Fakultät für Maschinenbau

Module Handbook for the Masters Program Systems Engineering for Manufacturing

Modulhandbuch für den Masterstudiengang Systems Engineering for Manufacturing

zur
Studien- und Prüfungsordnung vom 06.02.2020
in der geltenden Fassung gemäß der ersten Satzungsäderung vom 01.03.2023
(Datum des Fakultätsratsbeschlusses)

ab Immatrikulation Wintersemester 2023-24 bis Wintersemester 2024-25
as of enrollment winter semester 2023-24 until winter semester 2024-25

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2 Einleitung | Introduction

Dieses Modulhandbuch richtet sich an Studenten des Masterstudienganges "Systems Engineering for Manufacturing" vom 06.02.2020 (Datum des Fakultätsratsbeschlusses) ab Immatrikulation Wintersemester 2023-24 bis zum Wintersemester 2024-25.

This module handbook is intended for the students participating in the masters program "Systems Engineering for Manufacturing" of 06.02.2020 (date of faculty decision) as of enrollment winter semester 2023-24 until winter semester 2024-25.

In diesem Masterstudiengang ist die Lehre fachübergreifend auf die Fachgebiete mit Relevanz für Produktionssysteme fokussiert. Damit werden Fähigkeiten zur standortübergreifenden Entwicklung neuer Produktionssysteme auf Basis der in ihnen zu fertigenden Produkte sowie zur Life Cycle Beherrschung von Produktionssystemen herausgebildet.

This master's program provides interdisciplinary education in scientific fields relevant for engineering and use of production systems. It provides knowledge and skills related to the location crossing engineering of new production systems based on the products to be manufactured as well as to life-cycle management of production systems.

Der Studiengang adressiert die methodischen Grundlagen zur Entwicklung von Produktionssystemen nach dem Paradigma der Systems of Systems. Er vermittelt dabei zum einen die fachlichen Grundlagen zum Entwurf und zur Steuerung von Produktionssystemen und ermöglicht zum anderen die Identifikation und bewusste Nutzung der Abhängigkeiten zwischen den einzelnen Teilaspekten eines Produktionssystems.
Zusätzlich werden sprachliche Kenntnisse vermittelt, die eine Anwendung des erlernten Wissens in internationalen Kontexten ermöglicht.

The master’s program covers the methodical basis for the engineering of production systems exploiting the paradigm of systems of systems. It provides expertise for the engineering and control of production systems and enables the identification and meaningful application of dependencies between different parts and/or aspects of production systems.
In addition lingual skills are provided enabling the application of the gained knowledge within international contexts.

Das Lehrangebot im Studiengang "Systems Engineering for Manufacturing " umfasst neben anderen Umfängen den Pflicht-, den Wahlpflicht- und den E-Learning-Bereich.

The curriculum of the masters program “Systems Engineering for Manufacturing” consists (among others) of compulsory, compulsory chosen, and e-learning areas.

Der Pflichtbereich besteht aus Pflichtmodulen. Als Pflichtmodule werden alle Module bezeichnet, die nach Prüfungs- und Studienordnung für den erfolgreichen Abschluss des Studiums zwingend erforderlich sind. Kapitel 2 dieses Modulhandbuchs definiert alle Lehrveranstaltungen, die als Pflichtmodule dem Pflichtbereich des Studienganges zugehörig sind.

The compulsory area consists of compulsory modules. Compulsory modules are modules which are mandatory for the successful finalization of the master’s program following Study and Examination Regulations. Section 2 of this module handbook subsumes all lectures belonging as compulsory modules to the compulsory area.

Der Wahlpflichtbereich besteht aus Wahlpflichtmodulen. Als Wahlpflichtmodule werden alle Module bezeichnet, die Studierende nach Maßgabe der Prüfungs- und

The compulsory chosen area consists of compulsory chosen modules. The compulsory chosen modules are named compulsory chosen if they are selectable by students out

Studienordnung aus dem Wahlpflichtbereich auszuwählen haben.
Der Wahlpflichtbereich ist in verschiedene fachspezifische Teilbereiche gegliedert. Die dabei wählbaren Fachbereiche sind die Fachbereiche:

- Mechanik
- Digitale Systeme
- Planung und Steuerung
- Logistik
- Fertigungstechnik
- Wissenschaftliche Grundlagen

Kapitel 3 dieses Modulhandbuchs definiert alle Lehrveranstaltungen, die dem Studiengang als Pflichtmodule zugehörig sind.

