**Amtliche Bekanntmachungen der TU Bergakademie Freiberg**

**Nr. 16, Heft 2 vom 6. Oktober 2016**

# Modulhandbuch

# für den

# Internationalen Masterstudiengang

# Computational Materials Science

**Inhaltsverzeichnis**

**Abkürzungen**

KA: schriftliche Klausur / written exam
MP: mündliche Prüfung / oral examination
AP: alternative Prüfungsleistung / alternative examination
PVL: Prüfungsvorleistung / prerequisite
MP/KA: mündliche oder schriftliche Prüfungsleistung (abhängig von Teilnehmerzahl) / written or oral examination (dependent on number of students)

SS, SoSe: Sommersemester / sommer semester
WS, WiSe: Wintersemester / winter semester

SX: Lehrveranstaltung in Semester X des Moduls / lecture in module semester x

SWS: Semesterwochenstunden

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|---|---|---|---|
| Data: | CerEng. MA. Nr. / Examination number: - | Version: 15.06.2016 | Start Year: WiSe 2016 |
| Module Name: | **Ceramic Engineering** | | |
| (English): | | | |
| Responsible: | Aneziris, Christos G. / Prof. Dr.-Ing. | | |
| Lecturer(s): | Aneziris, Christos G. / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Ceramics, Glass and Construction Materials | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students will understand ceramic materials:<br>• in micro structural design,<br>• ceramic processing,<br>• testing and<br>• application | | |
| Contents: | Most important ingredients are:<br>• definition, bonding,<br>• micro structure, density, porosity<br>• mechanical properties,<br>• thermal and thermo mechanical properties<br>• chemical properties<br>• sintering<br>• basics in ceramic technology, theoretical<br>• ceramic technology pressing/extruding/casting, experimental<br>• engineering ceramics, alumina/zirconia<br>• engineering ceramics, silicon carbide<br>• functional ceramics, non linear dielectric/piezoelectric properties - barium titanate<br>• refractories, carbon bonded materials<br>• silicate ceramics<br>• Exercise: theoretical density / Enthalpy<br>• Visiting of ceramic plant or research institute | | |
| Literature: | Introduction to Ceramics, David Kingery<br>Introduction to the Principles of Ceramic Processing, James Reed<br>Physical Ceramics, Yet-Ming Chiang, Dunbar Birnie III, W. David Kingery | | |
| Types of Teaching: | S1 (WS): Incl. Exercises / Lectures (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basic fundamentals of materials science | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>MP/KA (KA if 6 students or more) [MP minimum 30 min / KA 90 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA (KA bei 6 und mehr Teilnehmern) [MP mindestens 30 min / KA 90 min] | | |
| Credit Points: | 3 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA [w: 1] | | |
| Workload: | The workload is 90h. It is the result of 30h attendance and 60h self-studies. | | |

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|---|---|---|---|
| Data: | KOTM. MA. Nr. 3120 / Examination number: - | Version: 11.07.2016 | Start Year: SoSe 2012 |
| Module Name: | **Continuum Mechanics** | | |
| (English): | | | |
| Responsible: | Kuna, Meinhard / Prof. Dr. rer. nat. habil. | | |
| Lecturer(s): | Kuna, Meinhard / Prof. Dr. rer. nat. habil. | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students will get familiar with the fundamentals of continuum mechanics of three-dimensional bodies under large deformations. | | |
| Contents: | Most important ingredients are:<br>• tensor algebra and analysis<br>• Eulerian and Lagrangian description<br>• kinematics of continua in large deformations<br>• definition of various measures of stretch and strain<br>• dynamics of continua<br>• generalizes stress tensors<br>• balance laws (mass, momentum, energy, entropy)<br>• material theory | | |
| Literature: | P. Haupt: Continuum Mechanics and Theory of Materials, Springer, 2000 | | |
| Types of Teaching: | S1 (SS): Lectures (2 SWS)<br>S1 (SS): Exercises (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basic knowledge in theoretical mechanics | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>MP/KA (KA if 10 students or more) [MP minimum 45 min / KA 120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 45 min / KA 120 min] | | |
| Credit Points: | 4 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA [w: 1] | | |
| Workload: | The workload is 120h. It is the result of 45h attendance and 75h self-studies. | | |

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| Daten: | DEU A2/1. Sem. BA.Nr. 950 / Prüfungs-Nr.: - | Stand: 26.08.2015 | Start: WiSe 2016 |
| Modulname: | **Deutsch A2/ 1. Semester** | | |
| (englisch): | German A2/ 1st Semester | | |
| Verantwortlich(e): | Bellmann, Kerstin | | |
| Dozent(en): | Paul, Sandra / Diplom-Lehrerin<br>Bellmann, Kerstin | | |
| Institut(e): | Internationales Universitätszentrum | | |
| Dauer: | 1 Semester | | |
| Qualifikationsziele / Kompetenzen: | Die Teilnehmer erweitern ihre Kenntnisse zu Grundlagen der deutschen Grammatik sowie ihren allgemeinsprachlichen Wortschatz und führen Gespräche zu verschiedenen Themen des Alltags. | | |
| Inhalte: | Familie und Verwandtschaft, Feste und Feiern in Deutschland, Wohnung und Wohnungseinrichtung, Schule und Ausbildung, Aussehen und Mode, Jahreszeiten, Wetter und Urlaub, Aspekte der Geschichte (Deutschland, Österreich, Schweiz); Grammatik: z.B. Nebensätze mit weil, wenn, dass; Rektion der Verben; Ordinalzahlen; Präpositionen; Reflexivpronomen; Zukunft ausdrücken; Adjektivdeklination | | |
| Typische Fachliteratur: | Begegnungen A2+, Schubert Verlag | | |
| Lehrformen: | S1 (WS): Übung (4 SWS) | | |
| Voraussetzungen für die Teilnahme: | **Obligatorisch:**<br>Deutsch A1/ 2. Semester, 2015-08-26<br>oder äquivalente Sprachkenntnisse | | |
| Turnus: | jährlich im Wintersemester | | |
| Voraussetzungen für die Vergabe von Leistungspunkten: | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [90 min]<br>PVL: Erfolgreiche aktive Teilnahme an mind. 80% d. Unterrichts<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. | | |
| Leistungspunkte: | 4 | | |
| Note: | Die Note ergibt sich entsprechend der Gewichtung (w) aus folgenden(r) Prüfungsleistung(en):<br>KA [w: 1] | | |
| Arbeitsaufwand: | Der Zeitaufwand beträgt 120h und setzt sich zusammen aus 60h Präsenzzeit und 60h Selbststudium. | | |

