

Department	SciTec
Degree programme	SI, WT
Module name	<b>Scientific Computing</b>
Module number	<b>GW.2.403</b>
Study and Examination Regulations	ER-version 38 (of 21.03.2018), ER-version 39 (of 23.07.2019), ER-version 41 (of 16.07.2021)
Compulsory/ compulsory optional/ optional module	compulsory optional module
Module coordinator	Prof. Dr. Henning Kempka
Module content	<p>Fundamentals:</p> <ul style="list-style-type: none"> <li>▪ Matrix Analysis</li> <li>▪ Condition and well posedness of problems</li> <li>▪ Stability of numerical algorithms</li> </ul> <p>Solving linear systems:</p> <ul style="list-style-type: none"> <li>▪ Gauss elimination method</li> <li>▪ various factorizations</li> <li>▪ iterative methods</li> </ul> <p>Nonlinear equations:</p> <ul style="list-style-type: none"> <li>▪ Newton's method</li> <li>▪ Fixed Point methods</li> </ul> <p>Interpolation and Approximation:</p> <ul style="list-style-type: none"> <li>▪ Polynomial interpolation</li> <li>▪ Least squares approximation</li> </ul> <p>Differential equations:</p> <ul style="list-style-type: none"> <li>▪ Basics on ODE</li> <li>▪ Numerical solutions of ODE</li> <li>▪ Boundary value problems</li> </ul>
Learning objectives	The students know the fundamental theories and algorithms of scientific computing. They are able to analyse, identify, formulate, and solve numerical problems and define the computing requirements appropriate to their solutions. They also get to know and are able to use current techniques, skills, and tools necessary for computing numerical problems.
Course type (lecture, seminar, exercises, practical course)	4 L – 0 S – 0 E – 2 P
Recommended literature	<ul style="list-style-type: none"> <li>▪ A. Quarteroni, R. Sacco, F. Saleri: Numerical Mathematics, Texts in applied mathematics 37, Springer.</li> <li>▪ A. Quarteroni, F. Saleri, P. Gervasio: Scientific Computing with MATLAB and Octave, Texts in Computational Science and Engineering 2, Springer.</li> <li>▪ H. P. Langtangen: A Primer on Scientific Programming with Python, Texts in Computational Science and Engineering 6, Springer.</li> </ul>
Learning materials	Working sheets and self-created manuscript.
Method(s) of instruction/ media being used	Data projector, blackboard and computers in lab.
Level/ category	Master (category: 2)
Which semester (winter/ summer term)	summer term
Which semester during the programme	2
Requirements for attendance, necessary knowledge	Successfully completed basic calculus courses thought during Bachelors studies.
Assessment (written/ oral test, paper, etc.)	written examination (90 minutes), course achievement: successful attendance of practical course
ECTS credits	6
Work load in:	180 h of total work load, therefrom <ul style="list-style-type: none"> <li>▪ 90 h of presence at university</li> <li>▪ 90 h of self-study</li> </ul>
Usability of this module	-
Frequency of offer	Every study year
Duration of module	1 semester
Place/ room	Ernst-Abbe-Hochschule Jena - University of Applied Sciences Jena

<b>Time</b>	According to schedule
<b>Language(s)</b>	English