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Appendix B: Module catalogue

for the study programme Optimisation and Simulation M.Sc.

| Bionic Methods of Optimisation | 15 |
|--|----|
| Discrete Optimisation | 17 |
| Discrete Simulation and Reinforcement Learning | 18 |
| Colloquium | 20 |
| Management Skills | 21 |
| Master Thesis | 23 |
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| Multi-Body Simulation | 26 |
| Model-Based Signal Processing | |
| Multidisciplinary Modelling With Modelica | |
| Multiphysics Simulation | |
| Project | |
| Risk Management | |
| Seminar | |
| Simulation of Optical Systems | |
| System Simulation | |
| Elective Module: Optimisation and Simulation | |

| Bion | ic Methoc | ls of Optir | misatio | n | | | | | | BMO | | |
|---------------|--|---|-----------------|-----------------------|-----------|------------|-----------------|------------------------------------|-----------------|------------|------------|--|
| Ident numb | ification | Workload | d: | Credits: | Study | / semes | ter: | Frequency | of the | Duration | : | |
| 2015 |) | 180 h61st or 2nd semesterAnn (Win | | Annual (Winter) | | 1 semester | | | | | | |
| 1 | Course: | Į | PI | anned group s | izes | Scope | e | Actual co time/clas teaching | ontact sroom | Self-study | Self-study | |
| | Lecture | | 60 |) students | | 2 | weekly hours | 30 | h | 60 | h | |
| | Tuition in | seminars | 30 |) students | | 0 | weekly | 0 | h | 0 | h | |
| | Exercise | | 20 |) students | | 2 | weekly | [,] 30 | h | 60 | h | |
| | Practical | or seminar | r 15 | students | | 0 | weekly | ′ O | h | 0 | h | |
| | Supervise | ed self-stu | dy 60 |) students | | 0 | weekly | ′ O | h | 0 | h | |
| 3 | Learning outcomes/competences: The students know the concept of bionics as well as types and procedures of bionic optimisation algorithms. The students are able to assess for which problems bionic algorithms, especially genetic algorithms, are suitable, as well as evaluate the quality of the optimisation results. They can structure and model given problems in such a way that bionic algorithms become applicable. They are able to use neural networks for modelling and increasing efficiency. Contents: Classification of optimisation algorithms (heuristic, combinatorial, analytical, bionic). Types of heuristic procedures: Random walk, hill climbing, simulated annealing, genetic algorithms, other stochastic methods. On genetic algorithms: Biological model, mathematical operators (selection, mutation, etc.), theoretical background (schema theorem, building block hypothesis, speed of convergence). Evolutionary strategies, differential evolution, particle swarming, ant algorithms, bee swarming algorithms. Case studies, classic test functions (Rosenbrock saddle, Travelling Salesperson, etc.). Implementation of a programming project. Basics of artificial neural networks, the most important models, areas of application, especially | | | | | | | | | | | |
| 4 | Forms of Seminar | teaching: lessons v | with pro | oject work | | | | | | | | |
| 5 | Participat Formal: | tion require N | ements: Ione | | | | | | | | | |
| | Content: | N | lone | | | | | | | | | |
| 6 | Project v | work | 111. | | | | | | | | | |
| 7 | Prerequis | site for the | award c | of credit points: | | | | | | | | |
| 8 | Applicatio | on of the m | nodule (i | s in the following | ı study ı | orogran | nmes) | | | | | |
| | BioMech | natronics | M.Sc. a | and Optimisat | tion an | d Simu | lation N | 1.Sc. | | | | |
| 9 | Importan | ce of the g na to MRF | irade foi PO | r the final grade | 9: | | | | | | | |
| 10 | Module c | coordinato | r: | | | | | | | | | |
| | Prof. Dr. | phil. Bern | hard Ba | achmann | | | | | | | | |

| 11 | Other information: |
|----|--|
| | Literature will be announced at the beginning of the course. |
| | - Gerdes et. al, Evolutionäre Algorithmen |
| | - Script Neural Networks |
| 12 | Language: |
| | German |

| Disc | rete Optin | nisation | | | | | | | DOPT | |
|---------------|--|-----------------------------------|------------------------------|--------------------|----------------------|-----------------|--|-------------------|-------------|-----------|
| Ident numb | ification per: | Workload: | Credits: | Study | y semes | ster: | Frequency offer | of the | Duration | : |
| 203 | ō | 180 h | 6 | 1st o | r 2nd s | em. | Annual (Summer) | Annual Summer) | | ster |
| 1 | Course: | I | Planned group s | lanned group sizes | | | Actual contact time/classroom teaching | | Self-study | |
| | Lecture | | 60 students | | 2 | weekly hours | 30 | h | 60 | h |
| | Tuition in | seminars | 30 students | | 2 | weekly hours | 30 | h | 60 | h |
| | Exercise | | 20 students | | 0 | weekly hours | 0 | h | 0 | h |
| | Practical | or seminar | 15 students | | 0 | weekly hours | 0 | h | 0 | h |
| | Supervise | ed self-study | 60 students | | 0 | weekly hours | 0 | h | 0 | h |
| 2 | Learning | outcomes/con | npetences: | | | | | | | |
| | The stuc | dents are fam | iliar with differer | it prob | lem ch | aracteri | stics and t | he corre | sponding | solutior |
| | methods | s of integer ar | id combinatorial | optim | isation | problem | ns and are | able to se | olve releva | ant real- |
| | world pr | oblems with t | he help of suitab | ole moo | dels an | d metho | ods of disc | rete optir | misation. | |
| 3 | Contents: | | | | | | | | | |
| | - Integer linear optimisation problems | | | | | | | | | |
| | - Branc | h and bound i | nethod | | | | | | | |
| | - Cuttin | g method for | solving discrete | optimi | isation | problem | าร | | | |
| | - Colum | nn generation | and branch & p | rice | | • | | | | |
| | - Knaps | ack problems | 5 | | | | | | | |
| | - Assigr | nment and tra | nsport problems | 6 | | | | | | |
| | - Travel | ling Salesper | son problems | | | | | | | |
| | - Schec | luling problen | ns (machine allo | cation, | , flow p | roductio | on) | | | |
| | - Cuttin | g-stock & bin | -packing proble | ems | | | | | | |
| | - Facility | y & hub locati | on problems | | | | | | | |
| 4 | Forms of | teaching: | | | | | | | | |
| | Seminar | lessons with | accompanying | exerci | se | | | | | |
| 5 | Participat | tion requirement | | | | | | | | |
| | Formal: | Basic | knowledge of li | near o | ntimisa | ation | | | | |
| 6 | Forms of | assessment: | | | Punnoc | | | | | |
| 0 | Term pa | per, written e | xamination, com | binatio | on exar | nination | , project w | ork or or | al examina | ation |
| 7 | Prerequis | site for the awa | rd of credit points: | | | | | | | |
| 0 | Application | examination p | Dass le (in the following | 1 study | nroarar | nmeel | | | | |
| ð | Ontimis | ation and Sim | ulation M.Sc | Judy | program | | | | | |
| 9 | Importan | ce of the grade | e for the final grade | e: | | | | | | |
| | accordir | ng to MRPO | | | | | | | | |
| 10 | Module c | coordinator: | | | | | | | | |
| | Prot. Dr. | Jonas Ide | | | | | | | | |
| 11 | | | upood at the l | aineir | a of th | 0.001.000 | ` | | | |
| | | e will be anno rse material io | summarised in | a scrir | y ur me of that a | | ». anies the l | ecture | | |
| 12 | Languag | e: | | | | | | | | |
| | German | | | | | | | | | |
| | | | | | | | | | | |

