CAS MA 242 **Linear Algebra** **Semester II / 2014**

Lecture:	Prof. Dr.rer.nat.habil. Martin R. Weber
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Discussions:	Prof. Dr. M. R. Weber

Class time: Lectures: Mondays 11:10 - 12:40 in WIL/C133
Thursdays 9:20 - 10:50 in WIL/A120
Discussion section: Thursdays 11:00 - 12:00 in WIL/C102

Textbook: David C. Lay. Linear Algebra and its Applications (fourth edition), Addison-Wesley-Longman, 2011.

Course Description: The course gives an introduction to the Linear Algebra and its applications. This mathematical field is fundamental for many other mathematical branches, in particular, for the course Ordinary Differential Equations, which is highly important in practice. The main topics include vector and matrix algebra, determinants, solution theory for systems of linear equations, geometrical interpretations, theory of finite dimensional vector spaces, linear operators, eigenvalues and eigenvectors of matrices, diagonalizability, inner products, orthogonality and quadratic forms. Finally applications to discrete dynamical systems will be considered.

Exams and grading: There will be **two in-class exams** during the semester, both during normal class time. They will be held in the middle of May and in the third week of June. The **final exam** will take place in the third week of July. University policy states that each student must take the final exam at the scheduled time. The attendance at lectures, discussion sessions and at all three exams is required. Written excuses for missing a class have to be provided.
Each student has to give at least two presentations of exercises in one of the discussion sessions during the semester. This work will determine your "discussion session grade (homework)".
Grades for the course will be determined by applying the most favorable of the following two weighting schemes to your curved exam grades:

Scheme 1	
Your best in-class exam :	20%
Your other in-class exam:	10%
The final exam:	50%
Homework:	20%

Scheme 2	
Each in-class exam:	20%
The final exam:	40%
Homework:	20%

Homework: In addition to the in-class exams, you will be required to submit home work once a week during the semester. At the end of the Thursday's lecture you will get exercises related to the current subjects discussed in the classes. You will be expected to submit your homework at Thursday's lecture in the next week.

Summary of the subjects of the lecture:

1. Matrix Algebra
2. Determinants, Solving Linear Equations, Gauß-Algorithm
3. Geometric Description of $\mathbb{R}^2, \mathbb{R}^3$ and $\mathbb{R}^n$
4. Vector Spaces, linear independence, bases, dimension
5. Scalar product, Orthogonality
6. Linear Transformations, linear Operators, Matrix respresentation of linear operators
7. Best approximation and least square problem
8. Eigenvalues and Eigenvectors
9. Diagonalizability, Minimization Problems
10. Application to discrete dynamical systems and to differential equations

Time schedule and correlation of the subjects to the sections of the book:

Week	Date	Lecture	Section	Discussion
1	07/04/14	Introduction, examples, Matrix-Vector operations	I.3-4	
	10/04/14	Matrix operations	II.1	10/04/14
2	14/04/14	Specific matrices, determinants, inverse matrix	III.1,2	
	17/04/14	Computing of the inverse matrix	II.2, II.5	17/04/14
3	21/04/14	*Easter holiday*		
	24/04/14	Procedure for solving linear equations, Echelon forms	I.1-2	24/04/14
4	28/04/14	Row Reduction Algorithm, Solution sets	I.2,I.5	
	01/05/14	*First May* (Maifeiertag)		
5	05/05/14	The rank of a matrix		
	08/05/14	LU-factorization, iterative solving	II.5	08/05/14
6	12/05/14	Partitioned matrices, Geometric description of $\mathbb{R}^2, \mathbb{R}^n$	II.4, I.3, I.7	
	15/05/14	**In class Exam I**	15/05/14	
7	19/05/14	Subspaces of $\mathbb{R}^n$, linear transformations	II.8, I.8-9	
	22/05/14	Vector spaces: basic notations, subspaces	IV.1	22.05.14
8	26/05/14	Linear independence, basis, dimension	IV.3	
	29/05/14	*Ascension Day* (Himmelfahrt)		
9	02/06/14	Coordinates, change of basis	IV.4-5, IV.7	
	05/06/14	Linear transformations in vector spaces	IV.2	05/06/14
10	09/06/14	*Whitsun* (Pfingsten)		
	12/06/14	Pfingstferien		
11	16/06/14	**In-class Exam II**		
	19/06/14	Matrix representation of linear operators	IV.2	19/06/14
12	23/06/14	Inner product, Orthogonality	VI.1, VI.7	
	26/06/14	Gram-Schmidt Orthogonalization Process	VI.4	26/06/14
13	30/06/14	Orthogonal projections, Best approximation, Least square	VI.2-3, 5	
	03/07/14	Eigenvalues and Eigenvectors	V.1-2	03/07/14
14	07/07/14	Similarity, Diagonalization	V.2-3	
	10/07/14	Complex eigenvalues, Applications	V.5-7	10/07/14
15	14/07/14	**Final Exam**		
	17/07/14	Discrete dynamical systems, Predator-prey-model	V.5-6	17/07/14