b>Group1</b> Selected Topics in the Theories of Plasticity and Viscoelasticity Elements of non-linear Continuum Thermodynamics Introduction to Continuum Mechanics of Polyphase Materials Geometrical Methods of Non-Linear Continuum Mechanics and Continuum Thermodynamics Micromechanics of Smart and Multifunctional Materials Theoretical and Computer-Oriented Materials Theory Continuum Biomechanics Non-linear Dynamics Multiphase Modeling in Porous Media Micromechanics of Materials and Homogenization Methods Foundation of Continuum Thermodynamics for Single- and Multiphase Materials Metals and Computational Materials Science Simulation of coupled problems with the Finite Element Methods	6	Coupled Problems	5
	<b>Group 2</b> Visualization in Science and Engineering Computational Dynamics for Robotics Data Processing for Engineers and Scientists	6	Programming for Engineers and Scientists	5
	<b>Group 3</b> Optimal Control	6	Advanced Discretization Methods	5

	<p>Fuzzy Methods</p> <p>Advanced Numerics of Partial Differential Equations</p> <p>Simulation Methods in Physics for SimTech I</p> <p>Simulation Methods in Physics for SimTech II</p> <p>Numerical Methods for Differential Equations</p> <p>Nonlinear Methods for Differential Equations</p> <p>Nonlinear Dynamics of Mechanics Systems</p> <p>Nonsmooth Dynamics</p> <p>Introduction to model order reduction of mechanical systems</p> <p>Non-linear Computational Mechanics of Structures</p> <p>Computational Methods for Shell Analysis</p> <p>Numerical Modeling of Soils and Concrete Structures</p> <p>Computational Contact Mechanics</p> <p>Simulation of multi-phase and multi-scale materials with homogenization approaches</p> <p>Variational methods in Structural Dynamics</p>			
Q4	Master's thesis	30	Master's thesis	30

(\* In Q3, choose one subject from each of the groups 1, 2 and 3