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| Data: | DisTheo. MA. Nr. 3206 / Examination number: - | Version: 12.07.2016 | Start Year: WiSe 2015 |
| Module Name: | **Discrete Element Method** | | |
| (English): | | | |
| Responsible: | Schwarze, Rüdiger / Prof. Dr.-Ing. | | |
| Lecturer(s): | Schwarze, Rüdiger / Prof. Dr.-Ing. | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The student will get familiar with the theoretical fundamentals, the different techniques and the numerical algorithms on discrete elements method to perform and evaluate corresponding simulations | | |
| Contents: | Most important ingredients are:<br>• modeling strategy (conceptual and numerical model); classification of DEM<br>• contact detection; interaction force-displacement laws, contact and friction laws<br>• algorithms for solving the equations of motion<br>• modelling of granular material<br>• introduction to simulation tools and software (PFC, Jade, LIGGHTS,etc.)<br>• practical hints; applications; practical exercises in 2d and 3d. | | |
| Literature: | Discrete Element Method:<br>Pöschel, T. & Schwager, T. (2005): Computational Granular Dynamics, Springer, 322 p.<br>Jing, L & Stephansson, O. (2007): Fundamentals of Discrete Element Methods for Rock Engineering, Elsevier, 545 p.<br>Darve, F. & Ollivier, J.-P. (2008): Discrete Modelling of Geomaterials, European J. Env. Civil Eng., 12(2008)7-8, 253 p.<br>UDEC/3DEC-Manuals (2010), Itasca Consulting Group<br>PFC/PFC3D-Manuals (2010), Itasca Consulting Group | | |
| Types of Teaching: | S1 (WS): Discrete Element Method / Lectures (2 SWS)<br>S1 (WS): Discrete Element Method / Exercises (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Fundamental of Microstructures, 2010-12-02<br>Continuum Mechanics, 2016-07-11<br>Introduction to Scientific Programming, Fundamentals in mechanics | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>MP/KA: fundamentals, numerics and applications of DEM (KA if 6 students or more) [MP minimum 30 min / KA 60 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA: Grundlagen, Numerik und Anwendungen der DEM (KA bei 6 und mehr Teilnehmern) [MP mindestens 30 min / KA 60 min] | | |
| Credit Points: | 5 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA: fundamentals, numerics and applications of DEM [w: 1] | | |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. | | |

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| Data: | MechTest. MA. Nr. 3207 / Examination number: - | Version: 03.02.2011 | Start Year: WiSe 2012 |
| Module Name: | **Experimental Methods** | | |
| (English): | | | |
| Responsible: | Rafaja, David / Prof. Dr. rer. nat. habil.<br>Krüger, Lutz / Prof. Dr.-Ing. | | |
| Lecturer(s): | Krüger, Lutz / Prof. Dr.-Ing.<br>Klemm, Volker / Dr.-Ing. | | |
| Institute(s): | Institute of Materials Engineering<br>Institute of Materials Science | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students will get familiar with:<br>Experimental Methods to measure the flow stress-, deformation- and failure behavior in a wide range of loading rate, temperature and stress state.<br>Basic principles and examples of the methods for microstructure analysis (optical and scanning electron microscopy, X-ray diffraction). | | |
| Contents: | Most important topics are:<br>Mechanical Testing: hardness tests, methods to measure the flow stress-behavior under tensile, compressive, bending and shear loading, Charpy-impact test, drop weight tear test, Pellini-Test, Robertson test, effect of temperature and strain rate on mechanical properties, brittle and ductile failure, methods to determine fracture toughness properties under quasi-static, impact and cycling loading, fatigue testing (Wöhler test / SN-curve), multiaxial testing methods, high strain rate tests (drop weight test, split Hopkinson bar)<br>Microstructure Analysis: physical background of optical and scanning electron microscopy and X-ray diffraction; phase identification and quantification, determination of the grain and crystallite size, global and local preferred orientation of crystallites | | |
| Literature: | Experimental Methods:<br>Dowling, Norman E.: Mechanical Behavior of Materials – Engineering Methods for Deformation, Fracture, and Fatigue, 2007, Pearson Prentice Hall<br>Meyers, Marc A.: Dynamic Behavior of Materials, John Wiley & Sons, New York, 1994<br>Microstructure Analysis:<br>V. Randle, O. Engler: Introduction to texture analysis, macrotexture, microtexture and orientation mapping, Gordon & Breach, Amsterdam, 2000.<br>V. Randle: Microtexture determination and its applications, Institute of Materials, London, 1992.<br>Klug, Harold P., Alexander, Leroy E.: X-ray diffraction procedures for polycrystalline and amorphous materials, New York, Wiley, 2nd edition 1974. | | |
| Types of Teaching: | S1 (WS): Lectures (3 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Profound knowledge of English, basics in materials science, mechanics, advanced mathematics, physics for scientists, crystallography. | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP/KA (KA if 5 students or more) [MP minimum 30 min / KA 120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst: | | |