Kapitel 4 dieses Modulhandbuchs definiert alle Lehrveranstaltungen, die als Wahlpflichtmodule dem Wahlpflichtbereich des Studienganges zugehörig sind.

Der E-Learning-Bereich besteht aus Modulen, die neue, insbesondere Internet basierte Lehrmedien zur Wissensvermittlung nutzen.

Kapitel 5 dieses Modulhandbuchs spezifiziert alle Lehrveranstaltungen, die dem E -Learning- Bereich zugeordnet werden können.

Kapitel 6 dieses Modulhandbuch spezifiziert alle Anforderungen an das Fachpraktikum.

Kapitel 7 dieses Modulhandbuch spezifiziert alle Anforderungen an die Masterarbeit.

Bitte beachten Sie die Allgemeine Regelungen betreffend die Organisation und Durchführung von Studienangeboten an der OVGU Magdeburg (AROStA-2026). Diese Ordnung regelt studien- und prüfungsrelevante Sachverhalte sowohl für Bachelor- und Masterstudiengänge der Otto-von-Guericke-Universität Magdeburg (OVGU) als auch für andere Studienangebote und findet Anwendung ab dem Wintersemester 2026/27 auf alle an der OVGU immatrikulierten Studierenden. Soweit in aSPO bzw. in der sSPO Bestimmungen enthalten sind, die von den Regelungen der AROStA abweichen, gelten die Bestimmungen der AROStA, außer in den Fällen, in denen die

of the compulsory chosen lecture set.

The compulsory chosen modules are arranged in the different scientific areas. The applicable areas are the following:

- Mechanics
- Digital systems
- Planning and Control
- Logistics
- Manufacturing technology
- Scientific Basics

Section 3 of this module handbook defines all lectures that are part of the study program as compulsory modules.

Section 4 of this module handbook subsumes all lectures belonging as compulsory chosen modules to the compulsory chosen area.

The e-learning area consists of modules covering new, especially Internet based learning media for knowledge acquisition.

Section 5 of this module handbook defines requirements to all lectures possibly being accepted within the e-learning area.

Section 6 of this module handbook defines requirements to the internship.

Section 7 of this module handbook defines requirements to the master thesis.

Please observe the General Regulations concerning the organization and conduct of study programs at OVGU Magdeburg (AROStA-2026). These regulations govern matters relating to studies and examinations for Bachelor's and Master's degree programs at Otto von Guericke University Magdeburg (OVGU) as well as for other study programs; they apply to all students enrolled at OVGU starting from the 2026/27 winter semester. Insofar as the general study and examination regulations (aSPO) or specific study and examination regulations (sSPO) contain provisions that deviate from the AROStA regulations, the AROStA provisions shall apply,

aSPO bzw. die sSPO eine Abweichung von der AROStA ausdrücklich vorsieht.

except in cases where the aSPO or sSPO explicitly name provisions deviating from AROStA.

Legende Prüfungsformen | Legend Forms of examination:

V – Vorlesung | Lecture,
Ü – Übung | Exercise,
P – Praktikum | Practical course,
PL– Prüfungsleistung | Forms of examination,
K – Klausur (angegebene Dauer in Minuten) | written exam (duration in minutes),
M– Mündliche Prüfung (angegebene Dauer in Minuten) | oral examination (duration in minutes)
R – Referat | oral presentation,
S – Seminar– / Hausarbeit | homework, term paper
W – Wissenschaftliches Projekt | scientific project
B – Belegarbeit | coursework
BIP– Blended Intensive Programm–lecture

3 Pflichtbereich | Compulsotory area

Der Pflichtbereich besteht aus den nachfolgend genannten Pflichtmodulen.
Die Module sind im Modulkatalog der Fakultät für Maschinenbau im Detail beschrieben. Entsprechend ist das erfolgreiche Absolvieren gemäß der Studien– und Prüfungsordnung für alle nachfolgend genannten Module für den erfolgreichen Abschluss des Studiums zwingend erforderlich.

