

Structural Design			
Module number: BC-01			
Access requirement Successful enrolment in the Basic Course Archineer® in Membrane Structures	ECTS none	Frequency Annual	
Time expenditure			
Online Lecture 2 x 4,5 h = 9,0 h	Tutorial 2 x 4,5 h = 9,0 h	Self-study 15,0 h	Total 33,0 h
Person responsible for the module	Prof. Dr. Lars Schiemann		
Further lecturers	Prof. Dr. Karsten Moritz		
Module Type	Compulsory module		
Teaching formats	Online lecture / tutorial / student project		
Language	English		
Media forms	Online lecture with provision of a written script or a visual presentation of the lecture. During the self-study phase, students are supervised via the internet platform Moodle, Zoom and email.		
Study achievements	<ul style="list-style-type: none"> - Preparation and post-processing of the lectures - Working on the student project - Part 1: Structural design - Scheduled interim submissions (tutorial) - Final presentation with digital drawings and visualisations as well as hand sketches 		
Qualification goals	<p>The aim of the module "Structural Design" is to introduce students to the conceptual design of lightweight membrane structures in the sense of an overall architectural concept. This includes raising the students' awareness of architectural conception in the context of urban, cultural, social, sustainable and economic parameters. Based on historical and current trends in architecture, in particular on historical developments in lightweight and membrane construction, the students are able to develop and evaluate contemporary concepts and designs for membrane constructions from an architectural and design point of view. The focus is particularly on the acquisition of the following skills:</p> <ul style="list-style-type: none"> - Conceptual approach - Constructive design taking into account functional, utilisation and structural aspects - Form finding and constructive design of the supporting structure - Interaction of architectural and constructive form <p>For this purpose, students are taught the development of design-relevant parameters for the creation of architectural concepts. They will subsequently be able to transfer and apply the conceptual principles to practical tasks.</p> <p>Taking into account the interaction of form and construction, application scenarios are examined and the performance of the structures is analysed.</p> <p>The work is done in (individual or) preferably group work and thus increases the students' teamwork and communication skills. The elaboration of the projects trains the interdisciplinary design and planning process in membrane construction.</p> <p>The students are able to evaluate the results of the form-finding process and present the complex structures in two- as well as three-dimensional representations.</p> <p>The final presentation promotes the ability to comprehensively and structurally present the design and structural interrelationships of the</p>		

	constructive design using digital representation techniques. It is carried out in plenary, in front of all students, and thus enables an active, critical examination of the design idea, the underlying concepts as well as the structural and constructive design by all students.
Teaching content	<ul style="list-style-type: none"> - History of architecture, history of membrane construction - Forms and typologies in membrane construction, special forms - Form finding of membrane structures - Areas of use, possible applications, new technologies in membrane construction - Aspects of interdisciplinary planning processes - Ability to design constructively in an architectural context, to analyse the load-bearing structure qualitatively and to explain the design - Visualisation and presentation of the designs
Literature	<ul style="list-style-type: none"> - lecture notes - Knippers, J.; Cremers, J.; Gabler, M.; Lienhard, J.: Atlas Kunststoffe + Membranen. Werkstoffe und Halbzeuge, Formfindung und Konstruktion. Inst. für Internat. Architektur-Dokumentation, München, 2010. - Schiemann, L.: Tragverhalten von ETFE-Folien unter biaxialer Beanspruchung, Dissertation, TU München, 2009. - Moritz, K.: ETFE-Folien als Tragelement, Dissertation, TU München, 2007. - Publication series of the Institute for Lightweight Structures (IL) University of Stuttgart - Frei, O.: Gestaltwerdung. Zur Formentstehung in Natur, Technik und Baukunst, Köln, 1988. - Frei, O.: Das hängende Dach. Gestalt und Struktur. Reprint von 1954, Verlag der Kunst, Dresden, 1990. - Forster B.; Mollaert M., ed: „European Design Guide for Tensile Surface Structures“, Tensinet, 2004. - Koch K.-M.: "Membrane Structures", Prestel, München, 2004. - Seidel M.: "Tensile Surface Structures. A Practical Guide to Cable and Membrane Construction: Materials, Design, Assembly and Erection" Ernst & Sohn Verlag, 2009. - Schlaich, Bergemann und Partner: Tragwerk und Architektur als Einheit, Edition Detail. - LeCuyer A.: ETFE: Technologie und Entwurf, Birkhäuser Verlag, 2008. - www.ims-institute.org; www.tensinet.com
Further Documents	Current literature sources as well as lecture and exercise materials can be found on the specially set up internet platform Moodle.
Current version	22.09.2021