| Disci | Discrete Simulation and Reinforcement Learning | | | | | | | DSRL | | | |
|---------------|---|---------------------|----------------|--------------------|----------|----------|-----------------|--------------------------------|--------------|------------|---|
| ldent numb | ification per: | Workl | oad: | Credits: | Study | / semes | ster: | Frequency | of the | Duration: | |
| 2061 | | 180 | | 6 | 1st or | 2nd se | em. | Annual (Summer) | | 1 sem. | |
| 1 | Course: | 1 | | Planned group s | sizes: | Scope: | | Actual contact time/clas | ssro nina | Self-study | y |
| | Lecture | | | 60 students | | 0 | weekly hours | / 0 | h | 0 | h |
| | Sem. less | sons | | 30 students | | 2 | weekly hours | / 30 | h | 60 | h |
| | Exercise | | | 20 students | | 2 | weekly hours | / 30 | h | 60 | h |
| | Practical | or semi | nar | 15 students | | 0 | weekly hours | / 0 | h | 0 | h |
| | Supervis | ed self- | study | 60 students | | | weekly hours | / | h | | h |
| 2 | Students are familiar with the basic principles of discrete simulation and are able to build time- discrete, agent-based simulation models using simulation software. They know basic and advanced methods of reinforcement learning and can apply them using a higher programming language. They are able to use the methods of discrete simulation they have learned to model and analyse practical problems. In addition, they are able to combine simulation and reinforcement learning to train an AI to make optimal decisions in a practical context. | | | | | | | | | | |
| 5 | Contents: The course consists of three parts: Introduction to discrete simulation: time-discrete simulation, event-discrete simulation, agent-based simulation, discrete automata, queues, simulation tools Introduction to reinforcement learning: fundamentals of reinforcement learning, fundamentals of supervised learning with deep neural networks, Bellman equation, deep-Q learning Modeling concrete problems: both weekly in the practical part of the course as well as in the combination examination in the context of a group project. | | | | | | | | | | |
| 4 | Forms of | teachin | g: with pro | iaat work | | | | | | | |
| 5 | Participa | tion req | uiremen | ts: | | | | | | | |
| | Formal: | | | | | | | | | | |
| | Content: | | | | | | | | | | |
| 6 | Form of a | issessm tion exa | ent: | | | | | | | | |
| 7 | Prerequis | site for t | he award | d of credit points | s: | | | | | | |
| | Module e | examina | tion pas | S. | | | | | | | |
| 8 | Applicati | on of th | e module | e (in the followin | ig study | / progra | ammes): | | | | |
| | Research | n Maste | r Data So | cience and Optin | misatio | n and S | imulatio | n M.Sc. | | | |
| 9 | Importan | ce of th | e grade ' | for the final grac | de: | | | | | | |
| 10 | Module c | Coordina | ator | | | | | | | | |
| | Prof. Dr | Jonas Ic | le | | | | | | | | |
| 11 | Other info | ormatio | n: | | | | | | | | |

| 12 | Language: |
|----|-----------|
| | English |

| Colloquium MKO | | | | | | | | | МКО | | |
|----------------|--|-----------------|----------------------|-----------|-----------------|------------|------------------|-----------|---------------|-----------|--|
| Ident numb | ification | Workload: | Credits: | Study | Study semester: | | Frequency of the | | Duration | Duration: | |
| 2033 | 3 | 180 h | 6 | 3rd c | 3rd or 4th | | each sem | lester | | | |
| 2000 | | 10011 | Ũ | semeste | | | | | | | |
| 1 | Course: | | Planned group | sizes | Scop | e | Actual co | ontact | Self-stuc | lv | |
| | | | | | | | time/clas | sroom | | , | |
| | | | | | | i | leaching | i | | 1 | |
| | Lecture | | 60 students | | 0 | weekly | 0 | h | 180 | h | |
| | Tuition in | seminars | 30 students | | 0 | nours | / O | h | 0 | h | |
| | Tultorrin | Serrindis | 30 students | | 0 | bours | 0 | n | 0 | n | |
| | Exercise | | 20 students | | 0 | weekly | 0 | h | 0 | h | |
| | | | | | - | hours | | | - | | |
| | Practical | or seminar | 15 students | | 0 | weekly | 0 | h | 0 | h | |
| | | | | | | hours | | | | | |
| | Supervise | ed self-study | 60 students | | 0 | weekly | 0 | h | 0 | h | |
| | | | | | | hours | | | | | |
| 2 | Learning | outcomes/cor | npetences: | | | | | | 1 11 14 | | |
| | I he collo | oquium comp | plements the ma | aster the | esis and | d is to be | eassesseo | lindeper | ndently. It s | serves | |
| | to deter | mine whethe | er the candida | te is ca | apable | of ora | lly preser | iting and | indepen | dently | |
| | justifying the scientific topic of the master thesis, its subject-related foundations, its | | | | | | | | | | |
| | interdisciplinary connections and its non-subject-related references, as well as assessing its | | | | | | | | | | |
| | significa | nce for pract | ice. | | | | | | | C | |
| 3 | Contents | : | | | | | | | | | |
| 0 | - Co | ontent of the t | thesis accordin | a to the | tonic | | | | | | |
| | | soutation on t | the procedure i | n tha nr | opio | ion of th | na thacic a | nd the au | lastions th | at | |
| | - Di | sputation on i | nte procedure i | n uie pi | eparat | | | nu the qu | | iat | |
| 1 | Forms of | teaching: | | 515 | | | | | | | |
| 4 | Oral exa | mination for 1 | the master thes | is | | | | | | | |
| 5 | Participat | ion requireme | nts: | - | | | | | | | |
| Ũ | Formal: | None | 9 | | | | | | | | |
| | Content: | Treat | ment of the ma | ster the | sis | | | | | | |
| 6 | Forms of | assessment: | | | | | | | | | |
| | Oral exa | mination | | | | | | | | | |
| 7 | Prerequis | ite for the awa | rd of credit points | S: | | | | | | | |
| | | | | | | | | | | | |
| 8 | Application | on of the modu | ile (in the followin | ig study | prograr | nmes) | | | | | |
| | Electrica | al Engineering | g M.Eng., Resea | rch Ma | ster Da | ita Scier | nce, Mech | anical Er | ngineering | M.Sc. | |
| | and Opt | imisation and | I Simulation M.S | Sc. | | | | | | | |
| 9 | Importan | ce of the grade | e for the final grad | de: | | | | | | | |
| | accordir | ng to MRPO | | | | | | | | | |
| 10 | IVIOQUIE C | oorainator: | | | | | | | | | |
| 44 | N.N. | ormation | | | | | | | | | |
| 11 | Literatur | e will be anno | ounced at the h | eainnin | a of th | | 2 | | | | |
| 12 | Language | | | <u> </u> | 90111 | 0 000130 | | | | | |
| 12 | German | | | | | | | | | | |