The compulsory area consists of the following compulsory modules.
The modules are described in detail in the module catalogue of the Faculty of Mechanical Engineering.
For all modules named in the following it is necessary to successfully pass all modules following the Study and Examination Regulations for the successful finalization of the master's program.

	Umfang			1. Sem. WiSe			2. Sem. SoSe			3. Sem. WiSe			4. Sem. SoSe		
	V	S	P	CP	LN	PL	CP	LN	PL	CP	LN	PL	CP	LN	PL
Pflichtbereich / Compulsotory area	**Σ 25 CP**														
Mechanics of Materials	2	2		5		K									
Systems Engineering for Manufacturing Systems	2	1		5		K									
Material Handling Systems	2	1		5		K									
Polymers in Engineering Science – From Polymer Structure to Final Product	2	1		5		K									
Resources and Recycling	2	1					5		K						

4 Wahlpflichtbereich | Compulsotory chosen area

Der Wahlpflichtbereich besteht aus den Fachbereichen

- Mechanik
- Digitale Systeme
- Planung und Steuerung
- Logistik
- Fertigungstechnik
- Wissenschaftliche Grundlagen

mit den nachfolgend genannten Wahlpflichtmodulen.

The compulsory chosen area consists of the scientific areas

- Mechanics
- Digital systems
- Planning and Control
- Logistics
- Manufacturing technology
- Scientific basics

with the following compulsory modules.

Gemäß Studien- und Prüfungsordnung müssen für einen erfolgreichen Studienabschluss aus dem Wahlpflichtbereich aus drei Fachbereichen so viele Wahlpflichtmodule erfolgreich absolviert werden, dass die Summe in den einzelnen Fachbereichen 10 CP ergibt.

Following the Study and Examination Regulations it is mandatory to pass at least as much modules out of three of these areas that the sum of the CPs of the modules successfully passed in each of the selected scientific areas reaches 10 CPs.

Für die Fachbereiche

- Mechanik
- Digitale Systeme
- Planung und Steuerung
- Logistik
- Fertigungstechnik

sind die entsprechenden Module aus der nachfolgenden Auflistung zu wählen.

The required modules for the scientific areas

- Mechanics
- Digital systems
- Planning and Control
- Logistics
- Manufacturing technology

can be selected from the following listing.

Für den Fachbereich Wissenschaftliche Grundlagen können zwei Module der Fachbereiche

- Mechanik
- Digitale Systeme
- Planung und Steuerung
- Logistik
- Fertigungstechnik

gewählt werden.
Dabei können nur Module angerechnet werden, die noch nicht für einen anderen Fachbereich angerechnet wurden.

Within the scientific area Scientific Basics two modules of the scientific area

- Mechanics
- Digital systems
- Planning and Control
- Logistics
- Manufacturing technology

can be selected.
Only those modules can be accepts not having been accepted for another scientific area.

Zudem müssen gemäß Studien- und Prüfungsordnung für einen erfolgreichen Studienabschluss zwei frei wählbare Module im Umfang von 10 CP erfolgreich absolviert werden.

Additionally, following the Study and Examination Regulations it is mandatory to pass two free selectable modules with a volume of 10 CP successfully.

Als frei wählbares Modul kann jedes an der Otto-von-Guericke Universität gehaltene Modul mit mindestens 5 CP gewählt werden.

As free selectable module any module can be accepted provided at Otto-von-Guericke University in a volume of at least 5 CP.

