

# Module Catalog Master Program Computational Engineering

## Winter Term 2019/2020 – FPO 2018

Note that standard study plans for all technical application fields are found on the CE website!

### General modules (max. 15 ECTS)

	Module Name	ECTS	Exam (optional)	Type
	<b>Seminar</b>	5		Any seminar offered at Technical Faculty
	Programming Project	5 (10)		Any project related to programming offered at Technical Faculty

### Mathematics (min. 20 ECTS)

	Module Name	ECTS	Exam (optional)	Type
	<b>Functional Analysis for Engineers</b>	5	32301 / 32302	WS
	<b>Optimization for Engineers</b>	7.5	40501 / 40502	SS
	Elementary Numerical Mathematics	7.5	494959	WS
	Algorithms of Numerical Linear Algebra	7.5	352989	WS
	Multigrid Methods	5	35601	SS
	Advanced Discretization Techniques	10	59001	WS
	Numerics of PDEs II	5		SS
	Introduction Numerics of PDEs	10	52401 / 52402	WS
	Introduction to Structural Optimization	5		WS, SS
	Theorie der Optimalsteuerung	10		
	Advanced Solution Techniques	5		SS
	Mathematics of Multiscale Models	5		WS
	Introduction to Material and Shape Optimization	10		SS

### Computer Science (min. 20 ECTS)

	Module Name	ECTS	Exam (optional)	Type
	<b>Area Simulation / HPC</b>			
	Programming Techniques for Supercomputers	5 (7.5)	278169	SS
	High End Simulation in Practice	7.5	45101	SS

**Bold:** Compulsory Module; Abbreviations WS: winter term, SS: summer term

	<b>Module Name</b>	<b>ECTS</b>	<b>Exam (optional)</b>	<b>Type</b>
	Architectures of Supercomputers	5	44601	WS
	Computational Optics	7.5	768903	SS
	Advanced Simulation Technology	5	661589	WS
	Simulation und wissenschaftliches Rechnen 2	7.5	684900	SS
	Modellierung, Optimierung und Simulation von Energiesystemen	5	858896	WS
	Simulation und Modellierung 1	5	70901	WS
	<b>Area Technical Computer Science</b>			
	Hardware-Software-co-design	7,5		
	Rechnerarchitektur	5	798810	WS
	Smart Grids	5	623734	SS
	Fahrzeugkommunikation	5	716033	
	Heterogeneous Computer Architectures Online (VHB)	5	275245	WS
	Automotive Systems & Software Engineering	5	313638	SS
	<b>Area Data Sciences</b>			
	Medical Image Processing for Diagnostic Applications	5		WS
	Echtzeitsysteme 2	7,5		SS
	Image Processing in Optical Nanoscopy	5	289629	
	Computer Vision			SS
	Pattern Recognition Deluxe	7,5	456863	WS
	Computer Graphics	5 (7,5)	38201	
	Pattern Analysis	7,5		SS
	Human Computer Interaction	5		SS
	Medical Image Processing for Interventional Applications	5	37601	WS/SS
	Deep Learning	5	514944	WS
	Applied Visualization			SS
	Geometric Modeling	7,5	796399	WS
	<b>Area Practical Computer Science</b>			
	Softwarearchitektur	5 (10)	453543	SS
	The AMOS Project	5 (10)	753997	
	Nailing your thesis	5 (10)		WS
	Advanced Programming Techniques	7.5	465562	WS
	Programming in C++ (VHB)	6		WS, SS
	Praktische Softwaretechnik	5	816763	WS

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	Module Name	ECTS	Exam (optional)	Type
	<b>Area Theoretical Computer Science</b>			
	Organic Computing	5	39701	SS
	Effiziente kombinatorische Algorithmen	5	843472	WS

## Technical Application Fields (min. 20 ECTS)

Technical Application Field: Information Technology – DSP

	Module Name	ECTS	Exam (optional)	Type
	<i>Image and Video Compression</i>	5	63101	SS
	Multimedia Communications II	5	44801	
	<i>Speech and Audio Signal Processing</i>	5	64601	SS
	Convex Optimization in Communication and Signal Processing	5	772738	WS
	Signalanalyse	2.5	250058	WS
	Transform. in der Signalverarbeitung		498723	SS
	Music Processing Synthesis	2.5		WS
	<i>Statistical Signal Processing</i>		64301	WS
	Machine Learning in Signal Processing	5	84401	WS
	<b>Digital Signal Processing</b>	5	35001	WS
	<i>Image, Video, and Multidimensional Signal Processing</i>			WS

Technical Application Field: Information Technology – DT

	Module Name	ECTS	Exam (optional)	Type
	<b>Digital Communications</b>	5	78001	WS
	Fundamentals of Mobile Communications	5	31401	
	<i>Channel Coding</i>	5		SS
	Information Theory and Coding	5	36011	WS, SS