Membran-Materialeigenschaften			
Module number: BC-02			
Access requirement Successful enrolment in the Basic Course Archineer® in Membrane Structures	ECTS none	Frequency Annual	
Time expenditure			
Online Lecture 2 x 4,5 h = 9,0 h	Tutorial 2 x 4,5 h = 9,0 h	Self-study 10,0 h	Total 28,0 h
Person responsible for the module	Dr. Heidrun Bögner-Balz		
Further lecturers	-		
Module Type	Compulsory module		
Teaching formats	Online lecture / tutorial / student project		
Language	English		
Media forms	Online lecture with provision of a written script or a visual presentation of the lecture. During the self-study phase, students are supervised via the internet platform Moodle, Zoom and email.		
Study achievements	<ul style="list-style-type: none"> - Preparation and post-processing of the lectures - Work on study project - Part 2: Selection of membrane material - Scheduled interim submissions (tutorial) - Final presentation of the required subtasks 		
Qualification goals	<p>The aim of the module "Membrane Material Properties" is to understand the material-specific behaviour of textile materials, as well as the application of test methods to determine the mechanical properties. The test results should be able to be interpreted and applied appropriately.</p> <p>The students are able to design in accordance with the material and are sensitised to the handling of these materials during production and assembly. They are familiar with the necessary testing, verification and certification procedures and can either apply them themselves or arrange for them to be applied.</p> <p>This module enables the participants to make decisions regarding the correct area of application of the materials and existing boundary conditions, independent of standards, solely on the basis of the material behaviour and the material laws.</p>		

Teaching content	<p>Material properties:</p> <ul style="list-style-type: none"> - Polymers - Woven fabrics: threads, weave, mechanical properties of thread and fabric - Coated fabrics: coating materials, manufacturing processes - Foils: materials, properties <p>Material properties:</p> <ul style="list-style-type: none"> - Modulus of elasticity - Stress calculation - Determination of compensation values <p>Joining methods:</p> <ul style="list-style-type: none"> - Material-specific seams and joining methods <p>Material failure behaviour:</p> <ul style="list-style-type: none"> - Fracture behaviour, tear propagation behaviour - Detail failure: <ul style="list-style-type: none"> - Seams: temperature influence, weathering influence, delamination, combing out, stress distribution in the seam, <p>Tests to determine material and detail properties:</p> <ul style="list-style-type: none"> - Uniaxial tensile tests, Biaxial tensile tests, Burst tests, Thread-parallel tests, Shear tests, Examples
Literature	<ul style="list-style-type: none"> - lecture notes - Forster B.; Mollaert M., ed: „European Design Guide for Tensile Surface Structures“, Tensinet, 2004. - Koch K.-M.: "Membrane Structures", Prestel, München, 2004. - Mollaert, M.: "Designing Tensile Architecture", Vrije Universiteit Brussels, 2003. - Schock, H. J.: "Soft Shells", Birkhäuser, Basel, 1997. - Knippers, J.; Cremers, J.; Gabler, M.; Lienhard, J.: Atlas Kunststoffe + Membranen. Werkstoffe und Halbzeuge, Formfindung und Konstruktion. Inst. für Internat. Architektur-Dokumentation, München, 2010.
Further Documents	Current literature sources as well as lecture and exercise materials can be found on the specially set up internet platform Moodle.
Current version	22.09.2021

