

PROGRAM KERJASAMA UKM - UDE
Sarjanamuda Kejuruteraan Dengan Keupujian (Kejuruteraan Mekanikal), UKM
dan Bachelor of Science Mechanical Engineering, UDE

1. Pengenalan

Program Kerjasama adalah merupakan salah satu cadangan ekoran dari Memorandum Persefahaman yang telah ditandatangani antara UKM dan University of Duisburg-Essen (UDE) pada 25 September 2002. Cadangan mengwujudkan Program Kerjasama adalah usaha untuk mengantarabangsakan Fakulti Kejuruteraan dan UKM selaras dengan (i) strategi ke-lima dalam Pelan Strategik UKM 2000-2020, dan (ii) objektif ke-lapan pendidikan tinggi negara, iaitu, mengantarabangsakan program pengajian. Di samping itu, pelajar UKM dapat diberi pendedahan antarabangsa yang boleh menyediakan satu ruang untuk pelajar menghadapi cabaran globalisasi.

2. Tujuan

Kertas ini bertujuan untuk memohon kelulusan berikut:

- i. Melaksanakan program kerjasama untuk mendapatkan Ijazah Sarjanamuda Kejuruteraan Dengan Keupujian (Kejuruteraan Mekanikal), UKM dan Ijazah *Bachelor of Science Mechanical Engineering, UDE*.
- ii. Memberi pemindahan kredit bagi pelajar UKM yang akan mengikuti Program *Bachelor of Science Mechanical Engineering, UDE* dan juga bagi pelajar UDE yang akan mengikuti Program Sarjanamuda Kejuruteraan Dengan Keupujian (Kejuruteraan Mekanikal), UKM.
- iii. Memberi pengiktirafan terhadap kursus-kursus yang telah diambil selama dua tahun di UDE bagi pelajar UDE yang akan mengikuti Program Sarjanamuda Kejuruteraan Dengan Keupujian (Kejuruteraan Mekanikal), UKM.

3. Program Kerjasama Untuk Pelajar dari UKM ke UDE Mengikuti Program *Bachelor of Science Mechanical Engineering (UDE)*.

Butiran mengenai program (3+1) ini adalah seperti berikut:

- i. *Pelajar yang terlibat:*

Pelajar yang mengikuti program Sarjanamuda Kejuruteraan Dengan Keupujian (Kejuruteraan Mekanikal) yang akan memasuki pengajian tahun akhir (tahun 4). Pemilihan pelajar akan dibuat oleh fakulti berdasarkan prestasi yang baik dalam akademik dan ko-kurikulum.

- ii. *Bilangan pelajar yang terlibat:*

Bilangan pelajar yang akan mengikuti Program ini dihadkan sekitar 10 orang.

- iii. *Tempoh program:*

18 bulan.

iv. *Jadual pelaksanaan:*

Fakulti bercadang untuk memulakan program ini sepenuhnya pada sesi 2004/2005. Jadual program (3+1) UKM-UDE dan senarai kursus yang perlu diambil di UDE pada tahun akhir adalah seperti berikut:

1	Tahun 1 di UKM		
2			
3	Tahun 2 di UKM		
4			
5	Tahun 3 di UKM (termasuk 120 jam Bahasa Jerman)		
6			
Sampai UDE akhir Mac 1 April - 21 April: Bahasa Jerman (tambahan 120 jam)			
(Summer Semester : 20 April - 20 Julai)	<i>Modelling & Simulation</i> atau <i>Computational Fluid Dynamics</i>	<i>Material Flow & Logistics</i> atau <i>Waste Treatment</i> <i>Fluid Machines</i> atau <i>Machine Tools</i>	<i>German Language Class I</i>
	<i>Control Technique</i>	<i>Production Management</i>	<i>CAD/CAE</i>
20 Julai - 15 Okt	Peperiksaan		
Winter Semester 15 Okt.- 15 Feb	<i>Energy Engineering</i> atau <i>Mechatronics</i>	<i>2 Electives</i> atau <i>Design Project</i>	<i>German Language Class II or Living and Studying in a multicultural Community</i>
	<i>Product Engineering</i> Atau <i>Process Engineering</i>		
15 Feb - 15 Apr	Peperiksaan		
15 April - 15 Julai	Latihan Industri		
15 Julai - 30 Sept	<i>Bachelor Thesis (Projek)</i>		

Kursus-kursus yang akan diikuti di UDE adalah sebahagian kursus-kursus yang ditawarkan pada tahun akhir dalam program *Bachelor Science Mechanical Engineering* di UDE.