| Man | agement | Skills | | | | | | | ММК | |
|---------------|---|----------------------------------|---|--------------------|-------------------|-------------------|------------------------------------|-----------------|------------|---------|
| Ident numb | ification per: | Workload: | Credits: | Study | / semes | ster: | Frequency offer | of the | Duration | ו: |
| 2006 | 3 | 180 h | 6 | 1st o seme | r 2nd ester | | Annual Summer | | 1 sem. | |
| 1 | Course: | | Planned group s | izes | Scop | e | Actual co time/clas teaching | ontact sroom | Self-study | |
| | Lecture | | 60 students | | 2 | weekly hours | / 30 | h | 60 | h |
| | Tuition in | seminars | 30 students | | 2 | weekly | / 30 | h | 60 | h |
| | Exercise | | 20 students | | 0 | weekly | / 0 | h | 0 | h |
| | Practical | or seminar | 15 students | | 0 | weekly hours | / 0 | h | 0 | h |
| | Supervise | ed self-study | 60 students | | 0 | weekly hours | / 0 | h | 0 | h |
| | specific cases. They understand the connection between corporate goals, leadership culture and social mission. They have learned to analyse entrepreneurial measures from different perspectives. They can evaluate their own behaviour/perception more realistically. They can use methods to motivate employees and themselves, to work successfully in a team and to react sensibly in case of conflict or crisis. They can apply methods to deal sensibly with high task loads. | | | | | | | | | |
| 3 | 3 Contents: Strategic corporate planning, motivational theories, leadership methods, values in management, social, professional and methodological competence, general legal issues, occupational safety, environmental protection, energy and resource efficiency, sustainable economic activities, code of German references, intercultural management, global development and production strategies, project management, self-management, target tracking and controlling, balanced score card, technology excellence level, change management, conflict management, stress and time management, communication in the event of a crisis. | | | | | | | | | |
| 4 | Forms of Lectures | teaching: s, case studie | s, exercises | | | | | | | |
| 5 | Participat Formal: | tion requireme None None | nts: | | | | | | | |
| 6 | Forms of | assessment: | , | | | | | | | |
| 7 | Prerequis | examination, site for the awa | rd of credit points: | iminati | on or c | rai exai | mination | | | |
| | Module | examination | Dass | | | | | | | |
| 8 | Application Electrication M.Sc. | on of the modu al Engineering | ile (in the following M.Eng., Mechai | ı study nical E | prograr nginee | nmes) ring M.S | Sc. and Op | otimisatio | n and Sim | ulation |
| 9 | Importan accordir | ce of the grade ng to MRPO | e for the final grade | Э: | | | | | | |
| 10 | Module c Prof. Dr. | oordinator: -Ing. Bruno H | üsgen | | | | | | | |

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| 11 | Other information: |
|----|--|
| | Literature will be announced at the beginning of the course. |
| 12 | Language: |
| | German |

| Mas | ter Thesis | | | | | | | | M.A. | | |
|---------------|---|------------------------|-----------------------|-----------------|--------------------|-----------------|------------------------------------|-------------------------|----------------|-----------|--|
| Ident numb | ification | Workload: | Credits: | Study | y semes | ster: | Frequency | of the | Duration | Duration: | |
| 2034 | 4 | 720 h 24 3rd o seme | | or 4th ester | | each sem | ach semester | | 20 weeks | | |
| 1 | Course: Planned grou | | Planned group s | sizes | Scop | e | Actual co time/clas teaching | ontact ssroom | Self-stud | У | |
| | Lecture | | 60 students | | 0 | weekly hours | / 0 | h | 720 | h | |
| | Tuition in | seminars | 30 students | | 0 | weekly hours | / 0 | h | 0 | h | |
| | Exercise | | 20 students | | 0 | weekly hours | / 0 | h | 0 | h | |
| | Practical | or seminar | 15 students | | 0 | weekly hours | / 0 | h | 0 | h | |
| | Supervise | ed self-study | 60 students | | 0 | weekly hours | / 0 | h | 0 | h | |
| 2 | Learning | outcomes/cor | npetences: | | | nouro | 1 | 1 | 1 | | |
| - | With the master thesis, each candidate demonstrates that he/she is able to complete a | | | | | | | | | | |
| | practice-oriented task from his/her subject area within a specified period of time, both in its | | | | | | | | | | |
| | subject specific details and in the interdisciplinary contexts working independently and | | | | | | | | | | |
| | subject-specific details and in the interdisciplinary contexts, working independently and | | | | | | | | | | |
| | accordi | ig to scientifi | c methods. | | | | | | | | |
| 3 | | | | ! 4 | :e | | 41 | -4 | f the a manual | 41 | |
| | The mas | ster thesis is a | an independent | scient | ITIC WO planati | rk from | the subje | ct area o t con alor | t the respe | ective | |
| | by on or | | tigation or by or | | | | | | | victing | |
| | sources | . A combinati | on of these form | is is po | ssible. | uesign a | asks of by | anevalu | | asung | |
| 4 | Forms of | teaching: | | | | | | | | | |
| | Written o | composition v | with faculty tutor | ing | | | | | | | |
| 5 | Participat | tion requireme | nts: | | | | | | | | |
| | Formal: | None | 9 | | | | | | | | |
| | Content: | Coor | dinated topic fro | om the | studer | nt's spea | cial subjec | t area | | | |
| 6 | Forms of | assessment: | | | | | | | | | |
| 7 | Prerequis | site for the awa | rd of credit points | : | | | | | | | |
| 8 | Applicati | on of the modu | ule (in the following | g study | prograr | nmes) | | | | | |
| - | Electrica | al Engineering | g M.Eng., Resear | ch Ma | ster Da | ta Scier | nce, Mech | anical En | gineering | M.Sc. | |
| | and Opt | imisation and | Simulation M.So | С. | | | - | | - 0 | | |
| 9 | Importan | ce of the grade | e for the final grade | e: | | | | | | | |
| | accordir | ng to MRPO | | | | | | | | | |
| 10 | Module c | coordinator: | | | | | | | | | |
| | IN.IN. Other inf | ormation | | | | | | | | | |
| | Literatur | e will be anno | ounced at the he | ainnin | a of th | e cours | е. | | | | |
| 12 | Languag | e: | | 9 | gerar | 2 2 2 3 4 1 0 | | | | | |
| | German | | | | | | | | | | |

