

Double Degree Master Program in Engineering Science (DDMPES)

Module Catalogue

The DDMPES shall consist of the following categories:

- 18 credits advanced mathematical and advanced basic subject 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
- 18 elective credits in technical subjects
- 12 elective credits in non technical subjects
- 18 credits master thesis

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

Two strong points are to be chosen and at least together 24 credit points should belong to advanced level 2.

Module Catalogue of Mathematical Methods and basic subjects

Mathematical methods and basic subjects	Assigned modules	Credits (according to ECTS)
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Modules in Berlin

	Analysis III for Engineers	4
	Basics of Continuum Theory I	6
or	Basics of Continuum Theory II	6
	Numerical Methods for Engineers II	10
	Stochastics for Programmers	6
	Variational Calculus and Optimal Control	5

Modules in Niš

Mathematics 3	8
System control	7
Reliability of mechanical systems	6
Engineering metrology	6
Measurement and data acquisition systems	6
Operational Research	6

Module Catalogue of the Strong Points

Numerics and simulation	Assigned modules	Credits (according to ECTS)
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Modules in Berlin

Core area (level 1)		
	Procedures of Information and Communication Technology for Engineers	6
	Basics of Industrial Information Technology	6
	Numerical Mathematics for Engineers II	10
	Numerical Simulation Methods in Engineering	6
or	Numerical Thermo- and Hydrodynamics – Basics (CFD1)	6
	Numerical Thermo- and Hydrodynamics – Advanced (CFD2)	6
	Project – Simulation Tools and Application	6
	Structural Dynamics	6

advanced courses (level 2)		
	Analysis and Simulation of Machine Tools and Processing	6
	Visualisation Tools in Medicine and Neurobiology	6
	Control Theory	5
	Methods of Informatics in Civil Engineering	9
	Modeling and Simulation of Traffic Flow	6
	Multi-Agent Simulation of Traffic Flow	6
	Numerical Simulation of Fluid Dynamical Systems	6
	Computational Fluid Acoustics	6
	Computational Fluid Dynamics for Marine Systems I	6
	Object Oriented Software Development	6
	Project in Finite Element Method	6
	Computer Aided Design of Marine Systems	6
	Simulation in Automotive Industry	6
	Simulation and Measurement I	6
	Simulation and Measurement II	6
	Modeling of Turbulent Flow	6

Modules in Niš

Core area (level 1)		
	Object oriented programming	6
	Numerical methods and programming	6
	Digital image processing in mechatronics	6
	Computer input-output devices and protocols	6
	Computer applications	6
	Structural analysis of mechanical constructions	6
	CAD/CAM/CAE	6
	Software design	6
	Optimization of construction	6
	Basics of Modeling in Mechatronical Systems	6
	Numerical simulations in energy and process engineering	6
	Computational fluid dynamics	6

advanced courses (level 2)

Numerical simulations in energy and process engineering	6
Systems Modelling and Simulation	6
Application of FEM	6
Simulation of dynamical systems	6

Fluid dynamics**Assigned modules****Credits
(according
to ECTS)***Modules in Berlin***Core area (level 1)**

Aerodynamics I	6
Aerodynamics II	6
Aerodynamics of Automotive and Civil Structures	6
Gas Dynamics I	6
Gas Dynamics II	6
Basics of Computational Fluid Acoustics	6
Advanced Course on Fluid Flow / Fluid Dynamics I	6
Measurement and Information Techniques in Fluid Mechanics I	6
Measurement and Information Techniques in Fluid Mechanics II	6
Fluid Dynamics – Techniques and Examples / Fluid Dynamics II	6
Turbulence and Flow Control I	6
Turbulence and Flow Control II	6

advanced courses (level 2)

Aerothermodynamics II	9
Extensions to Aeroacoustics	6
Experimental Methods of Aerodynamics I (Project Aerodynamics I)	6
Fluid System Dynamics – Operational Properties	6
Gas Turbines and Thermoacoustics	6
Basics of Thermo- and Turbomachinery Acoustics	6
Methods to Influence Flow on Sailing Yachts	6
Low-Dimensional Modeling and Control of Turbulent Flows I	6
Low-Dimensional Modeling and Control of Turbulent Flows II	6
Numerical Simulation of Fluid System Dynamics	6
Methods of Numerical Simulation in Engineering	6
Numerical Thermo and Fluid Dynamics – Basics	6
Numerical Thermo and Fluid Dynamics – Advanced	6
Hydrodynamics of Ships I	6
Hydrodynamics of Ships II	6
Flow Control: Low-Dimensional Modeling and Cybernetics of Non-stationary Flows	3
Flow Control: Physical Principles and Technical Application	6
Flow Control: Controller Design and Model Reduction	6
Fluid Machinery – Design	6
Fluid Machinery – Machine Elements	6
Fluid Mechanics in Medicine	6