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| | MP/KA (KA bei 5 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min] |
| Credit Points: | 4 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA [w: 1] |
| Workload: | The workload is 120h. It is the result of 45h attendance and 75h self-studies. |

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| Data: | FMC. MA. Nr. 3208 / Examination number: - | Version: 02.12.2010 | Start Year: SoSe 2012 |
| Module Name: | **Fracture Mechanics Computations** | | |
| (English): | | | |
| Responsible: | Kuna, Meinhard / Prof. Dr. rer. nat. habil. | | |
| Lecturer(s): | Kuna, Meinhard / Prof. Dr. rer. nat. habil. | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Development of an understanding of the fracture of materials and structures from the point of view of a design engineer; students acquire knowledge about theoretical (numerical) stress analysis of cracked structures as well as fracture mechanics concepts of brittle, ductile and fatigue failure. Development of the ability to design fail-safe structures with defects, qualitatively assess the safety and durability as well as estimate the duration of life for subcritical crack growth under (random) in-service loads. | | |
| Contents: | Most important ingredients are: fundamentals of fracture mechanics, including fracture mechanics concepts and relevant load parameters for elastic and plastic materials under static as well as cyclic loading. Suitable Finite-Element techniques for the calculation of load parameters are introduced. The application of fracture mechanics concepts to the assessment of safety and durability of structures is demonstrated with the help of real-world examples. | | |
| Literature: | Ted L. Anderson: Fracture Mechanics: Fundamentals and Applications, CRC Press 2004<br>M. Kuna: Numerische Beanspruchungsanalyse von Rissen, FEM in der Bruchmechanik, Vieweg-Teubner 2010 | | |
| Types of Teaching: | S1 (SS): Lectures (2 SWS)<br>S1 (SS): Exercises (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basic knowledge in theoretical mechanics | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>KA [120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [120 min] | | |
| Credit Points: | 5 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA [w: 1] | | |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. | | |

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| Data: | FUNMICRO. MA. Nr. 3209 / Examination number: - | Version: 11.07.2016 | Start Year: WiSe 2011 |
| Module Name: | **Fundamental of Microstructures** | | |
| (English): | | | |
| Responsible: | Kuna, Meinhard / Prof. Dr. rer. nat. habil.<br>Mikromechanik / Prof. | | |
| Lecturer(s): | Mikromechanik / Prof. | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students will get familiar with the microstructural elements that can be found into real crystalline materials. | | |
| Contents: | Most important ingredients are: Crystallography, Dislocations, Void and Void growth mechanisms, solute atoms and strengthening mechanisms, Inclusion and Eshelby solution, characteristic length scale associated to each elements. | | |
| Literature: | Introduction to dislocations: Hull and Bacon<br>Crystal defects and microstructures: Modeling across length scale. Phillips<br>Strengthening Mechanisms in Crystal Plasticity (Oxford Series on Materials Modelling): Ali S. Argon | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Exercises (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>None | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>MP/KA: If Oral Exam: One question from the lecture notes and one exercise to discuss, 30 min time to prepare (KA if 6 students or more) [MP minimum 30 min / KA 120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA: Bei mündlicher Prüfung: Diskussion einer Frage aus dem Vorlesungsskript und einer Übung, 30 Minuten Vorbereitungszeit (KA bei 6 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min] | | |
| Credit Points: | 4 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA: If Oral Exam: One question from the lecture notes and one exercise to discuss, 30 min time to prepare [w: 1] | | |
| Workload: | The workload is 120h. It is the result of 45h attendance and 75h self-studies. | | |

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| Data: | IHPC. MA. Nr. 3210 / Examination number: 11110 | Version: 05.03.2015 | Start Year: WiSe 2012 |
| Module Name: | **Introduction to High Performance Computing and Optimization** | | |
| (English): | | | |
| Responsible: | Rheinbach, Oliver / Prof. Dr. | | |
| Lecturer(s): | Rheinbach, Oliver / Prof. Dr. | | |
| Institute(s): | Institute of Numerical Mathematics and Optimization | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students shall have an understanding of and ability to apply:<br>• parallel computing on shared and distributed memory multiprocessor systems<br>• parallel algorithms<br><br>The students know relevant terms in English. | | |
| Contents: | Ingredients can be:<br>• Portable parallel programming with OpenMP and MPI (Message Passing Interface); hybrid parallelization; accelerators<br>• Code profiling, tracing and optimization methods using tools (profiler, VAMPIRE, etc.);<br>• Relevant software libraries (e.g., BLAS, LAPACK, SCALAPACK, etc.)<br>• Design and analysis of algorithms<br>• Parallel solution of linear systems (dense/sparse systems)<br>• International literature and relevant terms in Englisch | | |
| Literature: | Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, Chapman & Hall, 2010<br>OpenMP Standard, www.openmp.org<br>Barbara Chapman, Gabriele Jost, Ruud van der Pas, Using OpenMP: portable shared memory parallel programming, MIT Press, 2008<br>William Gropp, Ewing Lusk, Anthony Skjellum, Using MPI: Portable Parallel Programming with the Message-Passing Interface, MIT press, 2000<br>Michael Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2003<br>Anne Greenbaum, Iterative Methods for Solving Linear Systems, SIAM, 1997 | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Exercises (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basics knowledge in scientific programming and algorithms. | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP/KA: MP = individual examination (KA if 30 students or more) [MP minimum 30 min / KA 120 min]<br>PVL: Programming Project<br>PVL have to be satisfied before the examination. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA: MP = individuelle Prüfung (KA bei 30 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min]<br>PVL: Programmierprojekt | | |