| dent | tification | Workload: | Credits: | Stud | y semes | ster: | Frequenc | cy of the | Duratio | on: | |
|--------|--|---|--|-------------------|-----------------------|---------------------|--|--------------------|-------------|------------|--|
| านทไ | ber: | 100 - | 6 | 1 ot o | r Ond | | offer | | | | |
| 2014 | 1 | 180 h | 6 1st o seme | | ester | ester | | Annual (Summer) | | 1 semester | |
| 1 | Course: | 1 | Planned group s | izes | Scop | e | Actual contact time/classroom teaching | | Self-stu | Self-study | |
| | Lecture | | 60 students | | 2 | weekly hours | 30 | h | 60 | h | |
| | Tuition ir | seminars | 30 students | | 2 | weekly hours | 30 | h | 60 | h | |
| | Exercise | | 20 students | | 0 | weekly hours | 0 | h | 0 | h | |
| | Practical or seminar | | 15 students | | 0 | weekly hours | 0 | h | 0 | h | |
| | Supervised self- study 60 students 0 weekly 0 h | | | | 0 | h | | | | | |
| 2 | Learning | outcomes/co | mpetences: | | | | | | | - | |
| | Student technica | s can apply s al systems. | tandardised met | hods t | to desc | ribe the | kinemati | cs and dy | namics o | of | |
| | Student | s can descrit | pe mechatronic c | lesian | proces | sses and | l know th | eir specia | al characte | eristic | |
| | Students can describe mechatronic design processes and know their special characteristics. | | | | | | | | | | |
| | can ann | | athode to sunth | | and col | | nonente | | Gyotorn | | |
| 2 | Content | | | 20100 0 | | | ponents. | | | | |
| 5 | Basic ki | pomatic princ | sinlos | | | | | | | | |
| | Kinematics of the point, the rigid and the solid body, the systems of rigid bodies in spatial motion | | | | | | | | | | |
| | Synthetic mechanics: Axioms of Newton and Euler (impulse theorem, twist theorem) | | | | | | | | | | |
| | Kinema | tics in the rela | ative system | | | | | | | | |
| | Analytic Principle | al mechanics of virtual wo | s, differential and ork, d'Alembert's | integi princij | ral princ ole, Lag | ciples: grange's | liberatio | n principl | e | | |
| | Hamilto | n's principle, | Lagrange's equa | itions | | | | | | | |
| | Structur | e and functio | oning of mechatro | onic sy | ystems | and the | ir special | l characte | eristics | | |
| | Design | methodology | for mechatronic | syste | ms | | | | | | |
| | Modelling, analysis and synthesis of the dynamic system behaviour of mechatronic systems | | | | | | | of mecha | atronic sys | stems | |
| | Modellin | ng, analysis a | | | | | | | | | |
| | Modellir | ng, analysis a | | | | | | | | | |
| 1 | Modellin Forms of | ng, analysis a teaching: | | | | | | | | | |
| 1 | Modellin Forms of Lecture | ng, analysis a teaching: , seminar less | sons | | | | | | | | |
| 1 5 | Modellin Forms of Lecture Participa | ng, analysis a teaching: , seminar less tion requireme | sons | | | | | | | | |

| 6 | Forms of assessment: |
|----|---|
| | Written examination or oral examination |
| 7 | Prerequisite for the award of credit points: |
| | Module examination pass |
| 8 | Application of the module (in the following study programmes) |
| | BioMechatronics M.Sc. and Optimisation and Simulation M.Sc. |
| 9 | Importance of the grade for the final grade: |
| | according to MRPO |
| 10 | Module coordinator: |
| | Prof. DrIng. Peter Reinold |
| 11 | Other information: |
| | Literature will be announced at the beginning of the course. |
| 12 | Language: |
| | German |

| Mult | i-Body Sir | mulation | | | | | | | MKS | |
|-------|--|-------------------------------------|------------------------------|---------------|----------------|-----------------|------------------------------------|------------------|-------------|--------|
| Ident | ification | Workload: | Credits: | Study | y semes | ster: | Frequency | of the | Duration | 1: |
| 2011 | | 180 h | 6 | 1st o seme | r 2nd ester | | Annual (Summer) | | 1 semes | ster |
| 1 | Course: | I | Planned group s | sizes | Scop | e | Actual co time/clas teaching | ontact ssroom | Self-study | у |
| | Lecture | | 60 students | | 2 | weekly | [,] 30 | h | 60 | h |
| | Tuition in | seminars | 30 students | | 0 | weekly | ′ O | h | 0 | h |
| | Exercise | | 20 students | | 1 | weekly hours | / 15 | h | 30 | h |
| | Practical or seminar | | 15 students | | 1 | weekly hours | ⁷ 15 | h | 30 | h |
| | Supervise | ed self-study | 60 students | | 0 | weekly hours | 0 | h | 0 | h |
| 3 | dynamics of mechanical and mechatronic systems, analyse the kinematics and dynamics of mechanisms with an MBS program system, interpret simulation results and compare them with the results of MBS simulation programmes. Contents: - Mechanisms (definition, examples) - Concepts in plane kinematics - Coordinate systems, generalised coordinates - Coercive conditions - Examples for the standardised description of mechanisms - Numerical solution of the kinematics - Equations of motion of dynamics under constraints - Lagrange multipliers - Force and control elements - Spatial systems | | | | | | | | | |
| | - Examp | | | | i oi spa | | ems | | | |
| 4 | Seminar | lessons with | exercises and p | oractica | al trainii | ng on th | e comput | er | | |
| 5 | Participat Formal: | tion requireme | nts: e | | | | | | | |
| 6 | Content: Forms of Written e | None assessment: examination, | e combination exa | aminati | on, per | forman | ce examin | ation or o | oral examir | nation |
| 7 | Prerequis Module | site for the awa examination | ard of credit points pass | : | | | | | | |
| 8 | Application of the module (in the following study programmes) BioMechatronics M.Sc., Mechanical Engineering M.Sc. and Optimisation and Simulation M.Sc. | | | | | | | | | |
| 9 | Importan accordir | ce of the grad ng to MRPO | e for the final grad | e: | | | | | | |
| 10 | Module coordinator: Prof. DrIng. Rolf Naumann | | | | | | | | | |

| 11 | Other information: |
|----|--|
| | Literature will be announced at the beginning of the course. |
| | Literature: |
| | Rill, G.: Schaeffer, T.: Grundlagen und Methodik der Mehrkörpersimulation, Vieweg +Teubner |
| | Verlag, ISBN 978-3-8348-0888-2,2010. |
| | Haug, E.J.H: Computer-Aided Kinematics and Dynamics of Mechanical Systems, Volume 1. |
| | Basic Methods, Allyn And Bacon, ISBN 0-205-11669-8 (v.1) 1989. |
| 12 | Language: |
| | German |