4. Pemindahan Kredit

Dalam merancang program kerjasama ini, untuk membenarkan pelajar UKM memperolehi ijazah Sarjanamuda Kejuruteraan Dengan Kepujian (Kejuruteraan Mekanikal), fakulti bercadang untuk memberikan pemindahan kredit sebanyak 27 kredit terhadap kursus-kursus berikut:

UKM	UDE
Kursus Bukan Teknikal	
<p><u>6 Kredit:</u></p> <p>KF4113 Pengurusan Kejuruteraan I KF4123 Pengurusan Kejuruteraan II</p>	<p><u>2 Kursus:</u> (Dipilih dari senarai berikut):</p> <p>i. German Language Class I ii. German Language Class II atau iii. Living & Studying in a Multicultural Community</p>
Projek Tahun Akhir	
<p><u>6 kredit:</u></p> <p>KJ4013 Projek Ilmiah I KJ4023 Projek Ilmiah II</p>	<p>Bachelor Thesis</p>
Kursus Teknikal	
<p><u>15 Kredit</u> (5 kursus yang dipilih dari senarai berikut):</p> <p>KJ4353 Mechanical Vibrations KJ4953 Design Project KJ4113 Combustion and Thermal Systems KJ4123 Utilisation of Natural Gas KJ4133 Efficient Use and Management of Energy KJ4143 Air Condition and Refrigeration KJ4153 Solar Energy and Technology KJ4163 Computational Fluid Dynamics KJ4173 Design Of Thermal- Fluid System KJ4183 Energy Conversion System KJ4303 No Destructive Testing KJ4313 Basic Theory Of Elasticity KJ4323 Advanced Control Engineering KJ4333 Basic Continuum Mechanics KJ4343 Acoustics KJ4363 Finite Element Method KJ4373 Automotive Engineering KJ4383 Robotics KJ4393 Advanced Applied Mechanics KJ4513 Polymer Processing KJ4523 Corrosion & Corrosion Technology KJ4533 Material Conservation KJ4543 Tribology KJ4553 Mechanic Of Polymer And Composite Materials KJ4563 Metal Forming Theory KJ4573 Processing Of Ceramics</p>	<p><u>5 Kursus</u> (Dipilih dari senarai berikut):</p> <p>i. Control Technique ii. Production Management iii. CAD/CAE iv. Modelling & Simulation or Computational Fluid Dynamics v. Material Flow & Logistics or Waste Treatment vi. Fluids Machines or Machine Tools vii. Energy Engineering or Mechatronics viii. Product Engineering or Process Engineering ix. Design Project or 2 Electives</p>

5. Program Kerjasama Untuk Pelajar dari UDE Mengikuti Program Sarjanamuda Kejuruteraan Dengan Kepujian (Kejuruteraan Mekanikal)

Butiran mengenai program ini adalah seperti berikut:

- i. Pelajar yang mengikuti program *Bachelor of Science Mechanical Engineering* di UDE akan memasuki tahun akhir di UKM.
- ii. *Bilangan pelajar yang terlibat:*
Maksima bilangan pelajar yang akan mengikuti program ini dihadkan sekitar 10 orang.
- iii. *Tempoh program:*
12 bulan.
- iv. *Jadual pelaksanaan:*

1	Tahun 1 di UDE		
2			
3	Tahun 2 di UDE		
4			
Tiba di Bangi pada Akhir bulan September Oktober - Bahasa Malaysia (4-5 minggu)			
Sem 2: (22 Nov. - 5 Mac)	<i>Control Engineering</i> KJ3343	<i>Systems Design</i> KJ3943	<i>Project I</i> (3 kredit)
	<i>Engineering Management 2</i> KF4123	Bahasa Melayu I ZM1013	(3 kursus pilihan)
7-26 Mac	Peperiksaan		
28 Mac - 4 Jun	Latihan Industri (10 minggu) - (5 kredit)		
Sem 1: (11 Julai - 22 Okt.)	<i>Engineering Management 1</i> KF4113	<i>Machine Component Design</i> KJ3933	<i>Project II</i> (3 kredit)
		Bahasa Melayu II ZM1023	
	<i>Dynamic Systems</i> KJ3333	(1 kursus pilihan) (3 kredit)	<i>Design Project</i> KJ4953
7 - 26 Nov.	Peperiksaan		

Jumlah Kredit Tahun Akhir Di UKM: 45 Kredit (Tidak termasuk Latihan Industri)

- v. *Syarat-syarat pertukaran pelajar dari UDE:*
- i. Pelajar-pelajar dari UDE dikehendaki mengambil kursus Bahasa Melayu I dan Bahasa Melayu II berjumlah 3 unit setiap kursus dan nilai gred kursus-kursus tersebut tidak diambil kira dalam pengiraan Purata Nilai Gred (PNG) semester dan Purata Nilai Gred Kumulatif (PNGK);
 - ii. Lulus semua kursus tahun 1 dan tahun 2 program *Bachelor of Science Mechanical Engineering*, UDE;
 - iii. Penilaian Purata Nilai Gred (PNG) pelajar adalah berdasarkan keputusan kursus tahun akhir program Sarjanamuda Kejuruteraan Dengan Kepujian (Kejuruteraan Mekanikal), UKM.

6. Pengiktirafan Program UDE

Untuk membenarkan pelajar UDE memperoleh ijazah Sarjanamuda Kejuruteraan Dengan Kepujian (Kejuruteraan Mekanikal), adalah dicadangkan supaya Fakulti memberikan pengiktirafan dan pemindahan kredit terhadap kursus-kursus yang telah diambil selama dua tahun di UDE.

