	HTWK Leipzig, Leipzig University of Applied Sciences			
	Module Course code	**Nonlinear Optimization** **nOp** (AMB8020)		
	Semester	**Summer semester**		
	ECTS, level	**5 points, Bachelor's in Math. / Master's in Engineering**		
	Language of instruction	**English**		
	Teaching staff	**Prof. Dr. rer. nat. habil. Jochen Merker**		
Prerequisites	Basics of mathematics			
Learning outcomes	The students know the basics of nonlinear optimization, particularly they know methods how to find minimizers of nonlinear functions with finitely many variables in the unrestricted and restricted case. Using this knowledge, they are able to solve applications from engineering and management like e.g. parameter estimation and optimal control problems. The students have developed a working knowledge of nonlinear optimization, i.e., they have developed the skills and background needed to recognize, formulate, and solve specific classes of nonlinear optimization problems which occur in applications.			
Course contents	- Introduction (Examples, Problem classes, Convexity) - Least Squares - Unrestricted optimization - Optimization with linear or convex restrictions			
Workload	150 hours, of which 56 hours attendance (14 weeks x 4 hours)			
Pre-examination requirements	Exercises			
Mode of instruction and assessment	**Lecture**	**Seminar**	**Laboratory Course**	**Assessment**
	2 hours per week	2 hours per week		Oral examination
Recommended reading	BOYD, Stephen; VANDENBERGHE, Lieven: *Convex Optimization*, Cambridge University Press BECK, Amir: *Introduction to Nonlinear Optimization*, SIAM BORWEIN, Jonathan M.; LEWIS, Adrian S.: *Convex Analysis and Nonlinear Optimization*, Springer			

	HTWK Leipzig, Leipzig University of Applied Sciences			
	Module Course code	**Applied Physics** **aPh** (DVM1400)		
	Semester	**Summer semester**		
	ECTS, level	**5 points, Master's (graduate)**		
	Language of instruction	**English**		
	Teaching staff	**Prof. Dr. rer. nat. habil. Christian Weickhardt**		
Prerequisites	Basics of physics			
Learning outcomes	The students have engineering knowledge of the mechanics of gases, liquids and multiphase systems. The students are able to apply the skills they have acquired to real-life problems in the industry. The students have knowledge of modern laser based technologies and their physical principles including applications in measuring and information technology derived from them. They are able to identify potential applications in the industry and to assess their application potentials from a technical point of view.			
Course contents	**Mechanics and thermodynamics of fluids:** Statics of fluids: characteristics of the fluid state, pressure, buoyancy, surface tension, capillarity, vapour pressure, multi-component systems Flowing fluids: kinematics, current filament theory of incompressible fluids, conservation laws, flow from vessels, flow in tubes, forces acting on solid objects, theory of similitude **Technical optics:** Optical calculation methods (matrix methods, ray tracing), laser technology, optical measuring techniques			
Workload	150 hours, of which 56 hours attendance (14 weeks x 4 hours)			
Pre-examination requirements	Exercises			
Mode of instruction and assessment	**Lecture**	**Seminar**	**Laboratory Course**	**Assessment**
	2 hours per week	2 hours per week		Written examination
Recommended reading	BÖCKH, Peter von: *Fluidmechanik*, Springer BÖSWIRTH, Leopold: *Technische Strömungslehre*, Vieweg Fachbücher der Technik SCHADE, Heinz; KUNZ, Ewald; PASCHEREIT, Oliver; KRAMEIER, Frank: *Strömungslehre*, de Gruyter LITFIN, Gerd: *Technische Optik in der Praxis*, Springer			

	HTWK Leipzig, Leipzig University of Applied Sciences	
	Module Course code	**Design of Experiments** **DoE** (DVM1300)
	Semester	**Summer semester**
	ECTS, level	**5 points, Master's (graduate)**
	Language of instruction	**English**
	Teaching staff	**Prof. Dr. rer. nat. Frank Roch**
Prerequisites	Basics of mathematical statistics	
Learning outcomes	The aim is to develop understanding of both the foundations and the application of the principles used in the discipline of Design of Experiments (DoE) in order to independently solve research and development problems. The students develop skills in the planning and evaluation of complex test series. Design of Experiments is used for investigating systems and processes in which the variables are simultaneously dependent on several factors which are usually also interdependent. The students develop the ability to apply DoE methods for the optimisation of processes, in order to enhance product quality both in the laboratory and in the production plant as part of quality control.	
Course contents	- Principles and terms: independent variables and factors, factor levels and factor level combinations, disturbance variables, dependent variables, effects - Possibilities and limitations, costs and benefits of DoE - Definition and analysis of problems, development of models, comparison of normal and statistical experimental designs - Fully factorial experimental designs of the first and second order: selection of level combinations, coordinate transformation, calculation of effects, significance analysis of effects, employment of regression polynomials - Reduced (fractional) experimental designs, mixing of effects - Variation and regression analysis - Application of statistical software, examples of the application of DoE	
Workload	150 hours, of which 56 hours attendance (14 weeks x 4 hours)	
Pre-examination requirements	Successful participation in the practicals (Laboratory Course)	