| Mod | el-Based | Signal Proce | ssing | | | | | | MSV | |
|--|--|---|---|--------------------------------|--------------------------------|----------------------|---|------------------|----------------------------|--------------|
| ldent numb | ification | Workload: | Credits: | Study | / semes | ster: | Frequency | of the | Duration | ו: |
| 2010 |) | 180 h | 6 | 1st o seme | r 2nd ester | | Annual (Winter) | | 1 seme | ster |
| 1 | Course: | <u> </u> | Planned group s | izes | Scop | e | Actual co time/clas teaching | ontact ssroom | Self-stud | ly |
| | Lecture | | 60 students | | 2 | weekly hours | / 30 | h | 60 | h |
| | Tuition in | seminars | 30 students | | 2 | weekly hours | / 30 | h | 60 | h |
| | Exercise | | 20 students | | 0 | weekly | 0 | h | 0 | h |
| | Practical | or seminar | 15 students | | 0 | weekly hours | 0 | h | 0 | h |
| | Supervise | ed self-study | 60 students | | 0 | weekly hours | 0 | h | 0 | h |
| The students use targeted methodical procedures (modelling and simulation methods) for the development of system solutions for signal processing in complex mechatronic systems. They confidently apply the basic signal and system theory methods and means of description in context, use fundamental signal processing methods and independently design signa processing systems. The students apply the essential steps of model-based development from the idea to the design and prototypical testing to the realisation (usually in the form of ar embedded system) and testing of the system in the respective development phases. They will use the MATLAB®/Simulink® tool chain for model-based development and be able to use the most important extensions and tools for coupling. | | | | | | | for the tion in signal oment of an ey will to use | | | |
| 3 | Contents Model-h | : based system | design: | | | | | | | |
| | Develop | ment proced | ure models, dev | elopm | ent me | thodolc | рду | | | |
| | Signal ar Element descript | nd systems th ary signals, sy ion methods, | neory supplemer /stem properties continuous-time | nts: s, time e view/ | domair ′discre [.] | n and fre te-time | equency d view, z-tra | omain me | ethods, sy tion, stabil | rstem ity |
| | Systems Signal pr Filters, fil special r | and method rocessing cha lter design, bi methods | s of signal proce ain, signal proce linear transforma | essing: ssing s ation, c | system: digital fi | s, ilters (di | rect const | ructs/wa | ve digital f | ïlters), |
| | Aspects of realisation and implementation: Fixed point arithmetic, scaling Test methods Architectures HW/SW implementation Application examples | | | | | | | | | |
| 4 | 4 Forms of teaching: | | | | | | | | | |
| | | | | - | • | - | 0 | | | |

| 5 | Participation req | uirements: |
|----|--------------------|---|
| | Formal: | None |
| | Content: | None |
| 6 | Forms of assess | ment: |
| | Written examin | ation, combination examination, performance examination or oral examination |
| 7 | Prerequisite for t | he award of credit points: |
| | Module examir | nation pass |
| 8 | Application of th | e module (in the following study programmes) |
| | BioMechatroni | cs M.Sc. and Optimisation and Simulation M.Sc. |
| 9 | Importance of th | e grade for the final grade: |
| | according to N | IRPO |
| 10 | Module coordina | ator: |
| | Prof. DrIng. Jo | bachim Waßmuth |
| 11 | Other informatio | n: |
| | Literature will b | e announced at the beginning of the course. |
| 12 | Language: | |
| | German | |

| Multi | idisciplina | ry Modelling | With Modelica | | | | | | MMM | |
|-------|---|-----------------------------------|-----------------------|-----------------|----------------|-----------------|------------------------------------|------------------|-------------|----------|
| Ident | ification | Workload: | Credits: | Study | / semes | ster: | Frequency | of the | Duration | า: |
| 2012 | | 180 h | 6 | 1st o seme | r 2nd ester | | Annual (Summer) | | 1 seme | ster |
| 1 | Course: | L | Planned group s | sizes | Scop | e | Actual co time/clas teaching | ontact ssroom | Self-stud | ly |
| | Lecture | | 60 students | | 2 | weekly hours | 30 | h | 60 | h |
| | Tuition in | seminars | 30 students | 30 students | | weekly hours | 0 | h | 0 | h |
| | Exercise | | 20 students | 20 students | | weekly | 30 | h | 60 | h |
| | Practical | or seminar | 15 students | | 0 | weekly | 0 | h | 0 | h |
| | Supervise | Supervised self-study 60 students | | | 0 | weekly | 0 | h | 0 | h |
| 2 | Learning outcomes/competences: | | | | | | | | | |
| | Students | s understand | the basic char | acteris | tics of | object- | -oriented | multidisc | iplinary m | odelling |
| | and sim | ulation. In par | ticular, they are a | able to | develo | p and s | imulate th | eir own p | hysical mo | odels on |
| | the basis | s of the mode | lling language N | /lodelic | ca. | | | | | |
| 2 | Contents | | | | | | | | | |
| 3 | | Nuque evetem | e | | | | | | | |
| | - Signal | and energy f | s Iow | | | | | | | |
| | - Object diagrams as generalisation of block diagrams | | | | | | | | | |
| | - Differe | ential Algebra | ic Equations (DA | 4F) | it diagi | amo | | | | |
| | - Code | generation fo | or DAFs | (_) | | | | | | |
| | - Discor | ntinuous and | structurally varia | able sv | stems | | | | | |
| | - Time a | and state ever | nts | liere ey | | | | | | |
| | - Efficie | nt handling o | f many switching | g eleme | ents | | | | | |
| | - Svnch | ronisation of | events | | | | | | | |
| | - Physic | al application | IS. | | | | | | | |
| 4 | Forms of | teaching | - | | | | | | | |
| 4 | Seminar | lessons with | exercises and p | ractica | als | | | | | |
| 5 | Participat | ion requireme | nts: | | - | | | | | |
| | Formal: | None |) | | | | | | | |
| | Content: | None | 9 | | | | | | | |
| 6 | Forms of | assessment: | | | | | - | | | |
| | lerm pa | per, written e | xamination, com | nbinatio | on exar | mination | n, pertorma | ance exai | mination, p | oroject |
| 7 | Prerequis | al examinatio | n or examination | <u>n auring</u> | g the c | ourse | | | | |
| 1 | Module | examination i | Dass | - | | | | | | |
| 8 | Applicati | on of the modu | lle (in the following | g study | prograr | nmes) | | | | |
| | BioMech | natronics M.S | c. and Optimisa | tion an | d Simu | lation N | 1.Sc. | | | |
| 9 | Importan | ce of the grade | e for the final grad | e: | | | | | | |
| 10 | Accordin | | | | | | | | | |
| 10 | Prof Dr | nhil Bernhar | Bachmann | | | | | | | |
| 11 | Other info | ormation: | | | | | | | | |
| 11 | Literatur | e will be anno | ounced at the be | ginnin | g of the | e course | Э. | | | |
| 12 | Languag | e: | | - | | | | | | |
| | German | | | | | | | | | |