Secara keseluruhan, kursus-kursus yang telah diambil oleh pelajar di UDE pada tahun 1 dan 2 adalah setara dengan kursus-kursus tahun 1, 2 dan 3 di UKM memandangkan bahawa kedua-dua negara iaitu Malaysia dan Jerman telah menjadi ahli provisional Washington Accord (WA).

Perincian unit mengikut *European Credit Transfer System* bagi kursus yang telah diambil di UDE dibandingkan dengan unit bagi kursus setara UKM adalah seperti di senarai berikutnya:

University of Duisburg Essen BSc in Mechanical Engineering			Universiti Kebangsaan Malaysia Sarjanamuda Kejuruteraan Dengan Kepujian (Mekanikal)			
Semester	Subjects	Credit	Semester	Subjects	Credit	
1	Mathematics 1	5	1	Pengenalan Kepada Kejuruteraan	3	
	Chemistry	3		Sains Bahan	3	
	Mechanics 1	4		Grafik Kejuruteraan	3	
	Design Theory 1	3		Persamaan Kebezaan Biasa	3	
	Fund of Elect Eng 1	3		Kursus ZT (U1)	2	
	Fund of Computer Eng 1	3		Kokurikulum	1	
	Introduction to CAx	3	2	Asas Mekanik Gunaan	3	
	Computer Labs	2		Pengenalan Kejuruteraan Elektrik	3	
	Non-technical 1	2		Pengenalan Termodinamik Kejuruteraan	3	
2	Mathematics 2	5	Aljabar Linear dan kalkulus Vektor	3		
	Physics	4		Pengarturcaraan Komputer	3	
	Mechanics 2	4		INTER	Aplikasi Kejuruteraan	1
	Fund of Elect Eng 2	3	English Language for Engineers		3	
	Fund of Computer Eng 2	3	3		Kursus PPU (U2)	3
	Interdisciplinary Labs	2			Statistik Kejuruteraan	3
	Non-technical 2	2	Asas Mekanik Bendalir	3		
3	Mathematics C2	4	Bahan Kejuruteraan	3		
	Mechanics 3	4	Mesin & Elektronik Kuasa	3		
	Thermodynamics 1	3	4	Kokurikulum	1	
	Materials Science 1	4		Analisis Kompleks & Persamaan Kebezaan Separa	3	
	Design Theory 2	3		Dinamik Kejuruteraan	3	
	Non-technical 3	2		Mekanik Bahan	3	
4	Statistics for Engineers	3	Proses Pembuatan	3		
	Thermodynamics 2	3	Kursus ZT (U1)	2		
	Materials Science 2	3	5	Pengiraan Berangka	3	
	Fluid Mechanics	3		Kejuruteraan Termodinamik	3	
	Design Theory 3	3		Pengukuran Instrumentasi	3	
	Non-technical 4	2		Sistem Dinamik	3	
	Non-technical 6	2		Rekabentuk Komponen Mesin	3	
	Manufacturing	3		6	Teknologi Peradaban	3
	Industrial Training	6	Mekanik Bendalir		3	
Pemindahan Haba			3			
Kejuruteraan Kawalan	3					
Rekabentuk Sistem	3					
Jumlah Unit			Jumlah Unit			
93			94			

Perincian maklumat tentang silibus kursus yang diambil oleh pelajar UDE selama dua tahun di UDE adalah seperti di lampiran.

Untuk membenarkan pemindahan kredit terhadap kursus-kursus yang telah diambil di UDE, penyeteraan kursus UDE dan UKM dibuat seperti dijadual berikut:

Tahun Pengajian	UDE	Tahun Pengajian	UKM
Kursus Bukan Teknikal			
Tahun 1	Non Technical Subject 1 Non Technical Subject 2	Tahun 1	Kenegaraan Malaysia dan Tamadun Islam I Kokurikulum
Tahun 2	Non Technical Subject 3 Non Technical Subject 4	Tahun 2	Kenegaraan Malaysia dan Tamadun Islam II Bahasa Inggeris Untuk Jurutera Kursus PPU Kokurikulum
		Tahun 3	Teknologi dan Peradaban
Kursus Teknikal			
Tahun 1	Mathematics 1 Mathematics 2 Mechanics 1 Mechanics 2 Physics Design Theory 1 General Chemistry Fundamentals of Electrical Engineering Introduction to Computer Aided Design Interdisciplinary Labs Fundamentals of Computer Engineering 1 Programming in C Computer Labs Fundamentals of Electrical Engineering 2 Fundamentals of Computer Engineering 2	Tahun 1	Persamaan Kebezaan Biasa Aljabar Linear dan Kalkulus Vektor Asas Mekanik Gunaan Pengenalan Termodinamik Kejuruteraan Pengenalan Kepada Kejuruteraan Sains Bahan Pengenalan Kejuruteraan Elektrik Grafik Kejuruteraan Aplikasi Kejuruteraan Pengaturcaraan Komputer
		Tahun 2	Mesin dan Elektronik Kuasa
Tahun 2	Discrete Mathematics	Tahun 2	Statistik Kejuruteraan Analisis Kompleks dan Persamaan Kebezaan Separa
		Tahun 3	Pengiraan Berangka