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| | PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. |
| Credit Points: | 4 |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA: MP = individual examination [w: 1] |
| Workload: | The workload is 120h. It is the result of 45h attendance and 75h self-studies. |

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|---|---|---|---|
| Data: | ISP. MA. Nr. 3211 / Examination number: - | Version: 07.02.2011 | Start Year: WiSe 2012 |
| Module Name: | **Introduction to Scientific Programming** | | |
| (English): | | | |
| Responsible: | Steinbach, Bernd / Prof. Dr. | | |
| Lecturer(s): | | | |
| Institute(s): | Institute of Computer Science | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students will get familiar with the syntax and semantic of a procedural programming language, an object oriented programming language and the approach of interactive programming. Based on this knowledge, the students must be able to implement interactive programs having a graphical user interface that can be executed in the environment of several operating systems. | | |
| Contents: | Most important ingredients are:<br>with regard to procedural programming:<br>data types and variables, pointer and arrays, expressions, statements, operators, control structures, functions, structures, functions of a standard library,<br>with regard to object oriented programming:<br>objects and classes, encapsulation, access rights, inheritance, polymorphism, overloading of functions an operators, type casting, templates, functions of a standard library, and<br>with regard to interactive programming:<br>signal, slot, event, property, graphical user interface. | | |
| Literature: | Kernighan, Ritchie: The C Programming Language (2nd Edition) – ANSI C, ISBN 0131103628;<br>Stroustrup: The C++ Programming Language: Special Edition, ISBN 0201700735;<br>Blanchette, Summerfield: C++ GUI Programming with Qt 4 (2nd Edition) - The official C++/Qt book, ISBN 0132354160; | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Exercises (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Höhere Mathematik für Ingenieure 1, 2009-05-27<br>Höhere Mathematik für Ingenieure 2, 2009-05-27 | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>in examination variant 1:<br>KA [120 min]<br>or<br>in examination variant 2:<br>AP: Programming Project | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>in Prüfungsvariante 1:<br>KA [120 min]<br>oder<br>in Prüfungsvariante 2:<br>AP: Programmierprojekt | | |
| Credit Points: | 6 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>in examination variant 1: | | |

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| | KA [w: 1]<br>or<br>in examination variant 2:<br>AP: Programming Project [w: 1] |
| Workload: | The workload is 180h. It is the result of 60h attendance and 120h self-studies. |

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| Data: | MasThesis. MA. Nr. 3212 / Examination number: - | Version: 02.12.2010 | Start Year: SoSe 2012 |
| Module Name: | **Master Thesis Computational Science** | | |
| (English): | | | |
| Responsible: | Kuna, Meinhard / Prof. Dr. rer. nat. habil. | | |
| Lecturer(s): | | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 6 Month(s) | | |
| Competencies: | The objective of the master thesis is to give the students the opportunity to apply the knowledge acquired during their studies on a research project. | | |
| Contents: | Not Applicable | | |
| Literature: | Not Applicable | | |
| Types of Teaching: | S1: Thesis (6 Mon) | | |
| Pre-requisites: | **Mandatory:**<br>Personal Programming Project, 2016-07-11<br>Abschluss aller Module des 1. u. 2. Semesters sowie Antritt aller Modulprüfungen des 3. Semesters und davon höchstens drei offene Prüfungsleistungen | | |
| Frequency: | constantly | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>AP*: Master Thesis<br>AP*: Colloquium [40 to 60 min]<br><br>* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>AP*: Masterarbeit<br>AP*: Kolloquium [40 bis 60 min]<br><br>* Bei Modulen mit mehreren Prüfungsleistungen muss diese Prüfungsleistung bestanden bzw. mit mindestens "ausreichend" (4,0) bewertet sein. | | |
| Credit Points: | 30 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>AP*: Master Thesis [w: 3]<br>AP*: Colloquium [w: 1]<br><br>* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively. | | |
| Workload: | The workload is 900h. | | |

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| Data: | WERKMEC. BA. Nr. 253 / Examination number: - | Version: 11.07.2016 | Start Year: WiSe 2016 |
| Module Name: | **Mechanics of Materials** | | |
| (English): | | | |
| Responsible: | Kuna, Meinhard / Prof. Dr. rer. nat. habil. | | |
| Lecturer(s): | Mikromechanik / Prof. | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Development of an understanding of the deformation behavior and failure mechanisms of technological materials; students will get familiar with elastic, plastic, viscous, viscoelastic and viscoplastic behaviors of materials; development of the ability to assess the behavior of materials and to design structures accordingly. | | |
| Contents: | Most important ingredients are:<br>• continuum mechanics foundations of stress, strain and displpacements<br>• rheological models for elastic, plastic, viscous, viscoelastic, and viscoplastic deformation behavior<br>• multi-axial continuum laws for anisotropic elasticity and plasticity<br>• extended strength and failure theories / criteria for multiaxial loading | | |
| Literature: | J. Lemaitre and J.-L. Chaboche: Mechanics of Solid Materials, Cambridge University Press,2000 | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Exercises (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basic knowledge in engineering mechanics | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>KA [120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [120 min] | | |
| Credit Points: | 5 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA [w: 1] | | |
| Workload: | The workload is 150h. It is the result of 60h attendance and 90h self-studies. | | |