| Mult | iphysics S | imulation | | | | | | | MPH | |
|-------|--|-----------------------------------|------------------------------|----------------|----------------|-----------------|------------------------------------|--|------------|------|
| Ident | ification | Workload: | Credits: | Study | / semes | ter: | Frequency | of the | Duration | : |
| 2047 | 7 | 180 h | 6 | 1st or seme | r 2nd ester | | Annual (Winter) | | 1 semes | ster |
| 1 | Course: | I | Planned group s | izes | Scop | e | Actual co time/clas teaching | ontact sroom | Self-study | У |
| | Lecture | | 60 students | | 2 | weekly hours | / 30 | h | 60 | h |
| | Tuition in | seminars | 30 students | | 0 | weekly | / 0 | h | 0 | h |
| | Exercise | | 20 students | 20 students | | weekly | / 30 | h | 60 | h |
| | Practical | or seminar | 15 students | | 0 | weekly | / 0 | h | 0 | h |
| | Supervised self-study | | 60 students | | 0 | weekly hours | / 0 | h | 0 | h |
| 2 | The students can describe various physical phenomena (e.g. from the fields of structural mechanics, heat transfer, electrodynamics, acoustics,) with the help of partial differential equations and identify the coupling terms in multi-physics problems. They know the methodological procedure for the modelling and numerical simulation of coupled partial differential equations and can use free and commercial simulation software to solve multiphysics problems in a target-oriented manner. | | | | | | | ctural rential v the partial solve | | |
| 5 | Contents: Definition of multiphysics via coupled partial differential equations Treatment of typical couplings (e.g. electro-thermal WW, fluid-thermal WW, fluid-structure interaction, etc.) and their applications in practice Numerical solution methods (especially FEM) Best practice in modelling (CAD for simulation, appropriate discretisation, domain and boundary conditions, development of solution strategies, etc.) Modelling and simulation using free and commercial simulation software | | | | | | | and | | |
| 4 | Forms of | teaching: seminar less | ons with exercise | es on t | he con | nputer | | | | |
| 5 | Participat Formal: | tion requirement None | nts: | | | 1 | | | | |
| | Content: | None | 9 | | | | | | | |
| 6 | Project v | work | | | | | | | | |
| 7 | Prerequis Module | site for the awa examination p | rd of credit points: cass | 1 | | | | | | |
| 8 | Application of the module (in the following study programmes) Mechanical Engineering M.Sc. and Optimisation and Simulation M.Sc. | | | | | | | | | |
| 9 | Importan | ce of the grade | e for the final grade | 9: 9: | ation a | | | | | |
| 10 | Module c | ng to MRPO | | | | | | | | |
| | Prof. Dr. | rer. nat. Lars | Fromme | | | | | | | |
| | Literatur | e will be anno | ounced at the be | ginnin | g of the | e course | e. | | | |
| 12 | Language German | e: | | | | | | | | |

| Droid | . et | | | | | | | | | | |
|-------|--|-----------------|----------------------|---------------|----------|-----------------|-----------|-------------|-----------|----------|--|
| Proje | ect | | | | | | | | PRO | | |
| Ident | ification | Workload: | Credits: | Stud | y semes | ster: | Frequence | cy of the | Duration: | | |
| numb | ber: | | | | | | offer | | | | |
| 2017 | | 180 h | 6 | 1st o | r 2nd | | Annual | | 1 sem | lester | |
| | | | | sem | ester | | (Winter) | | | | |
| | | | | | | | | | | | |
| 1 | Course: | | Planned group | sizes | Scop | e | Actual | contact | Self-stu | ıdy | |
| | | | | | | | time/cla | assroom | | | |
| | Locturo | | 60 students | | 0 | wookly | | lg Lb | 0 | h | |
| | Lecture | | oo siddeniis | ou students | | hours | | 11 | U | 11 | |
| | Tuition in seminars | | 30 students | | 0 | weekly | / 0 | h | 0 | h | |
| | | | | | Ũ | hours | | | Ũ | | |
| | Exercise | | 20 students | | 0 | weekly | / 0 | h | 0 | h | |
| | | | | | | hours | | | | | |
| | Practical | or seminar | 15 students | | 2 | weekly | / 30 | h | 150 | h | |
| | Supervie | ad a alf atudu | | | | hours | | · | | · · | |
| | Supervise | eu sen-study | 60 students | | 0 | weekly | / 0 | h | 0 | h | |
| 0 | | | | | | | | | | | |
| 2 | Mothods and tools for the creation of a scientifically interacting and comprehensive product | | | | | | | | | | |
| | through | independent | nlanning and in | nnleme | entation | מווא וווכו ז | coung a | na compi | CHCHSIVC | product | |
| | anough | | | | | | | | | | |
| 3 | Contents | : | | | | | | | | | |
| | - We | ork processe | s and time/proje | ect plar | าร | | | | | | |
| | – Ap | ply problem | -finding and pro | blem- | solving | strateg | ies | | | | |
| | - Do | | and presentation | on of th | ne proje | ect | | | | | |
| 4 | Forms of | teaching: | • | | | | | | | | |
| | Project i | n small group |)S | | | | | | | | |
| 5 | Participat | tion requireme | nts: | | | | | | | | |
| | Formal: | None | 9 | | | | | | | | |
| | Content: | None | <u>,</u> | | | | | | | | |
| 6 | Forms of | assessment: | | o molici o fi | | | | la atlara a | a | alia ati | |
| | VVritten e | examination, | combination ex | aminat | ion, pei | rtorman | ce exam | ination or | oralexar | nination | |
| 7 | Modulo | | na of credit points | 5. | | | | | | | |
| 0 | Applicatio | on of the modu | ule (in the followin | n study | program | nmes) | | | | | |
| 8 | Optimis | ation and Sim | ulation M.Sc. | gotady | program | mineoj | | | | | |
| q | Importan | ce of the grade | e for the final grac | de: | | | | | | | |
| | according to MRPO | | | | | | | | | | |
| 10 | Module c | oordinator: | | | | | | | | | |
| | Prof. Dr. | Ing. Rolf Nau | imann | | | | | | | | |
| 11 | Other info | ormation: | | | | | | | | | |
| | Literatur | e will be anno | ounced at the b | eginnin | ng of th | e cours | е. | | | | |
| 12 | Language | e: | | | | | | | | | |
| | German | | | | | | | | | | |