Tahun 2	Materials Science I Mechanics 3 Thermodynamic 1 Thermodynamic Fluid Mechanics Design Theory 3	Tahun 1	Sains Bahan
		Tahun 2	Asas Mekanik Bendalir Bahan Kejuruteraan Dinamik Kejuruteraan Mekanik Bahan Proses Pembuatan
		Tahun 3	Termodinamik Kejuruteraan Pengukuran dan Instrumentasi Sistem Dinamik Rekabentuk Komponen Mesin Mekanik Bendalir Pemindahan Haba Kejuruteraan Kawalan Rekabentuk Sistem

7. Pengijazahan

Penilaian dan pengurniaan ijazah adalah mengikut Akta dan Peraturan-peraturan UKM (Pengajian Sarjanamuda) 1990 seperti berikut:-

6.5 *Penilaian Untuk Mendapatkan Ijazah*

6.5.1 *Seseorang calon mestilah memenuhi semua syarat berikut untuk dikurniakan ijazah Sarjanamuda Kejuruteraan Dengan Kepujian (Kejuruteraan Mekanikal):*

6.5.1.1 *mencapai PNGK sekurang-kurangnya 2.00 bagi semua kursus yang diambilnya tertakluk kepada perenggan 5.1, 5.2 dan 5.3;*

6.5.1.2.1 *mendapat sekurang-kurangnya 45 unit kursus-kursus yang ditetapkan oleh Fakulti Kejuruteraan, UKM serta lulus kursus-kursus tahun 1 dan tahun 2 di UDE (pelajar UDE ke UKM);*

6.5.1.2.2 *mendapat sekurang-kurangnya 94 unit kursus-kursus yang ditetapkan oleh Fakulti Kejuruteraan, UKM serta lulus kursus-kursus tahun akhir di UDE (pelajar UKM ke UDE).*

6.5.2 *Pengurniaan Ijazah*

6.5.2.1 *Pengurniaan ijazah adalah mengikut kelas seperti berikut:*

PNGK	Kelas
3.70 - 4.00	➤ <i>Ijazah Sarjanamuda Kejuruteraan Dengan Kepujian (Cemerlang)</i>
2.00 - 3.69	➤ <i>Ijazah Sarjanamuda Kejuruteraan Dengan Kepujian</i>

6.5.2.2 *Ijazah boleh dikurniakan kepada calon yang telah:*

6.5.2.2.1 *memenuhi semua kehendak Akta Pengajian Sarjanamuda;*

- 6.5.2.2.2 *memenuhi semua kehendak Peraturan ini;*
- 6.5.2.2.3 *diperakui supaya diberi ijazah berkenaan oleh Lembaga Pemeriksa dan disahkan oleh Senat;*
- 6.5.2.2.4 *menjelaskan segala bayaran yang telah ditetapkan.*

8. Kewangan

Pembiayaan kewangan adalah tanggung jawab pelajar. Perbelanjaan yang diperlukan untuk belajar di Jerman adalah sebanyak Euro 500 atau RM2000 sebulan untuk elaun sara hidup. Yuran pengajian tidak dikenakan. Fakulti akan berusaha mendapatkan bantuan kewangan dari beberapa buah syarikat untuk menghantar pelajar ke UDE.

9. Tarikh Program Diluluskan:

- i. Senat : 24 November 2004
- ii. Lembaga Pengarah Universiti (LPU) : 14 Disember 2004

**SILABUS KURSUS YANG AKAN DIAMBIL OLEH PELAJAR UKM KE UDE
PROGRAM KERJASAMA**

Subject	Control Technique
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	terms, definition, idea of feedback, technical control, dynamic systems, description of dynamical systems, description of linear systems, behaviour of linear systems, time behaviour of elements and loops, frequency behaviour and Laplace transformation, characteristics of elements and of loops in the frequency domain, stability of dynamical systems, control design, tuning rules, modern approaches of control and control theory

Subject	Production Management
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	Production Management (PM) comprises the strategic as well as the operative PM. Production enterprises can be regarded as systems consisting of the production factors (man, machine, material). The lectures contain all process steps from the choice of the product program, create of work plans /process management and the implementation of Production Planning and Control (PPC) with their strategies. Knowledge over material flow management / store management and other variables of influence are indispensable requirements in PM. Students learn how the PM is involved in the value added chain.

