

Double Degree Master Program in Engineering Science (DDMPES)

Module Catalogue

The DDMPES shall consist of the following categories:

- 18 credits advanced mathematical courses
- 24 credits + project (6 credits) in one of the strong points listed below
- 24 credits + project (6 credits) in the second one of the strong points listed below
- 12 elective credits in technical subjects
- 12 elective credits in non technical subjects
- Master thesis (18 credits).

Advanced language courses may be chosen to fulfill 12 non-technical elective credits.

The list of the strong points:

- numerics and simulation
- fluid dynamics
- mechatronics
- solid state mechanics
- thermodynamics
- technical acoustics

2 strong points are to be chosen.

In each strong point, at least 24 credit points from advanced level 2 should be chosen, further 6 credit points shall be completed as a project.

Module group:	Assigned modules	Credits (according to ECTS)
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Mathematical methods		18
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Modules in Berlin

	Tensor Analysis and Continuum Physics	6
	Numerics II for Engineers	6
or	Finite-Element-Method in Mechanics I	6
	Measurement and Control	
	Control Theory	9
	Variational Calculus and Optimal Control	5
	Stochastics for Computer Scientists	6
	Analysis III	6
	Integral Transformations and Partial Differential Equations	6
	Numerics I for Engineers	6

Modules in Tomsk

Elements of the Theory of Elasticity, Oscillations and Vibration Mechanics	6
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Module Catalogue of the Strong Points

Numerics and simulation	Assigned modules	Credits (according to ECTS)
<i>Modules in Berlin</i>		
Core area (level 1)*		
	Computational Fluid Dynamics CFD I+II	12
	Finite Element Methods 1	6
	Finite Element Methods 2	6
	Applied Information Technology	6
or	Industrial Information Technology	12
	Software Engineering	6
	Programming of Parallel and Distributed Systems	9
	Parallel Numerics	12
advanced courses (level 2)**		
	CFD-Project (Applied Computational Fluid Dynamics (Project))	6
	Practical Training in Finite-Element-Method	6
	Seminar in Modeling	6
	Simulation and Measurement	12
	Numerical Linear Algebra	6
	Numerics of Elliptical Partial Differential Equations	6
	Statistical Turbulence Modeling	6
	Numerical Aeroacoustics (CAA)	12
	Technical Information Systems	6
	Information Systems Project	6
	OKS 1 - Basics (Fundamental Principles of Open Communication Systems)	6
and	OKS 3 - Practice (Advanced Communication Systems)	6
	OKS-Project (I or/and II)	6
	Fundamental Principles of Information Modeling	6
and	Databases (Database Systems)	6
	Picture Producing Process in Medicine and Neurobiology	6
	Algorithms of Image Processing	6
	Visualizing in Mathematics	10
	Picture Producing Process in Medicine I	6
	Industrial Image Processing	9
	Computer Graphics – Basics	6
	Computer Graphics – Completion	6
	Simulation of Production Systems - Work Place	
	Simulation of Production Systems - Material Flow	6
	Process and System Dynamics / Process Simulation	12
	Design and Simulation	12
	Numerical Simulation Methods in Engineering	6

Communication Networks and Technology	12
Modeling of Traffic Systems	8
Modeling with Differential Equations I	10
Control Theory	4
Advanced Control Theory	9
Neuronal Information Processing - Basics	9
Neuronal Information Processing - Extension	9
Linear Optimization	10
Non-linear Optimization	10

Modules in Tomsk

Information Technology in Science and Education	4
Mathematical Methods of Experimental Data Processing	4
Systems Analysis, Computer Modeling and Optimization in Mechanical Engineering	6
Artificial Intelligence, Experimental Systems and Data Bases in Mechanical Engineering	6

Fluid dynamics	Assigned modules	Credits (according to ECTS)
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Modules in Berlin

Core area (level 1)*

Advanced Fluid Dynamics	6
Turbulent Flows	12
An Introduction to Computational Fluid Dynamics	12
Fundamentals of Aeroacoustics	6
Gasdynamics I	6
Gasdynamics II	6
Measurement Techniques in Fluid Dynamics	12
Aerothermodynamics I	6
Aerothermodynamics II	6
Fluid System Dynamics	12
Fluid Machinery	12
Aerodynamics I	6
Aerodynamics II	6
Flow and Combustion in Gas Turbines	6
Flow around Automobiles and Buildings	6

advanced courses (level 2)**

Turbomachinery Noise	6
Applied Computational Fluid Dynamics	6
Modeling and Control of Combustion Systems: Thermal Acoustics	6
Dimensional Analysis (Stability and Transition)	12
Marine Hydrodynamics	12
Process Engineering I	9
Statistical Turbulence Modeling	6

Computational Fluid Dynamics (CFD)	12
Theoretical Acoustics (TA 8)	6
Numerical Aeroacoustics (CAA)	6
Supplement to Aeroacoustics	6
Fluid-Borne Sound-Basics (TA 1 PI)	9
Advanced Fluid-Borne Sound (TA 7)	6
Flight Mechanics 2	6
Numerical Simulation Methods in Engineering Science	6

Mechatronics	Assigned modules	Credits (according to ECTS)
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Modules in Berlin

