Syllabus:Theory & Computation of Composite Materials

TU Berlin Summer University 2019 Term 3

Week 1 July 22nd-26th

	22	23	24	25	26
	Monday	Tuesday	Wednesday	Thursday	Friday
9:00 - 10:30	**Welcome Day!** Room tbc, building tbc 10:30: Orientation session 12:30-13:15: Buffet lunch 13:30-15:30: Introduction to composite materials in MS 107 (BEA, CV) 15:30-16:15: Campus Tour 16:15-16:45: Coffee & Cake	Fundamentals of linear elasticity (CV)	Stiffness and compliance matrix, Voigts notation (CV)	Introduction to Python (BEA)	No class
11:00 - 12:30		HOOKEs law (CV)	Symmetries of the stiffness matrix (CV) Assignment #1	Analytical solution of beam bending (BEA)	Cultural Program
13:30 - 15:30		Introduction to 3D printing (guest lecturer: Gregor Ganzosch)	Cultural Program	Numerical solution of beam bending (BEA)	
16:00 +					

Week 2 July 29th- August 2nd

	29	30	31	1	2
	Monday	Tuesday	Wednesday	Thursday	Friday
9:00 - 10:30	Tensor algebra (submit assign. #1)	Engineering constants (CV)	Presentations Assignment #1 (CV)	Rotation of a UD Laminate (CV)	No class
11:00 - 12:30	Variational formulation in the theory of elasticity (BEA)	Plane Stress (CV)	Feedback on Assignment #1 (CV)	Homogenisation and effective stiffness of symmetric laminates(CV)	
13:30 – 15:30	Implementation and computation (BEA) Assignment #2	Laminates in Olympic Sports (guest lecturer: Oliver Hecken, FES)	Cultural Program	Precursor Classical Laminate Theory (CV)	

16:00 +	Cultural Program				

Week 3 August 5th- 9th

	5	6	7	8	9
	Monday	Tuesday	Wednesday	Thursday	Friday
9:00 - 10:30	Classical Laminate Theory I (CV)	Finite element method (BEA)	Presentations Assignment #2	Lab: Manufacturing of laminates (Dr. Anton Köllner)	No class
11:00 - 12:30	Classical Laminate Theory II (CV)	Formulation in shells and plates (BEA)	Presentations Assignment #2	Lab: Manufacturing of laminates (Dr. Anton Köllner)	
13:30 – 15:30	Failure mechanisms in Composite Materials (guest lecturer: Dr. Anton Köllner) Assignment #3 (submit assign. #2)	Stiffness evaluation of a realistic structure (BEA)	Cultural Program	Lab: Manufacturing of laminates (Dr. Anton Köllner)	
16:00 +	Cultural Program				

Week 4 August 12th-16th

	12	13	14	15	16
	Monday	Tuesday	Wednesday	Thursday	Friday
9:00 - 10:30	Design of a structure in CAD (BEA)	Introduction to Elastic Structural Stability (CV)	Presentations Assignment #3	Thermomechanics (BEA)	No class
11:00 - 12:30	Preprocessing for an FEM analysis (BEA)	Buckling of struts (CV)	Feedback Assignment #3	Computation of thermal stresses (BEA)	Closing lecture
13:30 - 15:30	Computation and postprocessing (submit assign. #3)	Buckling of plates (CV)	Buckling experiments (Arion Juritza)	No class	**Certificates Ceremony** Lichthof, 1st floor, TU Berlin main building
16:00 +	Cultural Program				

Key

Lecture	Practical or guest lecturer	Assessment	Cultural Program activity*

*The cultural program timetable will be emailed to you shortly before your course starts. For more information about the cultural program, and for examples of previous schedules, head here: https://www.tu-berlin.de/menue/summer_university/cultural_program/

Assessment information

You will be assessed in the following ways (see yellow sessions in schedule, if applicable):

- Group assignment, due Monday each week: July 29, August 05 and 12
- Group presentation, on July 31, August 07 and 14

Your assessments will be calculated as follows:

- Group assignment 60%
- Group presentation 40%

Grading information

All participants of the TU Berlin Summer & Winter University are required to select their grading option at the time of registration. The two options available are (i) graded or (ii) pass/fail.

All participants who select option (i) graded, will receive a grade under the German grading system. The following table provides an overview of the grading system and equivalent scores for international credit transfers:

Total mark	German grade	English description
More or equal to 95	1,0	Excellent
More or equal to 90	1,3	Very good
More or equal to 85	1,7	Good
More or equal to 80	2,0	Good
More or equal to 75	2,3	Good
More or equal to 70	2,7	Satisfactory
More or equal to 65	3,0	Satisfactory
More or equal to 60	3,3	Satisfactory
More or equal to 55	3,7	Sufficient
More or equal to 50	4,0	Sufficient
Less than 50	5,0	Failed

Credit Points

ECTS is a point system and European standard developed by the Commission of the European Community. ECTS stands for European Credit Transfer System. The aim is to provide common procedures and guarantee academic recognition of studies abroad. The credit system is based on student workload. All lectures, seminars, excursions and homework count towards the workload. One point is awarded for the equivalent of 25-30 hours of workload.

Reading list

Here are reading materials which will be used or referred to during the course. You are not required to read these in advance – this is for your information and reference.
All sources below are available either open source, in the TU Berlin library, or will be provided to you directly by your lecturers, during the course.

To search resources available in the TU Berlin library, check here: https://www.ub.tu-berlin.de/en/searching-for-resources/

1. Altenbach, H., Altenbach, J., & Kissing, W. (2018). *Mechanics of Composite Structural Elements*. Springer Nature, Singapore.
2. Abali, B. E. (2016). *Computational Reality: Solving Nonlinear and Coupled Problems in Continuum Mechanics.* Springer Nature, Singapore.
3. Zohdi, T. I. (2018). *Finite Element Primer for Beginners*. Springer Nature, Singapore.