Basics of Turbomachinery	6
Turbomachinery II - Aerodynamics of Turbomachinery	6
Modeling of Turbulences	

Modules in Niš

Core area (level 1)

Heat and mass transfer	6
Hydrostatic power transmissions	6
Hydromechanics equipment	6
Computational fluid dynamics	6
Numerical simulations in energy and process engineering	6

advanced courses (level 2)

Turbomachinery	6
Fluid Machinery	6
Hydraulic and pneumatic conveying	6
Hydromechanics of mixtures	6
Irrigation systems	6
Fluid machinery and system characteristics	6
Hydrodynamic power transmissions	6
Design of oil hydraulic and pneumatic systems	6
Hydro and wind energy	6
Pump stations	6
Special purpose pumps	6
Mini power plants and wind turbines	6
Hydraulic and pneumatic systems of vehicles	6

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

Core area (level 1)

Electrical Drives	6
Elements of Mechatronics	6
Embedded Operating Systems	6
Basics of Measurement and Control Technique	9
Theory of Mechanical Oscillations and Dynamics of Machines	6
Mechatronics and Systems Dynamics	6
Multi-Parameter Control in Time Domain	8
Measurement of Vibrations	6
Robotics	6

advanced courses (level 2)

Analog and Digital Electronics	6
Automation Technology	6
Image Guided Automation I	6
Digital Electronics and Microcontroller Programming	6

Power Electronics	9
Mechatronics in Industrial Applications	3
Measurement Exercises: Measurement of Mechanical Oscillations	2
Oil Hydraulic Drives and Control Systems	6
Photonics	6
Vibration Isolation and Control	6
Simulation 1	6
Simulations and Measurements I	6
Simulations and Measurements II	6
Systems Dynamics in Industrial Applications	3

Modules in Niš

Core area (level 1)

Robotics	6
Basics of Modeling in Mechatronical Systems	6
Development of mechatronical systems	6
Micromechatronics	6
Control Systems in Mechatronics	6

advanced courses (level 2)

Mechanical Functional Elements	6
Design of Mechanisms	6
Mechatronics in Vehicles	6
Biomechatronics	6
Mechanisms in Mechatronics	6
Compliant Mechanisms	6
Mechatronics Systems and Vehicle Equipment	6
Digital Control Systems	6
Digital image processing in mechatronics	6
Computer input-output devices and protocols	6
Computer applications	6
Nano-tribology	6
Advanced control systems	6

Solid State Mechanics

Assigned modules

**Credits
(according
to ECTS)**

Modules in Berlin

Core area (level 1)

Analytical Mechanics	6
Introduction into Vehicle Dynamics / Dynamics of Rail Vehicles	6
Flight Dynamics II	6
Basics of Continuum Theory II	6
Contact Mechanics and Friction Theory	6
Structure-Borne Noise - Basics	6
Theory of Mechanical Vibrations and Machine Dynamics	6
Rotor Dynamics	6

Structural Mechanics II	6
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advanced courses (level 2)

Aero-Elasticity	6
Elasticity and Plasticity	6
Advanced Course of Structure-Borne Noise	6
Material Science	6
Mechatronics in Industrial Applications	3
Mechatronics and System Dynamics	6
Nonlinear Vibrations	6
Numerical Simulations in Engineering	6
Project – Rolling Wheel on Flexible Ground (Terra-mechanics)	6
Project – Elasticity and Fracture Mechanics	6
Project - Plasticity and Fracture Mechanics	6
Project – Physics of Friction	6
Project - Finite Element Method	6
Vibrations of Elastic Continuum	6
Vibration Isolation and Control	6
Structural Dynamics	6
System Dynamics in Industrial Applications	3
Composites and Composite Structures: Theory and Application	6

Modules in Niš

Core area (level 1)

Theory of oscillations	6
Tribology	6
Applied theory of plasticity	6

advanced courses (level 2)

Nano-tribology	6
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Thermodynamics	Assigned modules	Credits (according to ECTS)
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Modules in Berlin

Core area (level 1)

Application of Thermodynamics	6
Transport of Energy, Impulse and Material A-I	7
Basics of Safety Technology	4
Numerical Thermo and Fluid Dynamics – Basics	6
Numerical Thermo and Fluid Dynamics - Extension	6
Statistical Thermodynamics	6
Basic Thermic Operations	6
Thermodynamics II	7

advanced courses (level 2)

Aerothermodynamics	9
Energy Processing Technology	6
Gas Dynamics I	6
Gas Dynamics II	6
Gas Turbines and Thermo-Acoustics	6