		Umfang			1. Sem. WiSe			2. Sem. SoSe			3. Sem. WiSe			4. Sem. SoSe		
		V	S	P	CP	LN	PL	CP	LN	PL	CP	LN	PL	CP	LN	PL
Wahlpflichtbereich / Compulsotory chosen area		**Σ 40 CP**														
FB 1: Mechanics	Finite Element Method	2	2					5		M						
	Inelastic Structural Analysis	2	2					5		K						
	Mechanics of Lightweight Structures	2	2					5		M						
	Simulation methods of dynamical systems	2	2					5		K						
FB 2: Digital systems	CAx Basics	2	2					5		K						
	Evolutionary Multi-Objective Optimization	2	2					5		K						
	Engineering Data Logistics based on AutomationML (BIP)	1	1	1				5		W						
	Human-Technology Interaction	2	1					5		W						
	Python in Production System Engineering (BIP)	1	1	1	5		W									
FB 3: Planning and Control	Advanced Applications of Industry 4.0-Technologies	2	1		5		W									
	Factory automation and industrial robotics	2	1					5		K						
	Production system planning	2	1					5		K						
	Applied Game Design (BIP)	2	1		5		W									
	Enterprise Resource Systems *until WiSe 2023-24: Supply Chain Practice: Enterprise Resource Planning (ERP) Systems*	2	1		5		W									
FB 4: Logistics	Collaboration in Supply Networks	2						5		W						
	Handling and Logistics of Bulk Materials	2	1					5		K						
	Modeling and Simulation in Logistics Planning	2	2					5		W						
	Supply Networks	2						5		K						
FB5: Manufacturing technology	Applied Engineering Design *until WiSe 2023-24 Engineering Design*	2	2		5		K									
	Precision and Micro Manufacturing Technologies	2	1					5		K						
FB6: Scientific	Modul 1 / Module 1															
	Modul 2 / Module 2															
Freies Wahlmodul 1 / Free elective module 1																
Freies Wahlmodul 2 / Free elective module 2																

5 eLearning lectures

	Umfang			1. Sem. WiSe			2. Sem. SoSe			3. Sem. WiSe			4. Sem. SoSe		
	V	S	P	CP	LN	PL	CP	LN	PL	CP	LN	PL	CP	LN	PL
eLearning lectures	**Σ 10 CP**														
Establishing digital engineering chains										10		W			
Digitalisation and Automation of Material Handling Systems										10		W			
Requirements, consideration and selection of materials along engineering chains										10		W			

5.1 Digitalisation and Automation of Material Handling Systems

Name of module	Digitalisation and Automation of Material Handling Systems
German title	Digitalisierung und Automatisierung von Materialflusstechnik
Teaching aims and content of the module	Teaching aims and competences to be gained: • Use of basic knowledge regarding material handling systems to design and layout complex material handling systems for general cargo • Understanding of automated material handling systems and its parts for diverting and merging of cargo flows • Basics of calculating the power consumption of continuous handling equipment. • Condition Monitoring and digital twin of material handling systems • Introduction automated guided vehicles (AGV) and autonomous mobile robots (AMR)
	Contents: • Introduction to automation and digitalisation of material handling systems • Calculating the power consumption of continuous conveyors • Measurement of technical parameters for condition monitoring of material handling systems • Introduction to automated guided vehicles (AGV) and automated mobile robots (AMR)
Type of lecture	Motivating lectures at semester start, asynchronous web based learning and group work, mid-term presentation, final presentation
Literature	See first lecture
Preconditions for attending	Material Handling Systems
Usability of module	M-SEM
Prerequisites for the provision of ECTS	Scientific Project, details will be announced in the first lecture“
ECTS and marks	10 CP Marks following Study and Examination Regulations
Efforts	Presence times: 2 SWS lecture, 1 SWS exercises Self-reliant work: pre- and post-preparation of lectures, study of literature, execution of online exercises, group work
Frequency of provision	WiSe
Duration of module	1 Semester
Responsible lecturer	Prof. Katterfeld, FMB-ILM, Other teachers: M.Sc. Lisa Wonner

5.2 Establishing digital engineering chains

Name of module	Establishing digital engineering chains
German title	Erstellung digitaler Entwurfsketten
Teaching aims and content of the module	Teaching aims and competences to be gained: • Provision of knowledge about methods and technologies for implementation of engineering tool chains for the engineering of production systems • Provision of knowledge about capabilities and limitations of engineering data exchange • Provision of design skills for engineering tool interfaces based on common concepts • Provision of AutomationML modelling skills
	Contents: • Motivation and basic structures of engineering tool chains • Problems within engineering data exchange • Views and common concepts on engineering data • Methods for view and common concepts identification • AutomationML basics • Modelling of engineering data views and common concepts with AutomationML • Implementation of engineering chains
Type of lecture	Motivating and summarizing lectures at semester begin and end Web based learning and learning progress control
Literature	
Preconditions for attending	Systems engineering lecture
Usability of module	M-SEM
Prerequisites for the provision of ECTS	Scientific Project, details will be announced in the first lecture“
ECTS and marks	10 CP Marks following Study and Examination Regulations
Efforts	Presence times: 4 lectures with 90 minutes each Self-reliant work online learning and execution of online exercises
Frequency of provision	WiSe
Duration of module	1 Semester
Responsible for the curriculum	Prof. Dr.-Ing. habil. Arndt Lüder, FMB-IAF
Responsible lecturer	Prof. Dr.-Ing. habil. Arndt Lüder, FMB-IAF