Subject	CAD / CAE
Language of Instruction	German
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	

Subject	Modelling and Simulation
Language of Instruction	German
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	

Subject	Computational Fluid Dynamics
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	Computational fluid dynamics has become an important range in research and development

	<p>due to the intensive improvement of numerical methods and increasing computer capacities.</p> <p>This lecture the basics of numerical discretizations and solutions and an introduction into modern methods of computational fluid dynamics.</p> <p>Examples are e.g. solution concepts for the Euler and Navier-Stokes equations of compressible and incompressible fluids, which form the basic algorithms of simulation methods in research and development.</p> <p>Organization of the lecture:</p> <ul style="list-style-type: none"> - governing equations of fluid flow - basics of numerical solutions - solution methods for typical model problems - grid generation and discretization on arbitrary grids - lattice Boltzmann methods - and many other details more
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Subject	Material Flow and Logistics
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	The lecture deals with the design and planning of production and distribution systems. Current control methods and algorithms are introduced in combination with push and pull concepts the Enterprise Resource Planning (ERP) level.

Subject	Waste Treatment
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	Municipal Solid Waste Incineration, Hazardous Waste Incineration Chem.-phys. and Biological Waste Treatment Composting and Fermentation Landfilling Techniques

Subject	FLUID MACHINES
Language of Instruction	German
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	

Subject	Machine Tools
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	The lecture of machine tools focusses on the fundamental concepts of this type of machine tools and classify them

	according to DIN 69 651. After introducing the Thematik, the students will be exposed to the design and analysis of the main components of machine tools. Control; Analysis of spindle, support and guides, drive components and the architecture of machine structures. The theory of machine tools will be given in the lecture supported by numerous examples from industrial application
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Subject	Energy Engineering
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	<p>The lecture focusses on the wide area of energy economics, generation of electrical energy, the preparation of process heat and to up to regenerative energy.</p> <ol style="list-style-type: none"> 1. Energy economies; energy supply, reserve and resources 2. Cyclic process for production of electrical energy 3. Combustion of fossil energy carrier 4. Cleaning of exhaust gas 5. Technology of fossil power station 6. Nuclear energy 7. Supplying of heat for heating system 8. Source of regenerative energies 9. Questions of economically viability

Subject	Mechatronics
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	<ol style="list-style-type: none"> 1 Introduction and Overview into Mechatronics 2 Mechanical Systems with Finite Degrees of Freedom <ol style="list-style-type: none"> 2.1 Definitions 2.2 Constraints <ol style="list-style-type: none"> 2.2.1 Geometrical constraints 2.2.2 Kinematical constraints 2.2.3 Holonomic, non-holonomic constraints Hertz 2.3 Degrees of freedom and virtual displacements 2.4 Main Problem in Dynamics <ol style="list-style-type: none"> 2.4.1 External forces, Reaction forces 2.4.2 Equations of motion of the constrained system 2.4.3 Ideal constraints 2.5 Fundamental equation of dynamics 2.6 d'Alemberts principle 2.7 Principles of dynamics: Lagrange equations of the first kind 3 Holonomic systems <ol style="list-style-type: none"> 3.1 Generalised coordinates 3.2 Generalised forces 3.3 Lagrange equation of the 2nd kind 3.4 Examples for the Lagrange Equations of the 2nd kind 3.5 Kinetic energy in generalized coordinates 3.6 Change of total energy of a holonomic system

	4 Modelling of technical systems 5 Solution of time-invariant, linear systems 5.1 Characteristic equation, eigen values 5.2 Function of a matrix 5.3 Solution of time-invariant, linear vector differential equations 5.4 Calculations 5.5 Other solution classical approach 5.6 Normal co-ordinates 6 stability of linear, time-invariant systems 6.1 Definitions 6.2 Stability criteria 6.3 Hurwitz - criteria (necessary and sufficient) 6.4 Qualitative consideration of homogeneous systems
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Subject	Product Engineering
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	Cooperative Product Development in the automobile industry. CAD, Multi Body Simulation, FEM, Technological and Production Simulation, Virtual Prototypes, Tests, Productions

Subject	Process Engineering
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	Disperse systems Introduction in separation processes like reverse osmosis, ultrafiltration and dialysis Mass- and energy balance equations Enthalpy-concentration diagrams Stirring and mixing: individual types of stirrers, homogenization, mixing time and power characteristics, optimization Gas distributors Batch processes and continuous chemical reaction in vessel Chemical reaction first order Heat capacity of ideal stirred tank

**SILABUS KURSUS YANG AKAN DIAMBIL OLEH PELAJAR UDE SELAMA DUA
TAHUN DI UDE
PROGRAM KERJASAMA**

Subject	Mathematics 1
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	Propositional calculus, Predicate calculus, Real numbers, Mathematical Induction, Complex numbers, Sequences of real numbers, Series of real numbers, Complex exponential function, Logarithm and general exponential functions, Limits and continuity of functions, Trigonometric functions, Hyperbolic functions, Techniques of differentiation, Tangent lines and rates of change, Rules for finding derivatives, Higher order derivatives, Antiderivatives, Rules for finding antiderivatives, Definite integrals, Properties of definite Integrals, Techniques of indefinite integration, The first derivative test, The second derivative test, Convexity and Concavity, Applications of extrema, L'Hôpital's Rule, Solids of revolution, Centroids of plane regions, Taylor series

Subject	Mathematics 2
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	Vector space, Matrices, Determinants and their properties, System of linear equations, Eigenvalues, Eigenvectors, Vector-valued functions, Functions of several variables, Limits and Continuity, Partial Derivatives, Local extrema, Vectorfields, Line Integrals, Introduction to ODE, Laplace transforms, Fourier series and transform, Introduction to PDE

Subject	Chemistry
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	The lecture deals with the fundamentals of general chemistry (atomic models, periodic table, chemical bonds, chemical thermodynamics and kinetics) as well as with some aspects of the field of chemistry which are of special relevance for engineering applications (structural and functional materials).