Mode of instruction and assessment	Lecture	Seminar	Laboratory Course	Assessment
	2 hours per week	1 hour per week	1 hour per week	Written examination

Recommended reading	BOX, George E. P.; HUNTER, J. Stuart; HUNTER, William G.: *Statistics for Experimenters,* John Wiley & Sons, Hoboken / New Jersey KLEPPMANN, W.: *Taschenbuch Versuchsplanung,* Hanser, München/Wien MONTGOMERY, Dougles C.: *Design and Analysis of Experiments*, John Wiley & Sons., Hoboken / New Jersey MASON, Robert L.; GUNST, Richard F.; HESS, James L.: *Statistical Design and Analysis of Experiments - With Applications to Engineering and Science,* John Wiley & Sons, Hoboken / New Jersey

	HTWK Leipzig, Leipzig University of Applied Sciences			
	Module Course code	**Cooperative Design Project** **cDP** (MBB4090)		
	Semester	**Summer semester**		
	ECTS, level	**5 points, Bachelor's (undergraduate)**		
	Language of instruction	**English**		
	Teaching staff	**Prof. Dr.-Ing. Johannes Zentner**		
Prerequisites	Basics of mechanical engineering, 3D-CAD			
Learning outcomes	Knowledge in - Management of developing projects in mechanical engineering - Design methodology in mechanical engineering - Cooperative techniques Capabilities in - Design of products - Using of project management methods - Using of design methods			
Course contents	Basics of management of developing projects in mechanical engineering - Project specification - Project planning - Project scheduling - Project control Basics of design methodology in mechanical engineering - Problem specification - Generation of conceptual solutions for the problem - Evaluation and selection of favourite solution - Generation of CAD model			
Workload	150 hours, of which 42 hours attendance (14 weeks x 3 hours)			
Pre-examination requirements	None			
Mode of instruction and assessment	**Lecture**	**Seminar**	**Laboratory Course**	**Assessment**
	1 hour per week	1 hour per week	1 hour per week	Cooperative homework
Recommended reading	TOOLEY, M.: *Design Engineering Manual,* Elsevier, Amsterdam et al., 2010 PAHL, G.; BEITZ, W. FELDHUSEN, J.; GROTE, K.-H.: *Design Engineering, A Systematic Approach*. 3rd Edition, Springer, Berlin et al., 2007 ULLMAN, DAVID G.: *The Mechanical Design Process*. 5th Edition. McGraw-Hill, New York, 2015 CROSS, NIGEL: *Engineering Design Methods. Strategies for Product Design*. Wiley, 2008 SCHMIDT, TERRY: *Strategic Project Management. Practical Tools for Leaders and Teams*. Wiley, 2009 Software Microsoft Project Electronic handbooks and scripts			

	HTWK Leipzig, Leipzig University of Applied Sciences	
	Module Course code	**Photovoltaics** **PhV** (EIM7801)
	Semester	**Summer semester**
	ECTS, level	**5 points, Master's (graduate)**
	Language of instruction	**English**
	Teaching staff	**Prof. Dr.-Ing. Frank Illing**
Prerequisites	Basics of power engineering / power management	
Learning outcomes	**Goals:** Mediation of deeper and advanced expertise in electrical engineering in particular theoretical and linguistic knowledge in photovoltaics. **Specialist and methodological skills:** - skills to design, assess and operate complex technical systems - work-related and specialised communication in a foreign language - knowledge of natural prerequisites of using solar energy - knowledge of the conversion of solar energy into electrical energy by using solar cells - application of the knowledge for the design and sizing of PV-systems - learning of the required technical terms - improvement of language skills e.g. listening comprehension and free speaking **Involvement in the vocational preparation:** The lecture lays the essential foundations in the field of photovoltaics and facilitates an overseas stay due to the learning and applying of discipline-specific terms.	
Course contents	- Introduction to Photovoltaics - The "power plant" sun – unlimited energy - Photovoltaic effect - Solar cells and PV-modules - Grid-tied photovoltaic systems - Stand-alone PV-systems - Potentials, economic viability and prospects of Photovoltaics	
Workload	150 hours, of which 28 hours attendance (14 weeks x 2 hours)	
Pre-examination requirements	Homework	

Mode of instruction and assessment	Lecture	Seminar	Laboratory Course	Assessment
	2 hours per week			Written examination

Recommended reading	Falk ANTHONY; Christian DÜRSCHER; Karl Heinz REMMERS: *Photovoltaics for Professionals*, Solarpraxis, Berlin 2006 Heinrich HÄBERLIN; *Photovoltaics – System Design and Practice*; John Wiley & Sons Ltd., 2012