5.3 Requirements, consideration and selection of materials along engineering chains

Name of Module	Requirements, consideration and selection of materials along engineering chains (RECOM)
German title	Anforderungen, Abwägungen und Auswahl von Materialien entlang von Prozessketten
Teaching aims and content of the module	Teaching aims and competences to be gained: • Knowledge of different materials classes for specific technical applications and engineering chains – materials selection • Knowledge of the relation between the processing conditions, the (micro)structure of materials and the resulting macroscopic material behavior based on fundamental knowledge • Basic knowledge of physical and chemical mechanisms and working principles
	Contents: • Motivation – A focus on materials along engineering chains • Analyzing the requirements on the materials for their applications along engineering chains using a specific example (this example is also subject of parallel ELearning lectures (no. 3.7.1 and 3.7.2 in module handbook) and will be modified from one to the other semester • Considerations on forming processes and the limits of elastic and plastic deformability depending on materials classes (metals and alloys, ceramics, polymers, composites) • Consideration of requirements, w.r.t. properties for the materials and material combination in various technologies and process chains • Knowledge of most important material properties, as well as destructive and non-destructive materials testing along process chains for quality control • Basic knowledge on the modification of materials properties by heat treatment and surface finishing
Type of lecture	Motivating lectures at semester begin, synchronous and asynchronous web-based learning and group work, mid-term presentation, final report
Literature	Will be provided in the lectures
Preconditions for attending	Systems engineering lecture
Usability of module	M-SEM
Prerequisites for the provision of ECTS	Scientific Project, details will be announced in the first lecture“
ECTS and marks	10 CP Marks following Study and Examination Regulations
Efforts	Presence times: weekly lectures, Self-reliant work online learning and execution of online exercises, group work, final written report
Frequency of provision	WS
Duration of module	1 Semester
Responsible lecturer	Prof. Manja Krüger, FMB-IWF

6 Internship

	Umfang			1. Sem. WiSe			2. Sem. SoSe			3. Sem. WiSe			4. Sem. SoSe		
	V	S	P	CP	LN	PL	CP	LN	PL	CP	LN	PL	CP	LN	PL
Praktikum / Internship	**Σ 15 CP**														
Praktikum / Internship										15	W	W			

6.1 Internship

Name of module	Internship
German title	Fachpraktikum
Teaching aims and content of the module	Teaching aims and competences to be gained: The internship aims at providing students with knowledge about the practical specialties of systems engineering as well as organizational and social knowledge of the work within practical engineering networks. In addition it shall support the perception of the theoretical concepts provided in the study program.
	Contents: • The contents shall be related to the usual working habit of a systems engineer. • It shall be related to the design/development of product / production systems and/or their components.
Type of lecture	Internship within a company Alternatively the internship can be executed within a research organization or an organization of higher education if the work is related to a research project
Preconditions for attending	Certification of at least 50 CP from compulsory, compulsory chosen, and free elective areas
Usability of module	M-SEM
Prerequisites for the provision of ECTS	Internship documentation providing a closed documentation of the content of the internship with its relation to the study program
ECTS and marks	15 CP Marks following Study and Examination Regulations
Efforts	Independent internship execution
Frequency of provision	Semester independent
Duration of module	Execution time of usually 3 month
Responsible lecturer	Lecturer from Faculty of Mechanical Engineering

7 Master Thesis

	Umfang			1. Sem. WiSe			2. Sem. SoSe			3. Sem. WiSe			4. Sem. SoSe		
	V	S	P	CP	LN	PL	CP	LN	PL	CP	LN	PL	CP	LN	PL
Masterarbeit / Master thesis	**Σ 30 CP**														
Masterarbeit incl. Kolloquium / Master thesis incl. colloquium													30	W	W

