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| COURSE: Numerical Methods in Biomedicine | | |
| DEGREE: Biomedical Engineering | YEAR: 2 | TERM: 2 |

| WEEKLY PLANNING | | | | | | | | |
|-----------------|---------|-----------------------------------|----------------|---------------|-------------------|--|-------------|----------------------------------|
| WEEK | SESSION | DESCRIPTION OF CONTENT | TEACHING | | Special classroom | WEEKLY PROGRAM FOR STUDENTS | | |
| | | | THEORY LECTURE | GROUP SEMINAR | | DETAILED DESCRIPTION | CLASS HOURS | WORKING HOURS (Max. 7h per week) |
| 1 | 1 | Ch1. Introduction (1) | | X | | Models, numerical analysis, errors, machine numbers. Refs.: Notes, [MF] 1.2, 1.3, [KC] 2.1, 2.2. | 1.66 | 4 |
| 2 | 2 | Ch1. Introduction (2) | X | | | Stability, Taylor polynomials. Refs.: Notes, [MF] 1.3, 1.1, [KC] 2.3, 1.1, 1.2. | 1.66 | 6 |
| 2 | 3 | Ch1. Problems | | X | C | Review of Matlab. Selected exercises Ch 1. Refs.: Notes, [MF] Appendix. | 1.66 | |
| 3 | 4 | Ch2. Rootfinding | X | | | Methods for solving nonlinear equations. Refs.: Notes, [MF] 2.1-2.4, [KC] 3.1-3.4. | 1.66 | 6 |
| 3 | 5 | Ch1 and Ch2. Problems, Assignment | | X | C | Selected exercises from Ch1 and Ch 2. First assignment | 1.66 | |
| 4 | 6 | Ch3. Optimization (1) | X | | | Optimality conditions, convexity, line search, one-dimensional optimization, bracketing. Refs.: Notes, [BC] 3.1-3.4, 2.1-2.5, [MF] 8.1, | 1.66 | 6 |
| 4 | 7 | Ch2 and Ch3. Problems | | X | C | Selected exercises from Ch2 and Ch 3 | 1.66 | |

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| 5 | 8 | Ch3. Optimization (2) | X | | | Steepest descent, conjugate gradient. Refs.: Notes, [BC] 3.4-3.6, [MF] 8.3 | 1.66 | 6 |
| 5 | 9 | Ch3. Problems | | X | C | Selected exercises from Ch 3 | 1.66 | |
| 6 | 10 | Ch3. Optimization (3) | X | | | Newton and quasi-newton methods, approximate line search. Refs.: Notes, [BC] 3.7-3.9, [MF] 8.3 | 1.66 | 6 |
| 6 | 11 | Ch3. Problems | | X | C | Selected exercises from Ch 3 | 1.66 | |
| 7 | 12 | Ch4. Finite Differences (1) | X | | | Interpolation. Refs.: Notes, [MF] 4.2-4.4, [KC] 6.1 | 1.66 | 6 |
| 7 | 13 | Ch4. Problems | | X | C | Selected exercises from Ch4. Second assignment | 1.66 | |
| 8 | 14 | Ch4. Finite Differences (2) | X | | | Splines. Numerical differentiation. Refs.: Notes, [MF] 5.3, 6.1, 6.2, [KC] 6.4, 7.1. | 1.66 | 6 |
| 8 | 15 | Ch4. Problems | | X | C | Selected exercises from Ch4 | 1.66 | |
| 9 | 16 | Ch4. Finite Differences (3) | X | | | Numerical integration. Extrapolation. Refs.: Notes, [MF] 7.1-7.3, [KC] 7.2 | 1.66 | 6 |
| 9 | 17 | Ch4. Problems | | X | C | Selected exercises from Ch4 | 1.66 | |
| 10 | 18 | Ch5. Ordinary differential equations (1) | X | | | Euler's method. Implicit methods. Refs.: Notes, [MF] 9.1-9.4, [KC] 8.1, 8.2 | 1.66 | 6 |
| 10 | 19 | Ch5. Problems | | X | C | Selected exercises from Ch5 | 1.66 | |
| 11 | 20 | Ch5. Ordinary differential equations (2) | X | | | Multistep methods. Runge-Kutta methods. Refs.: Notes, [MF] 9.5, 9.6, [KC] 8.3, 8.4 | 1.66 | 6 |
| 11 | 21 | Midterm exam | | X | C | Midterm exam | 1.66 | |
| 12 | 22 | Ch5. Ordinary differential equations (3) | X | | | Stability and stiff problems. Refs.: Notes, [KC] 8.5, 8.12 | 1.66 | 6 |
| 12 | 23 | Ch5. Problems | | X | C | Selected exercises from Ch5 | 1.66 | |

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| 13 | 24 | Ch6. Approximation Theory (1) | X | | | Least squares. Third assignment. Refs.: Notes, [MF] 5.1, 5.2, [KC] 6.8. | 1.66 | 6 |
| 13 | 25 | Ch6. Problems | | X | C | Selected exercises from Ch6 | 1.66 | |
| 14 | 26 | Ch6. Approximation Theory (2) | X | | | Fast Fourier Transform. Refs.: Notes, [MF] 5.4, [KC] 6.12, [QSS] 10.9. | 1.66 | 6 |
| 14 | 27 | Ch6. Problems | | X | C | Selected exercises from Ch6 | 1.66 | |
| Subtotal 1 | | | | | | | 48 | 88 |
| Total 1 (Class hours plus student homework hours in weeks 1-14) | | | | | | | 136 | |
| 15 | | Tutorials, handing in, etc. | | | | | 2 | 9.5 |
| 16 | | Assessment | | | | | 2.5 | |
| 17 | | | | | | | | |
| 18 | | | | | | | | |
| Subtotal 2 | | | | | | | 4.5 | 9.5 |
| Total 2 (Class hours plus student homework hours in weeks 15-18) | | | | | | | 14 | |
| TOTAL <i>Total 1</i> + <i>Total 2</i> | 150 | | | | | | | |