Basics of Measurement and Control Technology	9
Irreversible Thermodynamics	6
Material Science	6
Phase Equilibrium in Multi-Phase Systems	6
Process and Installation Dynamics	6
Thermodynamic Material Science	6
Thermodynamics of Low Temperatures	6
Conversion Technologies of Renewable Energies	5
Combustion	6

Modules in Niš

Core area (level 1)

Heat and mass transfer	6
Thermal unit operations	6
Numerical simulations in energy and process engineering	6
Computational fluid dynamics	6

advanced courses (level 2)

The chemical and biochemical reactors	6
Cooling devices	6
District heating	6
Thermal power plants	6
Purification techniques	6
Solid Waste Management	6
Construction of process equipment and appliances	6
Energy efficiency and environmental protection	6
Wastewater treatment	6
Industrial furnaces	6
Thermodynamics of the internal combustion engines	6
Cogeneration	6
Air protection in processes and thermal power plants	6
Air conditioning and ventilation	6
Steam boilers	6

Technical Acoustics

Assigned modules

**Credits
(according
to ECTS)**

Modules in Berlin

Core area (level 1)

Noise and Vibration Control	9
Fluid-Borne Sound – Basics	6
Structure-Borne Sound – Basics	6
Fundamentals of Aeroacoustics	9
Theory of Mechanical Vibrations and Machine Dynamics	6
Measurement Technique and Signal Processing	6
Vibration Isolation and Vibration Control in Machines Systems	6

advanced courses (level 2)

Advanced Fluid-Borne Sound	6
Gas Turbines and Thermo-Acoustics	6
Advanced Noise and Vibration Contro	9
Basics of Thermo- and Turbomachinery	6
Advanced Structure-Borne Sound	6
Psychoacoustics, Noise Effects and Urban Noise Protection	6
Advanced Aeroacoustics	6
Nonlinear Oscillations	6
Computational Aero-Acoustics	6
Psychoacoustics	6
Statistical Energy Analysis	6
Theoretical Acoustics	6
Environmental Impact of Air Transport	6

Modules in Niš**Core area (level 1)****advanced courses (level 2)****Module Catalogue of Technical Subjects**

	Assigned modules	Credits (according to ECTS)
Technical Subjects:		
<i>In Berlin:</i>	Free selection from the whole study program of TUB	
<i>Modules in Niš</i>	Logistics simulation	6
	Construction of process equipment and appliances	6
	Steam boilers	6
	Solid Waste Management	6
	Energy efficiency and environmental protection	6
	Wastewater treatment	6
	Computer Aided Product Development	6
	Quality of welded constructions	6
	Construction methods	6
	Basics of product development	6
	Design of welded constructions	6
	Methods of product development	6
	Integrated product development	6
	Diagnostics of technical systems	6
	Quality of mechanical systems	6
	Weldability of materials	6
	Welding technology II	6
	Industrial design	6
	Design for manufacturing	6
	Examination of welded constructions	6
	Machine tools	6
	CNC systems	6
	Technological systems	6

Systems for rapid product development	6
Cutting	6
Nonconventional machining	6
Forming and shaping	6
Wood processing technology	6
CAPP/CAM systems	6
Coating and surface hardening technology	6
Assembly technology	6
Maintenance of technical systems	6
Machine and tools for polymer processing	6
Components of technological systems	6
Forming and shaping tools	6
Welding technology 2	6
Recycling technology	6
Modeling and optimization of manufacturing processes	6
Maintenance management	6
Ecologizing the manufacturing systems	6
Organisation and technology of road traffic	6
Mobile machines 2	6
Organisation and technology of rail traffic	6
Warehouse and distribution systems	6
Theory of vehicles movement	6
Transportation machines	6
Reliability of mechanical systems	6
Ergonomics and industrial design	6
Safety of Traffic	6
Technical diagnostics	6
Packaging and palletization	6
Cargo transport centers	6
Transportation with pipes	6
Container`s transport	6
Aircraft transportation vehicles	6
CAD studio of machines and vehicles	6
Supply chain management	6
Digital image processing in mechatronics	6
Computer input-output devices and protocols	6
Computer applications	6
Nano-tribology	6
Advanced control systems	6
Engineering metrology	6
Measurement and data acquisition systems	6
Operational Research	6
Tribology	6
Applied theory of plasticity	6

Module Catalogue of Nontechnical Subjects

	Assigned modules	Credits (according to ECTS)
Nontechnical subjects:		

In Berlin:

Free selection from the whole study program of TUB

Modules in Niš

Professional engineering ethics	3
Professional practice M	6
Lean Six Sigma in manufacturing	6
Product for Six Sigma	6
Lean Six Sigma project	6
Management of projects and logistics systems	6
German advanced language course	3