| Risk Management | | | | | | | | | | |
|-----------------|--|-----------------------------------|-------------------------------------|----------------|--------------------|------------------|------------------------------------|-----------------|------------|------|
| Ident | ification | Workload: | Credits: | Study | / semes | ter: | Frequency | of the | Duration |): |
| 2039 |) | 180 h | 6 | 1st or seme | r 2nd ester | | Annual (Winter) | | 1 semes | ster |
| 1 | Course: | L | Planned group s | izes | Scop | e | Actual co time/clas teaching | ontact sroom | Self-study | У |
| | Lecture | | 60 students | | 0 | weekly hours | 0 | h | 0 | h |
| | Tuition in | seminars | 30 students | 30 students | | weekly | 60 | h | 120 | h |
| | Exercise | | 20 students | | 0 | weekly | 0 | h | 0 | h |
| | Practical or seminar | | 15 students | | 0 | weekly | 0 | h | 0 | h |
| | Supervise | ed self-study | 60 students | | 0 | weekly | 0 | h | 0 | h |
| 2 | Learning outcomes/competences: | | | | | | | unt in | 1 | |
| | compan | ients know ba ies and have | the ability to app | oly it in | special practic | iy financ ce. | cial) risk ma | anageme | ent in | |
| 3 | Contents: - Risk concept. History of risk management - Significance and objectives of risk management - Legal and institutional framework - Risk types. Risk classification - Organisation of risk management. Risk management as a process - Techniques for risk identification - Mathematical modelling of risks - Risk aggregation and assessment - Risk management strategies and techniques - IT support for risk management. esp. simulation of operational processes - Risk management as a building block for optimising the value chain in companies - Individual issues of risk management (e.g. sector-specific structuring) and case studies | | | | | | | udies | | |
| 4 | Seminar | lessons | | | | | | | | |
| 5 | Participat Formal: Content: | tion requirement None None | nts: 9 | | | | | | | |
| 6 | Forms of Written e | assessment: examination. | oral examination | orexa | aminatio | on acco | mpanving | the cour | 'Se | |
| 7 | Prerequis | site for the awa examination p | rd of credit points: Dass | : | annau | | pariying | | | |
| 8 | Application Optimisa | on of the modu ation and Sim | ile (in the following ulation M.Sc. | g study | progran | nmes) | | | | |
| 9 | Importance of the grade for the final grade: according to MRPO | | | | | | | | | |
| 10 | Module c Prof. Dr | oordinator: rer. nat. Claur | dia Cottin | | | | | | | |
| 11 | Other information: | | | | | | | | | |
| | Literature will be announced at the beginning of the course. Accompanying material is provided (e.g. short script and current professional articles). Literature source for mathematical aspects of the course in particular: C. Cottin, S. Doehler: Risikoanalyse, 2. Auflage. Springer | | | | | | | | | |

| 12 Language. | |
|--------------|--|
| German | |

| Sem | Seminar | | | | | | | | | | |
|-------|--|---------------------|-----------------------|---------------------|----------------|-----------------|----------|--|-----------|------------|--|
| Ident | ification | Workload: | Credits: | Study | / semes | ster: | Freque | ncy of the | Duratio | on: | |
| 2013 | 3 | 180 h | 6 | 1st or seme | r 2nd ester | | each s | emester | 1 sem | ester | |
| 1 | Course: | | Planned group s | Planned group sizes | | Scope | | Actual contact time/classroom teaching | | Self-study | |
| | Lecture | | 60 students | 60 students | | weekly hours | y O | h | 0 | h | |
| | Tuition in | seminars | 30 students | | 0 | weekly | y O | h | 0 | h | |
| | Exercise | | 20 students | | 0 | weekly | y O | h | 0 | h | |
| | Practical | or seminar | 15 students | | 4 | weekly | y 60 | h | 120 | h | |
| | Supervise | ed self-study | 60 students | | 0 | weekly hours | y O | h | 0 | h | |
| 2 | Learning | outcomes/con | npetences: | | | | | | | | |
| 2 | Students | s have devel | Sped their skills | in writ | ten an | d oral r | oresenta | ation of tec | hnical to | nics hv | |
| | working on a given topic from the field of entimization and simulation summarising it in writing | | | | | | | | | | |
| | working on a given topic from the field of optimization and simulation, summarising it in writing, | | | | | | | | | | |
| | and pres | senting it in ar | n approx. one-h | our lec | ture | | | | | | |
| 3 | Contents Selected | : 1 topics on or | ptimisation and s | simulati | ion (pa | rtlv in F | nalish) | | | | |
| Λ | Forms of | teachina: | | | | | | | | | |
| т | Indepen | dent elaborat | ion and present | ation c | of a giv | en topic | C | | | | |
| 5 | Participat | ion requireme | nts: | | 0 | | | | | | |
| - | Formal: | None | • | | | | | | | | |
| | Content: | None | • | | | | | | | | |
| 6 | Forms of | assessment: | | | | | | | | | |
| | In-class | examination | | | | | | | | | |
| 7 | Prerequis | ite for the awa | rd of credit points | : | | | | | | | |
| | Module | examination | Dass | | | | | | | | |
| 8 | Applicatio | on of the modu | le (in the following | g study | prograr | nmes) | | | | | |
| | Optimisa | ation and Sim | ulation M.Sc. | | | | | | | | |
| 9 | Importance | ce of the grade | e for the final grade | e: | | | | | | | |
| 10 | Accordin | | | | | | | | | | |
| 10 | Prof Dr | lonas Ida | | | | | | | | | |
| 11 | Other info | ormation. | | | | | | | | | |
| 11 | Literatur | e will be anno | ounced at the be | ainnin | a of th | e cours | e. | | | | |
| 12 | Language |);); | | | gerar | | | | | | |
| 12 | German | | | | | | | | | | |

| Simu | lation of (| Optical Syste | ทร | | | | | | SOS | | |
|-------|---|---|--|---|--|--|---|---|---|------------------------------------|--|
| Ident | ification | Workload: | Credits: | Study | y semes | ster: | Frequency | of the | Duration | Duration: | |
| 2016 | ber: | 180 h | 6 | 1st o seme | r 2nd ester | | offer Annual (Summer) | | 1 semes | ster | |
| 1 | Course: | <u> </u> | Planned group s | sizes | Scop | e | Actual co time/clas teaching | ontact sroom | Self-stud | У | |
| | Lecture | | 60 students | | 2 | weekly hours | / 30 | h | 60 | h | |
| | Tuition in | seminars | 30 students | | 0 | weekly | / 0 | h | 0 | h | |
| | Exercise | | 20 students | 20 students | | weekly | / 30 | h | 60 | h | |
| | Practical | or seminar | 15 students | | 0 | weekly hours | / 0 | h | 0 | h | |
| | Supervise | ed self-study | self-study 60 students | | 0 | weekly hours | / 0 | h | 0 | h | |
| | suitable systems for different questions. Evaluate the operational capability in the respective environment. Solve selected problems from the field of optical systems. Design optical systems. Select suitable components. Exemplary implementation of selected tasks for optical systems. Develop application programmes for optical systems. Apply typical optics and image processing libraries. Name, interpret and design interacting light-generating and light- directing components. Enable students to develop their own solutions in application areas of optical systems. | | | | | | | | Select ective optical mage light- eas of | | |
| 3 | Selected structure Interface technolo three-di | : d areas of ge e of selected es, sensor p ogy, optical o mensional da | ometrical optics optical system principles, spec device technolo ta acquisition, ill | s and w s, Indu ctral s pgy, im luminat | vave op strial u sensitiv aging tion pri | otics. O ise of o ity, op system: nciples, | verview of ptical syst tical sens s of senso optics des | optical s ems. Car ors and or technc sign and s | ystems, T mera con measure logy, two simulation | ypical cepts: ement - and | |
| 4 | Forms of Seminar | lessons with | accompanying | exerci | se | | | | | | |
| 5 | Participat Formal: Content: | tion requirement None None | nts: 9 | | | | | | | | |
| 6 | Forms of | assessment: | ombination ave | minati | | formon | oo ovomin | ation or a | vrol ovomi | action | |
| 7 | Prerequis | site for the awa | rd of credit points | : | on, per | Torman | ce examin | | orai examin | allon | |
| 8 | Applicatio | on of the modu | ile (in the following | g study | prograr | nmes) | | | | | |
| 9 | Importan | ce of the grade | e for the final grad | e: | | | | | | | |
| 10 | Module c | oordinator: | | | | | | | | | |
| 11 | Other info | ormation: | | | | | | | | | |
| 12 | Literature will be announced at the beginning of the course. Language: | | | | | | | | | | |
| | German | German | | | | | | | | | |

