Lecture Syllabus

Module Code	Semester	ECTS	SWS	Lecture	Tutorial	Lab
MECH-M-1-HMA-HMA-VO	1	3	2	2	0	0
Course Name	Higher Mathematics I					
Lecturer	D. T. McGuiness, Ph.D (Daniel.McGuiness@mci.edu) (4A-434c)					
Study Programme	Mechatronik Smart Technologies					
Official Name	Höhere Mathematik 1			**Lingo**	English	
Lecture Prerequisites	The student should be comfortable with working with calculus and be familiar with taking derivatives and doing integration.					
Course Objectives	The goal of this lecture is to introduce you to the tools you need to learn to tackle more advanced engineering problems. These could be ranging from doing circuit analysis to calculating the stress experienced by a bridge which will be covered in this lecture series as examples.					
Primary Course Content	Lecture Homepage on GitHub | WebBook					
Secondary Course Content(s)	*Thomas Calculus (12th Edition)* by G. B. Thomas, Jr. et.al , *Probability: A Graduate Course* by A. Gut , *Partial Differential Equations of Mathematical Physics* by S.L. Sobolev , *Partial Differential Equations - An Introduction* by W. A. Strauss , *Probability and Statistics for Engineers & Scientists* by R. E. Walpole, et. al , *Mathematical Methods in the Physical Sciences (3rd Edition)* by M. L. Boas ,					
Homework(s) and Project(s)	Personal Assignment (40) Final Exam (60)					

Assessment Criteria	Assignment Type	Effect	Count
	Personal Assignment	40	1
	Final Exam	60	1

Lecture Structure

Order	Topic	Units	Self Study
1	First Order Ordinary Differential Equations	4	8
	Introduction to Modelling · Separable Ordinary Differential Equations · Exact Ordinary Differential Equations · Linear Ordinary Differential Equations		
2	Second Order Ordinary Differential Equations	4	8
	Introduction · Homogeneous Linear ODEs · Euler-Cauchy Equations · Non-Homogeneous ODEs · A Study of Forced Oscillations and Resonance		
3	Higher Order Ordinary Differential Equations	2	4
	Homogeneous Linear ODEs · Non-Homogeneous Linear ODEs		
4	Systems of ODEs	4	8
	Looking at Connected ODEs · Constant Coefficient Systems · Criteria for Critical Points and Stability · Qualitative Methods for Non-Linear Systems · Self-Sustained Oscillations - Van der Pol Equation		
5	Special Functions for ODEs	4	8
	Defining Special Functions · The Method of Power Series · Legendre's Equation · Extending the Power Series using Frobenius Method · Bessel's Function		
6	Laplace Transform	2	4
	Introduction · First Shifting Theorem (s-Shifting) · Transforming Derivatives and Integrals · Unit Step Function (t - Shifting) · Dirac Delta Function · Convolution		
7	Linear Algebra	2	4
	Introduction · Matrices and Vectors · Matrix Multiplication · Solutions to Linear Systems · Second and Third Order Determinants · Linear Independence · Solution of Linear Systems · Inverse of a Matrix		
8	Eigenvalue Problems	2	4
	Introduction · The Eigenvalue Problem · Eigenvalue Applications · Symmetric, Skew-Symmetric and Orthogonal Matrices · Eigenbases, Diagonalisation and Quadratic Forms · Complex Matrices		
9	Vector Calculus	4	8
	Vector Algebra · Differential Calculus · Integral Calculus · Curvilinear Coordinates · Dirac Delta Function · Vector Field Theory		
10	**Sum**	28	56
	Exam		

- Any major announcements will be made on SAKAI regarding any possible date/content/structural changes for the assignment(s), exam(s).
- Any lecture material will be posted at the lectures corresponding GitHub home-page. The link will be present on the lectures SAKAI homepage.
- If there are any questions regarding course content/exams/assignments please do not refrain from contacting me (Daniel.McGuiness@mci.edu).