Subject	Physics
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	1)Introduction:vectors,units,equation of linear and circular motion, energy, elastic- and inelastic collision; 2)oscillations and waves:free-,damped-,enforced

	<p>oscillations,waves, acoustic waves, what is sound?,intensity of sound, dB scale</p> <p>3)optics: geometrical optics:prism,lenses, mirror, Snell´s law,light guiding, imaging with simple instruments</p> <p>4)atomic physics: Bohr´s model, quantum numbers and their meaning, Franck-Hertz-experiment, X-rays, application of X-rays</p> <p>5)nuclear physics: electrons, protons, neutrons, radiation, radioactive decay, radioactive clocks, nuclear energy from fusion and fission.</p> <p>5) nuclear physics</p>
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Subject	Mechanics 1
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	<p>Introduction; Vector Notation</p> <p>Kinematics of point masses "Geometry of Motion"</p> <p>Dynamics of point masses (" Interaction between forces and motion")</p> <p>Kinematics and dynamics of multi-particle systems (center of mass, constraint forces, degrees of freedom, etc.)</p> <p>Rotational Motion (planar)</p> <p>Energy Methods</p>

Subject	Mechanics 2
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	

Subject	Design Theory 1
Language of Instruction	German
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	<p>Einleitend werden die Grundbelastungen behandelt, denen Maschinen und ihre Bauteile unter Betriebsbedingungen unterworfen sind. Es folgen die Grenzbelastungen der Konstruktionswerkstoffe bei statischer und dynamischer Belastung mit der Definition der Gestaltfestigkeit realer Bauteile. Im Weiteren werden Lage- und Formtoleranzen sowie die Passungssysteme und Abmaße von Bauteilen behandelt. Die Anwendung der Grundlagen wird am Beispiel der Schraubenverbindungen verdeutlicht.</p>

Subject	Fundamentals of Electrical Engineering 1
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	<p>The first semester of this two semester course deals with three main topics. First, simple dc circuit elements are introduced (Sources, resistors) and methods for circuit analysis are taught</p>

	(e.g node and loop method). After that, amplifiers are introduced and various important circuits for operational amplifiers are discussed. At the end of the semester, ac circuit analysis and ac circuit elements like inductances and capacitors are introduced. Complex analysis is used for solving ac problems with sinusoidal voltages.
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Subject	Fundamentals of Electrical Engineering 2
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	"Fundamentals of Electrical Engineering" is a two semester course in the field of Electrical Engineering for the students of the first and second semester. The second semester continues with the ac circuit analysis already started with in the first semester. After that basic transistor and diode circuits are introduced and explained. At the end of the semester a brief introduction into electric machines and transformers finishes the second semester.

Subject	Fundamentals of Computer Engineering 1
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	This course covers the fundamentals of computer science necessary for design and analysis of hardware. The topics include Boolean algebra, basic minimization methods, coding of information, arithmetic and logic functions with binary codes, design of digital circuits (combinational and sequential) as well as basics of automata and microprogramming. Based on Boolean algebra and information coding, the functions of gates and similar components of digital circuits are explained. These components are used to design more complex functions up to the modules required for the set up of a basic microcomputer.

Subject	Fundamentals of Computer Engineering 2
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	Fundamentals of Computer architecture (ALU and registers, control, memory, I/O), program execution, client-server organization. Principles of imperative programming explained, demonstrated and practised on C language: Ordinary and structured, static and dynamic data types (string, array, structure and pointer). Program constructs and structures, functions. Data structures (linked lists, trees, graphs) and their usage. Evaluation of expressions: Infix, postfix, praefix. Huffman trees. Towards embedded systems: Hardware access, interrupts. Memory organization, stack and heap. Computational

	complexity, iteration and recursion; algorithms, sorting and searching. The lab includes problems of programming in C regarding complex data structures and the use of pointers.
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Subject	Introduction to CAx
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	The Lab Exercise will give an introduction into the possibilities of computer aided development in general. It consists of two parts. The first part is an introduction to the computer aided Design (CAD), in particular the creating of technical drawings with the CAD-system MegaCAD. The second half covers computer aided development of digital circuits. The software Workview will be used to draw and simulate logical circuits such as code converters, adders and counters.