	Module Name	ECTS	Exam (optional)	Type
	<i>Transmission and Detection for Advanced Mobile Communications</i>	2.5	34201	SS
	<i>MIMO Communication Systems</i>	5	63001	SS
	<i>Machine Learning in Communications</i>	5		
	Convex Optimization in Communication and Signal Processing	5	772738	WS

### Technical Application Field: Medical Engineering

	Module Name	ECTS	Exam (optional)	Type
	<b>Digitale Signalverarbeitung</b>		See TAF IT	WS
	Praktikum Vertiefung Medizinische Biotechnologie - Bildverarbeitung	2.5		
	Clinical Applications of Optical Technologies and Associated Fundamentals of Anatomy	5		SS
	Biomedizinische Signalanalyse	5	30701	WS
	Visual Computing in Medicine 1	2,5		WS
	Maschinelles Lernen für Zeitreihen	5		WS
	Medizinelektronik	5		SS

### Technical Application Field: Solid Mechanics and Dynamics

	Module Name	ECTS	Exam (optional)	Type
	Numerische Methoden in der Mechanik	5	74401	
	Computational Dynamics	5	44501	
	Materials Modeling and Simulation	5		
	Lineare Kontinuumsmechanik	5	71301	WS
	Nichtlineare Kontinuumsmechanik	5		SS
	Nichtlineare Finite Elemente	5	42601	WS
	Introduction to FEM	5		SS

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	Module Name	ECTS	Exam (optional)	Type
	Strukturoptimierung in der virtuellen Produktentwicklung	5		SS
	Dynamik nichtlinearer Balken	5		
	Elasticity of 1D continua	2,5		
	Mikromechanik	2,5	837601	WS
	Geometric Numerical Integration	5	72771	SS

## Technical Application Field: Thermo and Fluid Dynamics

	Module Name	ECTS	Exam (optional)	Type
	Numerische Methoden der Thermofluidmechanik	7.5	54871	WS
	Numerische Methoden der Thermofluidmechanik II	7.5		SS
	Physik der Turbulenz und Turbulenzmodellierung I	5		SS
	Physik der Turbulenz und Turbulenzmodellierung II	5	52201	WS
	Mikrofluiddynamik	5		
	Angewandte Thermofluiddynamik	5	31101	SS
	Strömungsakustik	5	54351	WS
	Verbrennungstechnik	5	51111	SS
	Partikelbasierte Strömungsmechanik	5		SS
	Strömungsmesstechnik	5	52601	SS

## Technical Application Field: Mechatronics

	Module Name	ECTS	Exam (optional)	Type
	<b>CAE von Sensoren und Aktoren</b>	7.5	60811	WS
	Turbomaschinen	5	54951	WS
	<b>Numerische Simulation Elektromechanischer Wandler</b>	7.5	668903	SS
	Numerische Strömungsmechanik I	7.5		
	Technische Akustik	5	23601	SS
	Ausgewählte Kapitel der Technischen Akustik	2,5	67301	WS

## Technical Application Field: Computational Material Science

	<b>Module Name</b>	<b>ECTS</b>	<b>Exam (optional)</b>	<b>Type</b>
	Introduction to Advanced Maths and Calculus	1.5		WS
	Foundations of Finite Element Simulation	3		WS
	Materials and Structure	3	1708	WS
	Material Properties I	3	1710	WS
	Multi-scale Simulation Methods I	3		WS
	Multi-scale Simulation Methods II	3		
	Numerische Methoden in den Werkstoffwissenschaften – Atomistische Methoden	3		
	Generalized Continuum Models of Materials with Microstructures	1.5		
	Dislocation Theory and Dislocation Simulation	3		
	Computer Lab	6		WS
	Material Properties and Structure			
	Basics in Computational Materials Science and Process Simulation 1	2,5		WS
	Computational Models of Biomaterial Failure II	3		WS
	Scientific Programming with PYTHON	1		WS
	Dislocation Theory and Dislocation Simulation	1,5		WS

## Technical Application Field: Computational Optics

	<b>Module Name</b>	<b>ECTS</b>	<b>Exam (optional)</b>	<b>Type</b>
	Moderne Optik III	5		WS
	Optical Technologies in Life Science	5	57301	WS
	Linear and Non-Linear Fibre Optics	5		SS
	Laser Tissue Interaction	5	763337	SS
	Komponenten optischer Kommunikationssysteme	5		WS
	Optical Properties of Modern Materials	5		SS
	Optische Übertragungstechnik	5		SS
	Advanced Optical Communication Systems	5	621649	WS
	Optische Kommunikationsnetze	2,5		WS
	Photonik 2	5	63501	SS

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