Structural Analysis and Dimensioning			
Modulnummer: BC-03			
Access requirement Successful enrolment in the Basic Course Archineer® in Membrane Structures	ECTS none	Frequency Annual	
Time expenditure			
Online Lecture 2 x 4,5 h = 9,0 h	Tutorial 2 x 4,5 h = 9,0 h	Self-study 10,0 h	Total 28,0 h
Person responsible for the module	Prof. Dr. Karsten Moritz		
Further lecturers	Prof. Dr. Lars Schiemann		
Module Type	Compulsory module		
Teaching formats	Online lecture / tutorial / student project		
Language	English		
Media forms	Online lecture with provision of a written script or a visual presentation of the lecture. During the self-study phase, students are supervised via the internet platform Moodle, Zoom and email.		
Study achievements	<ul style="list-style-type: none"> - Preparation and post-processing of the lectures - Working on the study project - Part 3: Structural analysis - Scheduled interim submissions (tutorial) - Final presentation of the required subtasks 		
Qualification goals	The students should be taught the basics of structural design and structural planning of membrane structures (static design of the membrane surface), as well as methods and application of the relevant European standardisation (actions, limit states, partial safety factors, etc.). The primary structure is only part of the lecture in excerpts.		
Teaching content	<p>The teaching content in this lecture is limited to the membrane surface. Due to the diversity of possible primary structures, this subject is not considered in detail.</p> <ul style="list-style-type: none"> - Basics of structural design (EN 1990) - Actions and superposition of actions (EN 1991); in particular wind loads, snow loads, temperature, prestressing and self-weight - Resistance, partial safety factors on the resistance side and reduction factors as well as mechanical material parameters of membrane materials - Structural preliminary design and design of the membrane area based on examples - Aspects of structural design and planning specific to membrane construction 		
Literature	<ul style="list-style-type: none"> - lecture notes - DIN EN 1990 - Eurocode: Grundlagen der Tragwerksplanung - DIN EN 1991 - Eurocode: Einwirkungen auf Tragwerke - Forster B.; Mollaert M., ed.: „European Design Guide for Tensile Surface Structures“, Tensinet, 2004. - Houtmans, R. et al., ed.: “TensiNet Working Group ETFE: Appendix A5 - Design Recommendations for ETFE-Foil Structures“, 2013. 		
Further Documents	Current literature sources as well as lecture and exercise materials can be found on the specially set up internet platform Moodle.		
Current version	22.09.2021		

Membrane Detailing and Patterning			
Module number: BC-04			
Part I – Membrane Detailing			
Access requirement Successful enrolment in the Basic Course Archineer® in Membrane Structures	ECTS none	Frequency Annual	
Time expenditure			
Online Lecture 1 x 4,5 h = 4,5 h	Tutorial 1 x 4,5 h = 4,5 h	Self-study 10,0 h	Total 19,0 h
Person responsible for the module	Prof. Dr. Gregor Grunwald		
Further lecturers	-		
Module Type	Compulsory module		
Teaching formats	Online lecture / tutorial / student project		
Language	English		
Media forms	Online lecture with provision of a written script or a visual presentation of the lecture. During the self-study phase, students are supervised via the internet platform Moodle, Zoom and email.		
Study achievements	<ul style="list-style-type: none"> - Preparation and post-processing of lectures - Online research - Working on study project - part 4: detailing - Scheduled interim submissions (tutorial) - Final presentation of the required subtasks 		
Qualification goals	The students learn about the individual connecting elements and details in membrane construction and are able to design these with regard to functionality and evaluate them with regard to their design. They are trained to use the components appropriately with regard to special properties and the shape of the membrane.		
Teaching content	<ul style="list-style-type: none"> - Detailed planning - Structural connection to the primary construction (no calculation) 		
Literature	<ul style="list-style-type: none"> - lecture notes - Forster B.; Mollaert M., ed: „European Design Guide for Tensile Surface Structures“, Tensinet, 2004. - Koch K.-M.: "Membrane Structures", Prestel, München, 2004. - Mollaert, M.: "Designing Tensile Architecture", Vrije Universiteit Brussels, 2003. - Schock, H. J.: "Soft Shells", Birkhäuser, Basel, 1997. - Knippers, J.; Cremers, J.; Gabler, M.; Lienhard, J.: Atlas Kunststoffe + Membranen. Werkstoffe und Halbzeuge, Formfindung und Konstruktion. Inst. für Internat. Architektur-Dokumentation, München, 2010. - Seidel M.: "Tensile Surface Structures. A Practical Guide to Cable and Membrane Construction: Materials, Design, Assembly and Erection" Ernst & Sohn Verlag, 2009. 		
Further Documents	Current literature sources as well as lecture and exercise materials can be found on the specially set up internet platform Moodle.		
Current version	22.09.2021		