Subject	Computer Labs
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	

Subject	Interdisciplinary Labs
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	

Subject	Mathematics C2
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	1 Error Analysis 1.1 Representation of numbers 1.1.1 Floating-point-numbers 1.1.2 Rounding errors 1.2 Error Propagation 1.2.1 Error propagation in arithmetic operations 1.2.2 Condition numbers 2 Nonlinear equations 2.1 The method of Bisection 2.2 The secant method 2.3 Newton's method 2.4 Fixed point iteration 2.5 Polynomial equations 2.6 Systems of nonlinear equations 2.6.1 Newton's method for systems 3 Systems of Linear Equations 3.1 The LR and Cholesky Decomposition 3.1.1 The LR-Decomposition

	3.1.2 The Cholesky Decomposition 3.2 Gauss Elimination and Back-Substitution 3.2.1 Pivoting strategies 3.3 The QR Decomposition 3.4 Data fitting; Least square problems 3.5 Iterative solutions 3.5.1 Jacobi Iteration (total-step-method) 3.5.2 Gauss-Seidel-Iteration (single-step-method) 3.6 Convergence properties 4 Finding Eigenvalues 4.1 The Power method 4.2 Localizing eigenvalues 4.3 The QR-method 4.4 Hessenberg matrices 5 Ordinary Differential Equations 5.1 Basic analytic methods 5.1.1 Separation of variables 5.1.2 Linear differential equations 5.2 One-step-methods 5.2.1 Euler's Method 5.2.2 Midpoint Euler 5.2.3 Two-stage-models 5.2.4 Runge-Kutta-methods 6 Polynomiial Interpolation 6.1 Lagrange form of Interpolation Polynomial 6.2 Interpolation Error 6.3 Divided Differences 6.4 Spline Interpolation
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Subject	Statistics for Engineers
Language of Instruction	German
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	Introduction to theory of Probability, Laplace-Probability, Permutation and combination, Conditional probability, Independent events, Random variables, Distribution of a random variable, Mean and variance of probability distributions, Binomial distribution, Poisson & Hypergeometric distributions, Normal distribution, Confidence intervals, Testing of hypothesis, Quality control, Control chart, Chi-Quadrat test, Kolmogoroff-Smirnow test, Regression analysis and curve fitting, Analysis of variance

Subject	Mechanics 3
Language of Instruction	English
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	

Subject	Thermodynamics 1
Language of Instruction	English

Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	<p>The fundamentals of engineering thermodynamics will be introduced and applied to problems of energy conversion, chemical engineering and materials science. (Power cycles, refrigeration, and combustion will be covered in the second part of the lecture: "Thermodynamics 2")</p> <p>Contents:</p> <ul style="list-style-type: none"> -> Introduction/Motivation, -> Concepts/Definitions, -> Properties of a pure substance , -> Work and Heat, -> The first Law of Thermodynamics (Cycles, closed systems, open Systems, internal energy and enthalpy) -> The second law of Thermodynamics(Carnot-Cycle, closed systems) -> Entropy and related properties (Gibbs and Helmholtz function, the chemical potential) -> The properties of simple mixtures ->Phase diagrams ->Chemical Equilibrium

Subject	Thermodynamics 2
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	<p>The fundamentals of thermodynamics, introduced in the first part of this lecture, will be applied more extensively to idealized technical systems and an introduction to chemical thermodynamics and heat transfer will be given.</p> <p>Contents:</p> <ul style="list-style-type: none"> + Recapitulation of the first course + Mixtures of ideal gases and vapors (humid air) + Second law control volume analysis + Exergy and availability + Idealized power and refrigeration cycles + Combustion thermodynamics + Basic heat transfer

Subject	Fluid Mechanics
Language of Instruction	English
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	<p>The lecture offers an extension to important problems of fluid dynamics and is divided in the following chapters:</p> <ul style="list-style-type: none"> - conservation equations of fluid dynamics <ul style="list-style-type: none"> conservation of mass, momentum and energy(Navier-Stokes equations) stress-strain relations

	<p>thermal and calorical equations of state</p> <ul style="list-style-type: none"> - similarity theory of fluids - creeping flows - boundary layer theory - introduction to turbulent flows - one-dimensional gasdynamics
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Subject	Materials Science 1
Language of Instruction	German
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	<p>Auf der Basis der werkstoffkundlichen Grundlagen der Metalle, keramischen Werkstoffe, den Kunststoffen (Polymeren) und deren Verbunden wird der Zusammenhang zwischen den naturwissenschaftlichen Zusammenhängen und den Gebrauchs- (z.B. Festigkeit, Zähigkeit, Korrosionsbeständigkeit) und Fertigungseigenschaften (z.B. Schweißbarkeit, Umformbarkeit, usw.) aufgezeigt. Im zweiten Teil der Vorlesung werden am Beispiel des Systems Fe-C die wichtigsten Gusseisen und Stähle und deren Wärmebehandlungen vorgestellt. Hieraus ergibt sich für die Fe-Basis Werkstoffe eine geschlossene Einordnung zwischen den Grundlagen, den Eigenschaften und den Anwendungen. Im Praktikum werden die Grundlagen zum Thema Werkstoffprüfung in den Laboren der Werkstofftechnik behandelt und vertieft.</p>

