

### A: Compulsory Modules (CM):

#### CM 1 Architecture:

- Historical background
- Design process
- Methods for visualization
- Form finding by computational and physical modeling
- Concept of utilization and applications

#### CM 2 Membrane Program:

- Exercises by using the membrane software ix FORTEN4000 by Gerry D'Anza
- Computational simulation of interaction of loads and large deformations
- Structural design
- Reactions at buildings

#### CM 3 Structural Design and Detail:

- Detailing
- Cables
- Interaction of main structure, substructures and membrane
- Retractable systems and movement mechanisms
- Cable structures
- Foundations

#### CM 4 Mechanical and Physical Properties:

- Testing of the mechanical material properties
- Quality controlling and certification
- International standards for testing Mechanical properties, mechanical theories and modeling
- Evidences of fire protection, hail stone and some others
- Cables

#### CM 5 Structural Design Concepts (Dimensioning):

- Exposures and its super position for load assumptions of membrane Structures
- Wind tunnel investigations for soft structures
- Reduction factors for fabrics and foils
- Mechanical characteristics of membrane materials
- Static concepts for membrane structures
- International approvals, safety levels and norms

#### CM 6 Building Physics:

- Thermal insulation
- Sound insulation
- Fire protection
- Moisture proofing
- Sustainable building

## **MM 7 Internship Theory - Fabrication and Project Management:**

- Confection and fabrication
- Connections at boundaries and edges
- Welding techniques and machines
- Transportation and erection principles
- Quality assurance
- Site facilities and operational safety
- Project
- Calculation of costs
- Service and maintenance
- Quantity survey

## **B: Additional Modules** (only for additional credits in case needed):

### **AM 1 Membrane Concepts**

- Membrane examples
- Structural principles
- Form finding by physical modeling

### **AM 2 CAD Software**

- Introduction into membrane software
- Form finding by computational modeling
- Patterning
- Load calculation

### **AM 3 Structural Engineering**

- Forces: definition, laws, equilibrium
- Structure: form, function, analysis and design, behavior of common structures
- Stress and strain: relationship, laws, properties of sections
- Dynamics: motion of a particle, velocity and acceleration, laws, torque, work
- Types of structures
- Torsion of structures
- Cables and arches
- Structural design: codes and standards, limit states, loads
- Steel work design

## **C: Optional Modules (OM):**

- Pneumatic Structures
- Studio Detailing and Patterning
- Bionics
- Foldable and Umbrellas
- Membrane Surveying
- Experimental Structures

## **D: Internship**

The internship period lasts 3 weeks and among others, can be carried out at some of the companies that sponsor the master program. Please have a look at the list of sponsors. Other companies in the field will be accepted on request.

## **E: Master Thesis**

The Master Thesis is scheduled for the fourth semester. If preferred it can be defended within a colloquium or via Skype presentation

## Study and Examination Plan for the Degree Course in Membrane Structures

The study plan specifies the volumes and allocations of the modules to the individual subject semesters within the standard course length. The elements of the master examination are: the compulsory and compulsory optional module examinations, the professional internship, the master thesis and the master colloquium. Admission to the examination shall require completion of the prior components as defined in this appendix

1. Semester	Workload			Prior examination component	Type of examination	Duration of the examination	Credits
	V/Ü Present	Ü <sup>Supervised</sup> Intern et	P				
<b>Pflichtmodule, Compulsory Modules</b>							
CM1 Architecture	20	30		H	E/B	-	5
CM2 Membrane Program/ Numerical Theory	20	30		H	K	60 min	5
CM3 Mechanical and Physical Properties	20	30		H	K	60 min	5
<b>Ergänzungsmodule, Additional Modules AM (optional)</b>							
AM 1 Membrane Concepts	(20)	(30)		LNW	E/B		(5)
AM 2 CAD Software	(20)	(30)		LNW	H		(5)
AM 3 Structural Engineering	(20)	(30)		LNW	M	20 min	(5)
<b>Summery 1. Semester</b>	<b>60</b>	<b>90</b>					<b>15</b>

2. Semester							
<b>Pflichtmodule, Compulsory Modules</b>							
CM4 Structural Design and Detail	20	30		LNW	E/B		5
CM5 Structural Design Concepts (Dimensioning)	20	30		LNW	K	60 min	5
<b>Optional Modules (1 must be selected))</b>							
OM 1 Pneumatic Structures	20	30		LNW	E/B		5
OM 4 Foldable and Umbrellas	20	30		LNW	E/B		
<b>Summery 2. Semester</b>	<b>60</b>	<b>90</b>					<b>15</b>

3. Semester							
<b>Pflichtmodule, Compulsory Modules</b>							
CM6 Detailing and Patterning	20	30		LNW	E/B		5
CM7 Internship Theory,	20	Praktikum 3 Woch		LNW	H		5

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<b>Optional Modules (1 must be selected)</b>							
OM 2 Building Physics	20	30		LNW	H		5
OM 3 Bionics	20	30		LNW	H		
OM 5 Membrane Surveying	20	30		LNW	K	60 min	
OM 6 Experimental Structures		30	20	LNW	E/B		
<b>Summery 3. Semester</b>	<b>60</b>	<b>60</b>					<b>15</b>

<b>4. Fachsemester</b>							
<b>Masterarbeit</b>				§ 29	H		<b>15</b>
<b>Summery 4. Semester</b>							<b>15</b>

<b>Total sum of degree course</b>	<b>180</b>	<b>240</b>					<b>60</b>
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- Module component: K      Written examination      Prior examination component: LNW      Performance slip  
M      Oral examination  
H      Course work  
E/B      Outline/document  
P      Presentation