7.1 Master Thesis

Name of module German title	Master Thesis Masterarbeit
Teaching aims and content of the module	Subjects from all parts of the Faculty of Mechanical Engineering usually with an orientation towards scientific relevance The master thesis shall prove the capabilities of the student to independently deal with a scientific subject within a predefined period of time applying scientific methodologies.
Type of lecture	Scientific project, documentation and colloqium following the design guidelines as well as the guidelines for the execution and presentation of scientific works of the Faculty of Mechanical Engineering
Preconditions for attending	Certification of at least 65 CP from compulsory and compulsory chosen areas as well as 15 CP from internship
Preconditions for colloquium	Certification of all necessary 90 CP Existence of two assessments with at least mark „sufficient”
Usability of module	M-SEM
Prerequisites for the provision of ECTS	2 Assessments, Colloquium
ECTS and marks	30 CP Marks following Study and Examination Regulations
Efforts	Independent scientific project, documentation (thesis), presentation, defense It is recommended to execute the master thesis in cooperation with a company based on a company driven scientific problem.
Frequency of provision	Semester independent
Duration of module	20 weeks Provision of a master thesis subject definition with start and end date documented at Examinations Office of the Faculty of Mechanical Engineering
Responsible lecturer	Lecturer of the Faculty of Mechanical Engineering

8 Regelstudienplan

		Umfang			1. Sem. WiSe			2. Sem. SoSe			3. Sem. WiSe			4. Sem. SoSe		
		V	S	P	CP	LN	V	S	P	CP	LN	V	S	P	CP	LN
Pflichtbereich / Compulsotory area		**Σ 25 CP**														
Mechanics of Materials		2	2		5		K									
Systems Engineering for Manufacturing Systems		2	1		5		K									
Material Handling Systems		2	1		5		K									
Polymers in Engineering Science – From Polymer Structure to Final Product		2	1		5		K									
Resources and Recycling		2	1					5		K						
Wahlpflichtbereich / Compulsotory chosen area		**Σ 40 CP**														
FB 1: Mechanics	Finite Element Method	2	2	1				5		M						
	Inelastic Structural Analysis	2	2					5		K						
	Mechanics of Lightweight Structures	2	2					5		M						
	Simulation methods of dynamical systems	2	2					5		K						
FB 2: Digital systems	CAx Basics	2	2					5		K						
	Evolutionary Multi-Objective Optimization	2	2					5		K						
	Engineering Data Logistics based on AutomationML (BIP)	1	1					5		W						
	Human-Technology Interaction	2	1					5		W						
	Python in Production System Engineering (BIP)	1	1		5		W									
FB 3: Planning and Control	Advanced Applications of Industry 4.0-Technologies	2	1		5		W									
	Factory automation and industrial robotics	2	1					5		K						
	Production system planning	2	1					5		K						
	Applied Game Design (BIP)	2	1		5		W									
	Enterprise Resource Systems *until WiSe 2023-24: Supply Chain Practice: Enterprise Resource Planning (ERP) Systems*	2	1		5		W									
FB 4: Logistics	Collaboration in Supply Networks	2						5		W						
	Handling and Logistics of Bulk Materials	2	1					5		K						
	Modeling and Simulation in Logistics Planning	2	2					5		W						
	Supply Networks	2						5		K						
FB5: Manufacturing technology	Applied Engineering Design *until WiSe 2023-24 Engineering Design*	2	2		5		K									
	Precision and Micro Manufacturing Technologies	2	1					5		K						
FB6: Scientific basics	Modul 1 / Module 1															
	Modul 2 / Module 2															
Freies Wahlmodul 1 / Free elective module 1																
Freies Wahlmodul 2 / Free elective module 2																
eLearning lectures		**Σ 10 CP**														
Establishing digital engineering chains											10		W			
Digitalisation and Automation of Material Handling Systems											10		W			
Requirements, consideration and selection of materials along engineering chains											10		W			
Praktikum / Internship		**Σ 15 CP**														
Praktikum / Internship											15	W	W			
Masterarbeit / Master thesis		**Σ 30 CP**														
Masterarbeit incl. Kolloquium / Master thesis incl. colloquium														30	W	W
Gesamt-CP je Semester					30			35			25			30		