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| Data: | MetMat. MA. Nr. / Examination number: - | Version: 27.06.2016 | Start Year: WiSe 2016 |
| Module Name: | **Metallic Materials** | | |
| (English): | | | |
| Responsible: | Biermann, Horst / Prof. Dr.-Ing. habil | | |
| Lecturer(s): | Weidner, Anja / Dr.-Ing. | | |
| Institute(s): | Institute of Materials Engineering | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students will get familiar with metallic materials (ferrous materials, non-ferrous metals, light metals, high-temperature metals), their microstructure and mechanical properties as well as heat treatment. Focus is given to plastic deformation and failure. The module will enable the students to differentiate the different groups of metallic construction materials. | | |
| Contents: | Most important topics are:<br>Ferrous metals (plain carbon steels, high-alloyed steels, cast irons);<br>Non-ferrous metals (e.g. copper, nickel)<br>Light metals (aluminum, titanium, magnesium)<br>High-temperature alloys (superalloys, intermetallic alloys) | | |
| Literature: | M. F. Ashby, D.R.H. Jones, Engineering materials 2, 2nd ed., Butterworth-Heinemann, Oxford, 1998<br>James F. Shackelford, Introduction to Materials Science for Engineers, 7th ed. Addison Wesley., 2009 | | |
| Types of Teaching: | S1 (WS): Metallic Materials / Lectures (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basic fundamentals of physics, chemistry and solid materials | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>KA [90 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [90 min] | | |
| Credit Points: | 3 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA [w: 1] | | |
| Workload: | The workload is 90h. It is the result of 30h attendance and 60h self-studies. | | |

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| Data: | NADE. MA. Nr. 3214 / Examination number: 11109 | Version: 01.06.2014 | Start Year: SoSe 2012 |
| Module Name: | **Numerical Analysis of Differential Equations** | | |
| (English): | | | |
| Responsible: | Eiermann, Michael / Prof. Dr. | | |
| Lecturer(s): | Eiermann, Michael / Prof. Dr.<br>Rheinbach, Oliver / Prof. Dr.<br>Helm, Mario / Dr. | | |
| Institute(s): | Institute of Numerical Mathematics and Optimization | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students shall have an understanding to fundamental techniques for the numerical solution of ordinary and partial differential equations. The students know relevant terms in English. | | |
| Contents: | ODEs: Euler methods, Runge Rutta Methods, Linear Multistep Methods, Stability, Stiffness;<br>PDEs: Finite Difference techniques, time stepping, von Neumann stability analysis.<br>International literature and relevant terms in English are explained. | | |
| Literature: | Finite Difference Methods for Ordinary and Partial Differential Equations von Randy Leveque, University of Washington | | |
| Types of Teaching: | S1 (SS): Lectures (2 SWS)<br>S1 (SS): Exercises (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Advanced mathematics course for scientists and engineers. Some familiarity with the theory or applications of differential equations is helpful | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam. The module exam contains:<br>KA [120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA [120 min] | | |
| Credit Points: | 3 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA [w: 1] | | |
| Workload: | The workload is 90h. It is the result of 45h attendance and 45h self-studies. | | |

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| Data: | PP. MA. Nr. 3215 / Examination number: - | Version: 11.07.2016 | Start Year: WiSe 2012 |
| Module Name: | **Personal Programming Project** | | |
| (English): | | | |
| Responsible: | Kuna, Meinhard / Prof. Dr. rer. nat. habil.<br>Mikromechanik / Prof. | | |
| Lecturer(s): | Schwarze, Rüdiger / Prof. Dr.-Ing.<br>Hütter, Geralf / Dr.<br>Mikromechanik / Prof. | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students will develop and document their own numerical tool (one out of the following three: Molecular Dynamics MD, Finite Elements Method FEM, Discrete Element Method DEM). Furthermore, they will use this method to simulate a material behavior or to calculate a physical property of their choice. | | |
| Contents: | Most important ingredients are: Developing the tool, commenting the source file, documentation and running a successful example to verify the code. | | |
| Literature: | None | | |
| Types of Teaching: | S1 (WS): By the end of the second semester, the students decide on which numerical tool they want to work. Accordingly, one of the threee above lectureres (MD, FEM, DEM) is the supervisor and examiner of the project. Then, the students make a concept for their project, which has to be discussed and approved by the responsible lecturer. After approval, the students register at examination office for the project. The final report has to be delivered after 22 weeks, usually in the third semester. / project (22 Wo) | | |
| Pre-requisites: | **Recommendations:**<br>None | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>AP: Programm (source code, documentation, analysis of an example solved with their numerical tool)<br>AP: Presentation and defending of the project [20 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>AP: Programm (Quellcode, Dokumentation, Analyse eines mit ihrem numerischen Tool gelösten Beispiels)<br>AP: Präsentation und Verteidigung des Projekts [20 min] | | |
| Credit Points: | 7 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>AP: Programm (source code, documentation, analysis of an example solved with their numerical tool) [w: 4]<br>AP: Presentation and defending of the project [w: 1] | | |
| Workload: | The workload is 210h. | | |