	HTWK Leipzig, Leipzig University of Applied Sciences			
	Module Course code	**Structural Mechanics** **sMe** (BIM 4221/4222)		
	Semester	**Summer semester**		
	ECTS, level	**5 points, Master's (graduate)**		
	Language of instruction	**English**		
	Teaching staff	**Prof. Dr.-Ing. Volker Slowik**		
Prerequisites	Basics of structural analysis			
Learning outcomes	The students have advanced knowledge of shell structures and energy methods in structural engineering and are able to apply technical terminology correctly in the English language. This improves their technical and linguistic abilities to follow a degree programme in an English-speaking country. The course on Energy Methods covers energy-based concepts of structural analysis like virtual work principles and variational methods. In the course on Shell Structures, both the membrane theory and the bending theory are utilised for determining internal forces in thin-walled shells.			
Course contents	**Energy Methods** - Real and virtual work - Virtual strain energy - Principle of virtual displacements - Principle of virtual forces - Energy theorems - Variational methods - Weighted residual methods - Virtual work principles in matrix structural analysis **Shell Structures** - Introduction to thin-walled shells - Membrane theory of shells of revolution - Membrane theory of shells of translation - Selected solutions of membrane theory for general shells - Bending theory of axi-symmetric shells			
Workload	150 hours, of which 56 hours attendance (14 weeks x 4 hours)			
Pre-examination requirements	None			
Mode of instruction and assessment	**Lecture**	**Seminar**	**Laboratory Course**	**Assessment**
	4 hours per week			Written examination
Recommended reading	J. N. REDDY: *Energy Principles and Variational Methods in Applied Mechanics*, John Wiley & Sons, 2002 W. MCGUIRE; R. H. GALLAGHER; R.D. ZIEMIAN: *Matrix Structural Analysis,* John Wiley & Sons, 1999 A. ZINGOSI: *Shell Structures in Civil and Mechanical Engineering,* Thomas Telford, London 1997 C.R. CALLADINE: *Theory of Shell Structures,* Cambridge University Press, 2007			

	HTWK Leipzig, Leipzig University of Applied Sciences	
	Module Course code	**Industrial Printing and Processing** **iPP** (FM/iP3)
	Semester	**Summer semester**
	ECTS, level	**5 points, Bachelor's/Master's (under-/graduate)**
	Language of instruction	**English**
	Teaching staff	**Prof. Dr.-Ing. Jörg Ackermann** **Prof. Dr. rer. nat. Lutz Engisch** **Prof. Dr.-Ing. Inés Heinze** **Prof. Dr.-Ing. Ulrike Herzau-Gerhardt** **Prof. Dr.-Ing. Michael Reiche** **Prof. Dr. rer. nat. habil. Holger Zellmer**
Prerequisites	Basics of general engineering	
Learning outcomes	The students know the fluid transfer principles of the four main groups of printing processes (gravure, relief, flat-bed, screen) as well as digital printing. The students are well-grounded in the functionality of the basic units of printing presses. The lessons provide knowledge about the different materials for printing applications. In addition to printing inks and fibre based materials, plastics are also presented. Both the classical material characterisation as well as the different possibilities of interaction of material and ink are presented. The students will have acquired basic knowledge in prepress technologies, like digitalisation, desktop publishing, digital image processing, production workflows in prepress and single source - multiple channel publishing. They know technical terminology in prepress and the common application for desktop publishing and image processing. The students know the definition of printed functionality and have the theoretical background of the applied materials for functional printing fluids and substrates. They have an overview of the applications of printed functionality. The students will have acquired an overview of refining and refining methods are used in graphical and packaging industry. They know some methods (technological principle, influencing facts, samples of use) in detail. The students will have acquired basic knowledge about factory planning and additional about factory management. They are able to solve typical practical tasks and to make calculations using specific methods and tools.	
Course contents	See next page	

Course contents	**Printing Processes** - Basic units of sheet-fed and web printing presses - Specialities of printing presses (e. g. applied for tubes, bottles, cups) - Basic principles of fluid transfer in printing presses (theoretical abstract and practical demonstration) **Materials** - Cardboard and corrugated board - Polymeric substances - Printing ink - Interaction of printing substrates - Hands-on-lesson: Material tests **Prepress Technologies** - Terminology in prepress stage - Common technical environment and applications for desktop publishing as well as image editing - Principles and technologies for single source - multiple channel publishing **Printed Functionality** - Definition of printed functionality with respect to the surplus value, additional use and/or information of a printed product - Sensors and indicators for heat, ultraviolet radiation and biological decay processes - Applications of printable conducting materials, printed electronics, electro-optical and light emitting systems **Refining** - Definition, classification and general information (functions, effects and application fields of refining) - Introduction of refining principles - Practical work to amplify special methods by showing the technique and discussing influencing facts. **Factory Planning and Management** - Purpose and goals, system description, methodology, planning cases and procedures - Modelling of factory systems as well as planning workflow including different planning steps and methods - Practical exercise: Deal with typical planning tasks and their solutions - Workshop Hybrid Factory Planning: How to realise a small planning project using digital and physical models			
Workload	150 hours, of which 60 hours attendance (30 teaching units á 90 min.)			
Pre-examination requirements	Successful participation in the practicals (Laboratory Course)			
Mode of instruction and assessment	**Lecture**	**Seminar**	**Laboratory Course**	**Assessment**
	24 hours	12 hours	24 hours	Poster presentation
Recommended reading	KIPPHAN, Helmut (Ed.): Handbook of Print Media – Technologies and Production Methods, Springer-Verlag Berlin Heidelberg Electronic handbooks and scripts			