Subject	Materials Science 2
Language of Instruction	German
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	<p>Aufbauend auf den Grundlagen der Werkstofftechnik I+II stehen in der Veranstaltung Gesichtspunkte der praktischen Werkstoffanwendung im Vordergrund. Die Werkstoffe (Metalle, Kunststoffe, Keramik, Verbundwerkstoffe) sind weit überwiegend mehr oder weniger unregelmäßig schwankend belastet. Das Betriebsfestigkeitsverhalten und nach Risseinleitung das Rissausbreitungs- und Bruchverhalten stehen daher im Vordergrund. Es werden Anwendungsbeispiele und grundlegende Auslegungsmethoden vorgestellt und auch im Praktikum ergänzend vertieft. Ebenso wird einschlägige Software präsentiert.</p> <p>Grundlagen zur metallischen Festigkeit der Metalle, Kunststoffe und Keramik Werkstoffe und kooperative Bauteilentwicklung Betriebsfestigkeits- und Lebensdauervorhersage/ -methoden (Schadensakkumulationshypothesen) Zerstörungsfreie Erkennung von Defekten Rissverhalten an Proben und Bauteilen und bruchmechanische Beschreibung Besondere Werkstoffe und Anforderungen im Bereich der Schiffstechnik</p>

Subject	Manufacturing
Language of Instruction	German
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	<p>Die Vorlesung Fertigungslehre behandelt Verfahren zur Herstellung geometrisch bestimmter fester Körper. Ihre Gliederung orientiert sich an den einzelnen Werkstoffgruppen (Metalle, Kunststoffe, Keramik und Holz) sowie an der DIN 8580, die eine Einteilung der Verfahren in sechs Hauptgruppen (Urformen, Umformen, Trennen, Fügen, Beschichten, Stoffeigenschaftsändern) vorgibt. Viele der Fertigungsverfahren können alternativ eingesetzt werden. Ihre Auswahl orientiert sich im konkreten Fall an den Anforderungen an das Werkstück, den Kosten zur Herstellung und der Qualität. Es werden daher Methoden zur Wirtschaftlichkeitsbetrachtung und Qualitätsmerkmale von Fertigteilen vorgestellt. Die Fertigungstechnik hat bei der Herstellung umweltverträglicher Produkte eine große Bedeutung. Durch innovative Verfahren können die Potentiale der Technologien besser genutzt und die natürlichen Ressourcen geschont werden. Im Rahmen der Vorlesung werden daher auch die Methoden der Kreislaufwirtschaft betrachtet.</p>

Subject	Design Theory 2
Language of Instruction	German
Semester	Winter
Degree Course	B.Sc. Mechanical Engineering
Description	<p>Vorlesung</p> <p>I Allgemeine konstruktive Grundlagen</p> <ul style="list-style-type: none"> - Grundlagen des Normenwesens - Normzahlen <p>II Toleranzen, Passungen, Oberflächenbeschaffenheit</p> <p>III Festigkeitsberechnung- Beanspruchungs- und Belastungsarten</p> <ul style="list-style-type: none"> - Werkstoffe und deren Festigkeitskennwerte - Statische/ dynamische Bauteilfestigkeit - Praktische Festigkeitsberechnung <p>IV Achsen, Wellen und Zapfen</p> <ul style="list-style-type: none"> - Funktion und Wirkung - Gestalten und Entwerfen - Kontrollberechnungen <p>V Schraubenverbindungen</p> <ul style="list-style-type: none"> - Funktion und Wirkung - Berechnung von Befestigungsschrauben - Bewegungsschrauben <p>VI Elemente zum Verbinden von Wellen und Naben</p> <ul style="list-style-type: none"> - Funktion und Wirkung - Formschlüssige Welle-Nabe-Verbindungen - Kraftschlüssige Welle-Nabe-Verbindungen - Stoffschlüssige Welle-Nabe-Verbindungen <p>Übung</p>

	I Auswahl von Toleranzen und Passungen II Festigkeitskennwerte, Berechnung zulässiger Spannungen III Berechnung/ Auslegung von Schraubverbindungen und Bewegungsschrauben V Berechnung des Richtdurchmessers und der Durchbiegung von Achsen/ Wellen VI Berechnung ausgesuchter Welle-Nabe-Verbindungen
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Subject	Design Theory 3
Language of Instruction	German
Semester	Summer
Degree Course	B.Sc. Mechanical Engineering
Description	Vorlesung VII Wälzlager und Wälzlagerungen - Funktion und Wirkung - Gestalten und Entwerfen von Wälzlagerungen - Berechnung von Wälzlagern VIII Gleitlager - Funktion und Wirkung IX Kupplungen - Funktion und Wirkung X Gerad- und Schrägverzahnte Stirnradgetriebe - Verzahnungsgeometrie - Grundlagen der Tragfähigkeitsberechnung - Auslegung und Gestaltung - Kräfteverhältnisse und Wirkungsgrad - Bemessungsgrundlagen XI Umlaufgetriebe - Drehzahlen und Übersetzungen Übung VII Berechnung ausgesuchter Wälzlagerungen VIII Auswahl und Berechnung ausgesuchter Kupplungen IX Gestaltung/ Dimensionierung von Stirnradgetrieben