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| Data: | PLAS. MA. Nr. 3216 / Examination number: - | Version: 12.07.2016 | Start Year: WiSe 2016 |
| Module Name: | **Plasticity** | | |
| (English): | | | |
| Responsible: | Budnitzki, Michael / Dr.-Ing. | | |
| Lecturer(s): | Budnitzki, Michael / Dr.-Ing. | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students will get familiar with an advanced treatment of nonlinear constitutive laws for solids from the viewpoint of thermomechanics. Particular emphasis is placed on the formulation of rate independent inelasticity. | | |
| Contents: | **Most important ingredients:**<br>• thermomechanics of solids:<br>◦ thermostatics, thermodynamics with internal variables<br>◦ thermoelasticity<br>• small-strain elastoplasticity:<br>◦ principle of maximum dissipation, stability, particular cases of elastoplastic media<br>◦ plastic flow from the point of view of convex analysis<br>• elastoplasticity at finite deformations:<br>◦ kinematics, thermodynamics, principles of material theory | | |
| Literature: | J. Lubliner: Plasticity Theory<br>G. A. Maugin: The Thermomechanics of Plasticity and Fracture<br>W. Han and B. D. Reddy: Plasticity<br>H. Ziegler: An Introduction to Thermomechanics<br>P. Haupt: Continuum Mechanics and Theory of Materials<br>Ottosen and Ristinmaa: ”The Mechanics of Constitutive Modeling”<br>J. Lemaitre and J.-L. Chaboche: “Mechanics of Solid Materials” | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Exercises (1 SWS) | | |
| Pre-requisites: | **Mandatory:**<br>Continuum Mechanics, 2016-07-11<br>or equivalent | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>KA: Closed book written examination (120 min). [120 to 120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA: Schriftliche Prüfung über 120 min. [120 bis 120 min] | | |
| Credit Points: | 4 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA: Closed book written examination (120 min). [w: 1] | | |
| Workload: | The workload is 120h. It is the result of 45h attendance and 75h self-studies. | | |

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| Data: | ResSem. MA. Nr. 3217 / Examination number: - | Version: 11.07.2016 | Start Year: WiSe 2016 |
| Module Name: | **Research Seminar and Journal Club** | | |
| (English): | | | |
| Responsible: | Kuna, Meinhard / Prof. Dr. rer. nat. habil.<br>Mikromechanik / Prof. | | |
| Lecturer(s): | Mikromechanik / Prof. | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 3 Semester(s) | | |
| Competencies: | The student will attend monthly research seminars. | | |
| Contents: | Most important ingredients are:<br>• Attending the seminar, where research results of CMS students are presented<br>• Interacting / discussion with the speakers<br>• 1. semester: Literature review on a general seminar topic<br>• 2. semester: Literature review on an individual topic<br>• written literature report and oral presentation | | |
| Literature: | None | | |
| Types of Teaching: | S1 (WS): Seminar (1 SWS)<br>S2 (SS): Seminar (1 SWS)<br>S3 (WS): Seminar (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>None | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>AP: Literatur report | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>AP: Literaturbericht | | |
| Credit Points: | 3 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>AP: Literatur report [w: 1] | | |
| Workload: | The workload is 90h. It is the result of 45h attendance and 45h self-studies. | | |

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| Data: | STSSP. MA. Nr. 3218 / Examination number: - | Version: 13.07.2016 | Start Year: SoSe 2012 |
| Module Name: | **Selected Topics of Solid State Physics** | | |
| (English): | | | |
| Responsible: | Rafaja, David / Prof. Dr. rer. nat. habil. | | |
| Lecturer(s): | Rafaja, David / Prof. Dr. rer. nat. habil. | | |
| Institute(s): | Institute of Materials Science | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Basic principles of solid state physics, correlation between the crystal structure, real structure and the electronic, magnetic, optical and thermal properties of solids. Absolving the course, the students should be able to recognise the effect of the structure on materials properties and to apply their knowledge in materials design | | |
| Contents: | Drude model of electrical conductivity; temperature dependence of electrical resistivity in metals and semiconductors; Schottky contact; p-n contact; superconductivity (Landau theory); magnetic susceptibility; dia-, para-, ferro-, antiferro- and ferrimagnetism; optical properties of solids; complex index of refraction; dispersion curves for systems with free and bound electrons; Kramers-Kronig relationship; colour of metals; optical theory of reflection for multilayer systems; thermal expansion; specific heat (Einstein and Debye models); heat conductivity | | |
| Literature: | R.E. Hummel: Electronic properties of materials<br>C. Kittel: Introduction in solid state physics | | |
| Types of Teaching: | S1 (SS): Lectures (3 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Höhere Mathematik für Ingenieure 1, 2015-03-12<br>Höhere Mathematik für Ingenieure 2, 2015-03-12<br>Allgemeine, Anorganische und Organische Chemie, 2009-09-02<br>Einführung in die Kristallographie, 2009-10-14<br>Physik für Naturwissenschaftler I, 2012-05-10<br>Physik für Naturwissenschaftler II, 2012-05-10<br>Fundamental of Microstructures, 2015-10-05 | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA (KA bei 10 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min] | | |
| Credit Points: | 4 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA [w: 1] | | |
| Workload: | The workload is 120h. It is the result of 45h attendance and 75h self-studies. | | |