Membrane Detailing and Patterning			
Module number: BC-04			
Part II – Membrane Patterning			
Access requirement Successful enrolment in the Basic Course Archineer® in Membrane Structures	ECTS none	Frequency Annual	
Time expenditure			
Online Lecture 1 x 4,5 h = 4,5 h	Tutorial 1 x 4,5 h = 4,5 h	Self-study 10,0 h	Total 19,0 h
Person responsible for the module	M.Eng. Atisit Sabmeethavorn		
Further lecturers	-		
Module Type	Compulsory module		
Teaching formats	Online lecture / tutorial / student project		
Language	English		
Media forms	Online lecture with provision of a written script or a visual presentation of the lecture. During the self-study phase, students are supervised via the internet platform Moodle, Zoom and email.		
Study achievements	<ul style="list-style-type: none"> - Preparation and post-processing of lectures - Working on the study project - Part 5: Cutting planning - Scheduled interim submissions (tutorial) - Final presentation of the required subtasks 		
Qualification goals	The students learn about different joining techniques and textile details and are able to use or assess them in a material- and function-oriented way. They acquire knowledge about the cutting of membrane fabrics and the application of compensation.		
Teaching content	<ul style="list-style-type: none"> - Cutting pattern planning - Compensation 		
Literature	<ul style="list-style-type: none"> - lecture notes - Forster B.; Mollaert M., ed: „European Design Guide for Tensile Surface Structures“, Tensinet, 2004. - Koch K.-M.: "Membrane Structures", Prestel, München, 2004. - Mollaert, M.: "Designing Tensile Architecture", Vrije Universiteit Brussels, 2003. - Schock, H. J.: "Soft Shells", Birkhäuser, Basel, 1997. - Seidel M.: "Tensile Surface Structures. A Practical Guide to Cable and Membrane Construction: Materials, Design, Assembly and Erection" Ernst & Sohn Verlag, 2009. 		
Further Documents	Current literature sources as well as lecture and exercise materials can be found on the specially set up internet platform Moodle.		
Current version	22.09.2021		

Membrane fabrication and construction management			
Module number: BC-05			
Part I – Membrane fabrication			
Access requirement Successful enrolment in the Basic Course Archineer® in Membrane Structures	ECTS none	Frequency Annual	
Time expenditure			
Online Lecture 1 x 2,5 h = 2,5 h	Tutorial 1 x 4,5 h = 4,5 h	Self-study 10,0 h	Total 17,0 h
Person responsible for the module	M.Eng. Christian Stegmaier		
Further lecturers	Dipl.-Ing. Henning Dürr		
Module Type	Compulsory module		
Teaching formats	Online lecture / tutorial / student project		
Language	English		
Media forms	Online lecture with provision of a written script or a visual presentation of the lecture. During the self-study phase, students are supervised via the internet platform Moodle, Zoom and email.		
Study achievements	<ul style="list-style-type: none"> - Preparation and post-processing of the lectures - Work on study project - Part 6: Membrane fabrication - Scheduled interim submissions (tutorial) - Final presentation of the required subtasks 		
Qualification goals	Students learn about fabrication processes in the membrane industry. The general aim is to raise awareness of the problems of manufacturing.		
Teaching content	<ul style="list-style-type: none"> - Manufacture and confection of membrane structures - Welding technology and welding machines - Quality control and monitoring 		
Literature	<ul style="list-style-type: none"> - Forster B.; Mollaert M., ed: „European Design Guide for Tensile Surface Structures“, Tensinet, 2004. - Koch K.-M.: "Membrane Structures", Prestel, München, 2004. - Mollaert, M.: "Designing Tensile Architecture", Vrije Universiteit Brussels, 2003. - Schock, H. J.: "Soft Shells", Birkhäuser, Basel, 1997. - Seidel M.: "Tensile Surface Structures. A Practical Guide to Cable and Membrane Construction: Materials, Design, Assembly and Erection" Ernst & Sohn Verlag, 2009. - www.tensinet.com 		
Further Documents	Current literature sources as well as lecture and exercise materials can be found on the specially set up internet platform Moodle.		
Current version	22.09.2021		