| Syst | em Simula | ation | | | | | | | | SYS | | |
|-------|--|---------------------------|---------|---------------------|---------------|----------------|-----------------|-----------------|--|----------------|------------|--|
| Ident | ification | Workload: | | Credits: | Study | / semes | ster: | Frequer | ncy of the | Duratio | n: | |
| 2009 | 9 | 180 h | | 6 | 1st o seme | r 2nd ester | | Annual (Summ | er) | 1 seme | ester | |
| 1 | Course: | Į | PI | Planned group sizes | | Scop | Scope | | Actual contact time/classroom teaching | | Self-study | |
| | Lecture | | 60 | 60 students | | 2 | weekly hours | / 30 | h | 60 | h | |
| | Tuition in | seminars | 30 | 0 students | | 2 | weekly hours | / 30 | h | 60 | h | |
| | Exercise | | 20 | 0 students | | 0 | weekly hours | / 0 | h | 0 | h | |
| | Practical or s | | 15 | 5 students | | 0 | weekly hours | / 0 | h | 0 | h | |
| | Supervise | ed self-stud | У 6 | 60 students | | 0 | weekly | / 0 | h | 0 | h | |
| 2 | Learning | outcomes/c | compe | etences: | | | nouro | | | | 1 | |
| | The students know the basic methods for modelling (complex) technical systems and can | | | | | | | | | | | |
| | apply th | ese to new | prob | lems. They kr | now ho | ow to p | repare | the moc | lels created | d and impl | ement | |
| | them on common system simulators, such as Matlab/Simulink. They can also plan simulation | | | | | | | | | | | |
| | experim | ents syster | matica | ally and carry | them | out in | a targe | ted mar | nner. Furthe | ermore, th | ey are | |
| | able to | assess the | oppo | ortunities, lim | its and | d probl | ems of | a nume | erical simu | lation as v | vell as | |
| | analyse | the results | profe | ssionally. | | | | | | | | |
| 3 | Contents | : | - | - | | | | | | | | |
| | Introduction (definitions, types of simulation, process models, goals) | | | | | | | | | | | |
| | - Me | odelling me | ethod | s (balance-sp | bace b | ased, f | ormalisi | ms for m | nech./elect | ri. syst., cro | DSS- | |
| | dis | sciplinary to | echni | ques, experin | nental | modell | ing) | | | | | |
| | - Me | odel prepa | ration | for simulation | n (tran | sfer to | state re | present | ation, blocl | k diagram, | | |
| | lin | earisation, | treatr | nent of algeb | raic lo | ops an | d struct | ural sing | gularities, d | escriptor f | orm) | |
| | – Sii | mulation pr | oced | ures (classific | ation, | selecti | on crite | ria, num | . problems |) | | |
| | – Sii | mulation e> | perin | nents (plannir | ng, imp | lement | ation a | nd follov | v-up) | | | |
| | - Ap | oplication e | examp | oles | | | | | | | | |
| 4 | Forms of | teaching: | | | | | | | | | | |
| | Lectures | s and comp | outer | seminars | | | | | | | | |
| 5 | Formal | tion requirer | nents: | | | | | | | | | |
| | Content: | No | ne | | | | | | | | | |
| 6 | Forms of | assessment | t: | | | | | | | | | |
| | Term pa | per, writter | nexar | nination, com | binatio | on exar | minatior | n, perfor | mance exa | mination, | project | |
| | work, or | al examina | tion o | r examination | during | g the c | ourse | • | | | | |
| 7 | Prerequis | site for the a | ward c | of credit points: | | | | | | | | |
| | Module | examinatic | n pas | S | | | | | | | | |
| 8 | Application | on of the mo | odule (| In the following | study | prograr | nmes) | | la ati | Character | - | |
| | | iatronics N | 1.SC., | iviechanicai E | ngine | ering IV | i.Sc. and | u Optim | isation and | SIMULATIO | 11 | |
| q | Importan | ce of the ar | ade fo | r the final arade | 9: | | | | | | | |
| 3 | accordir | ng to MRPC |) | 9.0.00 | | | | | | | | |
| 10 | Module c | oordinator: | | | | | | | | | | |
| | Prof. Dr. | -Ing. Klaus | Panre | eck | | | | | | | | |
| 11 | Other info | ormation: e will be ar | noun | ced at the be | ainnin | a of the | | 2 | | | | |
| 12 | Languag | e: | | | 9 | 90111 | 5 000130 | 0. | | | | |
| 12 | German | | | | | | | | | | | |
| | TI O | | | | 1.1.11 | | | | | | | |

| Elective Module: Optimisation and Simulation | | | | | | | | | | WM | |
|--|--|---------------|----|---------------------|------------------------|-------------|-----------------|--|---|------------|---|
| Identification number: | | Workload: | | Credits: Study | | / semester: | | Frequency of the offer | | Duration: | |
| 9023 | | 180 h | | 6 | 1st or 2nd semester | | | each semester | | 1 semester | |
| 1 | Course: | | PI | Planned group sizes | | Scope | | Actual contact time/classroom teaching | | Self-study | |
| | Lecture | | 60 | 60 students | | | weekly hours | ý | h | | h |
| | Tuition in seminars | | 30 | 30 students | | | weekly hours | ý | h | | h |
| | Exercise | | 20 | 20 students | | | weekly hours | ý | h | | h |
| | Practical or seminar | | 15 | 15 students | | 0 | weekly hours | y O | h | 0 | h |
| | Supervise | ed self-study | | 30 students | | | weekly hours | y | h | | h |
| 2 | Learning outcomes/competences: | | | | | | | | | | |
| 3 | Contents: | | | | | | | | | | |
| 4 | Forms of teaching: | | | | | | | | | | |
| 5 | Participation requirements: | | | | | | | | | | |
| | Formal: | | | | | | | | | | |
| | Content: | | | | | | | | | | |
| 6 | Forms of assessment: | | | | | | | | | | |
| 7 | Prerequisite for the award of credit points: | | | | | | | | | | |
| 8 | Application of the module (in the following study programmes) Optimisation and Simulation M.Sc. | | | | | | | | | | |
| 9 | Importance of the grade for the final grade: | | | | | | | | | | |
| 10 | Module coordinator: | | | | | | | | | | |
| | Prof. DrIng. Rolf Naumann | | | | | | | | | | |
| 11 | Other information: | | | | | | | | | | |
| 12 | Language: | | | | | | | | | | |
| | German | | | | | | | | | | |