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| Data: | STFEM. MA. Nr. 3219 / Examination number: - | Version: 02.12.2010 | Start Year: SoSe 2012 |
| Module Name: | **Selected Topics of the Finite Element Method** | | |
| (English): | | | |
| Responsible: | Mühlich, Uwe / Dr. | | |
| Lecturer(s): | Mühlich, Uwe / Dr. | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | Students will get familiar with the theoretical fundamentals of the FEM related to geometrically and physically nonlinear problems. They should be able to program Finite-Element-solutions for simple physically nonlinear applications. Based on the knowledge provided by the module, students should be able to select appropriate Finite-Element-tools for specific problems and to evaluate the numerical results properly. | | |
| Contents: | Most important ingredients are:<br>• Weak form of the equilibrium conditions<br>• FEM for physically nonlinear problems<br>• Coupled problems with FEM<br>• FEM for linear dynamic problems<br><br>Programming of FEM-solutions with MATLB and optional:<br>FEM for large deformations and specific structural elements. | | |
| Literature: | Wriggers: Nichtlineare Finite-Element-Methoden, Springer 2001<br>Bonet, Wood: Nonlinear continuum mechanics for finite element analysis | | |
| Types of Teaching: | S1 (SS): Lectures (2 SWS)<br>S1 (SS): Exercises (1 SWS)<br>S1 (SS): Practical Application (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Einführung in die Methode der finiten Elemente, 2010-08-17<br>Numerische Methoden der Mechanik, 2013-06-27<br>Basic knowledge in theoretical mechanics | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP [35 to 50 min]<br>PVL: successful preparation of a FEM solution with MATLAB<br>PVL have to be satisfied before the examination. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP [35 bis 50 min]<br>PVL: Erfolgreiche Vorbereitung einer FEM Lösung mit MATLAB<br>PVL müssen vor Prüfungsantritt erfüllt sein bzw. nachgewiesen werden. | | |
| Credit Points: | 6 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP [w: 1] | | |
| Workload: | The workload is 180h. It is the result of 60h attendance and 120h self-studies. The amount of time needed for the preparation and reworking of lectures and exercises is rather large due to the complexity of the topics treated within this course and because of the programming exercises involved. | | |

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| Data: | MD. MA. Nr. 3220 / Examination number: - | Version: 11.07.2016 | Start Year: SoSe 2017 |
| Module Name: | **Selected Topics of the Molecular Dynamics Method** | | |
| (English): | | | |
| Responsible: | Kuna, Meinhard / Prof. Dr. rer. nat. habil.<br>Mikromechanik / Prof. | | |
| Lecturer(s): | Mikromechanik / Prof. | | |
| Institute(s): | Institute of Mechanics and Fluid Dynamics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The student will get familiar with the Molecular Dynamics modeling tool and interatomic potential (EAM, MEAM). By the end of the semester, they will be able to implement new functionality in existing MD codes and to develop interatomic potentials for diverse elements. | | |
| Contents: | Most important ingredients are: Newton's equation of motion, numerical integrator (Verlet, leap-frog), order of accuracy of the integrator, conservation laws of Hamiltonian systems, Interatomic interactions, Energy minimization (conjugate gradient, steepest descent method), Periodic boundary conditions, microcanonical ensemble, constant pressure method, Parrinello-Rahman's method, Nose-Hoover thermostat and others. | | |
| Literature: | Computer simulations of dislocations (Oxford Series on Materials Modelling): Bulatov and Cai | | |
| Types of Teaching: | S1 (SS): Lectures (2 SWS)<br>S1 (SS): Exercises (1 SWS)<br>S1 (SS): Practical Application (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Fundamental of Microstructures, 2010-12-02<br>Knowledge in the fields of metals; Introduction to Scientific Programming and Fundamental of Microstructures, Quantum Mechanics | | |
| Frequency: | yearly in the summer semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP/KA* (KA if 5 students or more) [MP minimum 30 min / KA 120 min]<br>AP*: Programming project<br><br>* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively. | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA* (KA bei 5 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min]<br>AP*: Programmierprojekt<br><br>* Bei Modulen mit mehreren Prüfungsleistungen muss diese Prüfungsleistung bestanden bzw. mit mindestens "ausreichend" (4,0) bewertet sein. | | |
| Credit Points: | 6 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA* [w: 1]<br>AP*: Programming project [w: 1]<br><br>* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively. | | |
| Workload: | The workload is 180h. It is the result of 60h attendance and 120h self- | | |