Membrane fabrication and construction management			
Module number: BC-05			
Part II – Construction management			
Access requirement Successful enrolment in the Basic Course Archineer® in Membrane Structures	ECTS none	Frequency Annual	
Zeitaufwand			
Online Lecture 1 x 6,5 h = 6,5 h	Tutorial 1 x 4,5 h = 4,5 h	Self-study 10,0 h	Total 21,0 h
Person responsible for the module	Dr.-Ing. Alexander Hub		
Further lecturers	Dr.-Ing. Alfred Rein		
Module Type	Compulsory module		
Teaching formats	Online lecture / tutorial / student project		
Language	English		
Media forms	Online lecture with provision of a written script or a visual presentation of the lecture. During the self-study phase, students are supervised via the internet platform Moodle, Zoom and email.		
Study achievements	<ul style="list-style-type: none"> - Preparation and post-processing of the lectures - Work on study project - Part 7: Construction management - Scheduled interim submissions (tutorial) - Final presentation of the required subtasks 		
Qualification goals	<p>The general aim is to raise awareness of the problems of erection and to enable the participants to consider the problems of erection already in the planning process and to develop solution concepts. They are trained to avoid particular risks with regard to occupational safety and material injuries or errors due to the work process.</p> <p>The participants will be able to define the specifications for a measurement as the basis for a project-specific and precisely fitting workshop planning.</p> <p>The participants can create assembly concepts and are able to select different methods of pretensioning.</p> <p>The participants are able to apply project management methods such as scheduling and cost planning to projects. They are able to prepare and calculate offers in membrane construction.</p> <p>In the execution phase, they are able to coordinate the different work groups.</p> <p>They know the technically necessary steps regarding the maintenance of membrane constructions and are able to arrange these.</p> <p>The communicative competence in dealing with different nationalities and languages on the construction site is of great importance here, both for the correct assembly itself and for the responsibility for life and limb.</p>		
Teaching content	<ul style="list-style-type: none"> - Project management - Quotation preparation - Cost calculation, cost tracking and post calculation - Maintenance (inspection, servicing, repair) - Interfaces and coordination of work - Measurement preparation - Foundation construction 		
Literature	<ul style="list-style-type: none"> - - lecture notes 		

	<ul style="list-style-type: none"> - Forster B.; Mollaert M., ed: „European Design Guide for Tensile Surface Structures“, Tensinet, 2004. - Koch K.-M.: "Membrane Structures", Prestel, München, 2004. - Mollaert, M.: "Designing Tensile Architecture", Vrije Universiteit Brussels, 2003. - Schock, H. J.: "Soft Shells", Birkhäuser, Basel, 1997. - Seidel M.: "Tensile Surface Structures. A Practical Guide to Cable and Membrane Construction: Materials, Design, Assembly and Erection" Ernst & Sohn Verlag, 2009.
Further Documents	Current literature sources as well as lecture and exercise materials can be found on the specially set up internet platform Moodle.
Current version	22.09.2021