Core area (level 1)*		
	System Dynamics and Mechatronics	6
	Measurement and Control	12
	Measurement Technology	12
	Electric Drives	6
	Drive Systems and Components	12
	Precision Mechanics and Micro Technology	12
or	Analog and Digital	6
	Embedded Real-time Systems	6
	Robotics (PDV 3)	6
	Theoretical Electrical Engineering	6

advanced courses (level 2)**		
	Mechatronics in Industrial Application	3
	Measurement and Control - Completion	9
	Optimization Based Planning and Realization of Dynamic Processes	6
	Oil Hydraulics and Pneumatics 1	6
	Oil Hydraulics and Pneumatics 2	6
	Industrial Image Processing	9
	PDV / Robotics - Project	9
	Artificial Intelligence: Basis and Application	6
	Vibration Influence and Vibration Isolation in Machines Systems	6
	Flight Controlling	6
	Kinematics of Machinery Systems	6

Solid State Mechanics	Assigned modules	Credits (according to ECTS)
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Modules in Berlin

Core area (level 1)*		
	Contact Mechanics and Friction Physics	6
	Materials Science	6
	Mechanical Vibration Theory	6
	Finite Element Method - FEM I	6

Finite Element Method - FEM II	6
Fracture Mechanics I	6
Fracture Mechanics II	6
Project Finite Element Method	6
Elasticity and Plasticity	6
Vibration Influence and Vibration Isolation	6
Dynamics of Power Train Systems	6
System Dynamics and Mechatronics	6
Introduction into the Vehicle Dynamics / Dynamics of Rail Vehicles	6
Non-linear Continuum Mechanics	6

advanced courses (level 2)**

Structure-Borne Sound (TA 5)	6
Advanced Structure-Borne Sound (TA 9)	6
Numerical Simulation Methods in Engineering Science	6
Aeroelastics	6
Non-linear and Chaotic Vibrations	6
Rotor Dynamics	
Flight Mechanics 2	6
Flight Mechanics 3	6
Contact Mechanics and Friction Physics	

Modules in Tomsk

Special Course of Mechanical Engineering Technology	6
Automation and Control of Vacuum Equipment	6
Methodology and Equipment of Experimental Investigations in Mechanical Engineering	6
Physical Foundations of High-Temperature Technologies in Mechanical Engineering	6
Special Technologies of Heat Treatment in Mechanical Engineering	6
Production Methods of Special Heterophase and Heterogeneous Materials	6
Physical Foundations of Designing and Producing of Hard Alloys for Mechanical Engineering	4
Physical Foundations of Tribology	6
Elements of the Theory of Elasticity, Oscillations and Vibration Mechanics	4

Thermodynamics

Assigned modules

**Credits
(according
to ECTS)**

Modules in Berlin

Core area (level 1)*

Irreversible Thermodynamics	
Basic Thermic Operations	
Theoretical Physics IV: Thermodynamics and Statistics	10
Flow and Combustion in Gas Turbines	
Combustion	
Kinetic Theory	
Statistical Physics	12

advanced courses (level 2)**

Basics of Computational Fluid Dynamics (CFD 1+2)	
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Modeling and Control of Combustion Systems	6
Low Temperature (Cryogenic) Thermodynamics	
Phase Equilibrium in Multi-phase Systems	6
Thermodynamics for Biological Systems	6
Thermodynamics for Aggregating Systems	6
Physical Chemistry III	
Physical Chemistry IV	
Gasdynamics I	
Gasdynamics II	

Modules in Tomsk

Physical Foundations of High-temperature Technologies in Mechanical Engineering	6
Special Technologies of Heat Treatment in Mechanical Engineering	6
Production Methods of Special Heterophase and Heterogeneous Materials	6
Physical Foundations of Designing and Producing of Hard Alloys for Mechanical Engineering	4

Technical Acoustics	Assigned modules	Credits (according to ECTS)
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Modules in Berlin

Core area (level 1)*		
Fluid-Borne Sound - Basics (TA 1 PI)		9
Noise and Vibration Control (TA 2 PI)		9
Measurement Technique and Signal Processing (TA 4)		6
Structure-Borne Sound (TA 5)		6
Fundamentals of Aeroacoustics		6
Vibration Isolation and Vibration Control in Machines Systems		6
advanced courses (level 2)**		
Advanced Fluid-Borne Sound (TA 7)		6
Theoretical Acoustics (TA 8)		6
Aerodynamic Sound (TA 11)		6
Advanced Noise and Vibration Control (TA 6 PI)		9
Advanced Structure-Born Sound (TA 9)		6
Supplementing Aeroacoustics		6
Numerical Aeroacoustics (CAA)		6
Flow and Combustion in Gas Turbines		6
Modeling and Control of Combustion Systems (Thermoacoustics II)		6
Statistical Energy Analysis (TA 10)		6
Non-linear and Chaotic Vibrations		6
Psychoacoustics, Noise Effects and Urban Noise Protection (TA 3)		12
Project	Acoustic Project	6

Nontechnical subjects:		
<i>In Berlin:</i>	Free selection from the whole study program of German universities	

Modules in Tomsk

Topical Problems of Engineering Science	3
Methodology of Engineering Science	3
Methodology of Scientific Work	3
Philosophical Problems of the Natural Sciences, Humanities and Technology	3
Economic and Administration Problems in Mechanical Engineering: Problems of R&D Commercialization in Mechanical Engineering Management	3
Foreign Language (Russian / German)	6

* **level 1** corresponds to the level 5 of TPU

****level 2** corresponds to the level 6 of TPU