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| | studies. |

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| Data: | SEMIC. MA. Nr. 3213 / Examination number: - | Version: 20.07.2016 | Start Year: WiSe 2016 |
| Module Name: | **Semiconductors** | | |
| (English): | | | |
| Responsible: | Meyer, Dirk / Prof. Dr. rer. nat. | | |
| Lecturer(s): | Stöcker, Hartmut / Dr. | | |
| Institute(s): | Institute of Experimental Physics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The module conveys basic knowledge on the principles of semiconductor materials and devices based on their crystallographic and electronic structures. Students will get familiar with the electronic properties of semiconductors and should be able to calculate charge carrier concentrations and to describe and understand semiconductor devices based on energy band schemes. | | |
| Contents: | The lecture is divided in four consecutive parts:<br>• Structure of solids: crystal structure in general, examples of element structures and compound structures.<br>• Electrons in matter: energy bands, zone schemes, Brillouin zones, band structures, Fermi distribution, density of states, population density, effective mass, conductivity.<br>• Semiconductors: intrinsic vs. extrinsic semiconductors, band schemes, conductivity, possible defects.<br>• Semiconductor devices: metal-semiconductor contact, p-n junction, diodes, transistors, memory devices, device fabrication. | | |
| Literature: | Standard references on solid state physics and semiconductors for physicists, e.g.:<br>• R. E. Hummel: Electronic Properties of Materials (Springer)<br>• N. W. Ashcroft, N. D. Mermin: Solid State Physics (Brooks Cole)<br>• S. M. Sze: Physics of Semiconductor Devices (Wiley) | | |
| Types of Teaching: | S1 (WS): Semiconductors / Lectures (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Fundamentals of physics, chemistry and solid materials | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>KA: Semiconductors [90 to 120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>KA: Semiconductors [90 bis 120 min] | | |
| Credit Points: | 3 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>KA: Semiconductors [w: 1] | | |
| Workload: | The workload is 90h. It is the result of 30h attendance and 60h self-studies. | | |

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| Data: | STOMATE. MA. Nr. 3221 / Examination number: - | Version: 05.07.2016 | Start Year: WiSe 2016 |
| Module Name: | **Stochastic Methods for Materials Science** | | |
| (English): | | | |
| Responsible: | van den Boogaart, Gerald / Prof. Dr.<br>Ballani, Felix / Dr. rer. nat. | | |
| Lecturer(s): | van den Boogaart, Gerald / Prof. Dr.<br>Ballani, Felix / Dr. rer. nat. | | |
| Institute(s): | Institute of Stochastics | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The student will understand the role of stochastic modelling and stochastic algorithms for computational material sciences. He/she will learn to select, implement and test stochastic algorithms and models in an applied context. | | |
| Contents: | The lecture introduces examples of stochastic methods of material modeling, analysis and simulations: e.g. models and algorithms for the simulation of random structures (random mosaics, random composites, packing, ...) and random behavior (crack initiation, random loads, random fatigue, ...), statistical and stereological analysis of structural data and EBSD-crystal orientation measurements, Monte-Carle algorithms for material simulation, Markov-Chain-Monte-Carlo/Metropolis-Hastings algorithms for parameter estimation and structure reconstruction. | | |
| Literature: | e.g. Chiu, Stoyan, Kendall, Mecke: Stochastic geometry and its applications, 3rd ed. Wiley, Chichester, 2013 | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Basic knowledge of stochastic, statistic, geometry, continuum mechanics, computer programming, and either crystallography or basic group theory. | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP [30 min]<br>AP: Programming Project | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP [30 min]<br>AP: Programmierprojekt | | |
| Credit Points: | 4 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP [w: 1]<br>AP: Programming Project [w: 1] | | |
| Workload: | The workload is 120h. It is the result of 30h attendance and 90h self-studies. | | |

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| Data: | TM. MA. Nr. 3222 / Examination number: - | Version: 30.06.2016 | Start Year: WiSe 2016 |
| Module Name: | **Thermodynamics of Materials** | | |
| (English): | | | |
| Responsible: | Leineweber, Andreas / Prof. Dr. rer. nat. habil. | | |
| Lecturer(s): | Fabrichnaya, Olga / Dr. | | |
| Institute(s): | Institute of Materials Science | | |
| Duration: | 1 Semester(s) | | |
| Competencies: | The students understand thermodynamic properties of materials and are able to apply to calculation methods of phase diagrams. | | |
| Contents: | Most important topics are:<br>Thermodynamic laws and quantities<br>Thermodynamic properties of materials<br>Calculation of complex equilibria in multiphase and multicomponent systems<br>Optimization of phase diagrams | | |
| Literature: | Mats Hillert, “Phase equilibria, phase diagrams and phase transformations”, 2nd Ed., Cambridge (2009)<br>Robert de Hoff, “Thermodynamics in Materials Science", 2nd Ed., Taylor & Francis (2006)<br>Hans Leo Lukas, Suzana Fries, Bo Sundman, “Computational Thermodynamics, the CALPHAD method”, Cambridge (2007) | | |
| Types of Teaching: | S1 (WS): Lectures (2 SWS)<br>S1 (WS): Practical Application (1 SWS) | | |
| Pre-requisites: | **Recommendations:**<br>Background in physical chemistry and materials science | | |
| Frequency: | yearly in the winter semester | | |
| Requirements for Credit Points: | For the award of credit points it is necessary to pass the module exam.<br>The module exam contains:<br>MP/KA (KA if 6 students or more) [MP minimum 30 min / KA 120 min] | | |
| | Voraussetzung für die Vergabe von Leistungspunkten ist das Bestehen der Modulprüfung. Die Modulprüfung umfasst:<br>MP/KA (KA bei 6 und mehr Teilnehmern) [MP mindestens 30 min / KA 120 min] | | |
| Credit Points: | 3 | | |
| Grade: | The Grade is generated from the examination result(s) with the following weights (w):<br>MP/KA [w: 1] | | |
| Workload: | The workload is 90h. It is the result of 45h attendance and 45h self-studies. | | |

Freiberg, den 4. Oktober 2016

gez. i. V. Prof. Dr. Broder Merkel

Prof. Dr. Klaus-Dieter Barbknecht
Rektor

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