MATH 341, Numerical Analysis, Winter, 2010
Walla Walla University

BULLETIN DESCRIPTION: Study of numerical methods with computer applications; topics include numerical solutions of nonlinear equations, systems of equations, ordinary differential equations, interpolation, and numerical integration. Prerequisites: CPTR 141; MATH 289. Corequisite: MATH 312.

INSTRUCTOR: Dr. Ken Wiggins, 338 KRH, 527-2088

OFFICE HOURS: 3 M, 2 Tu-Th, 10 F, Other Office hours by appointment

OBJECTIVES: After finishing this course, students should be able solve problems and to organize and effectively communicate ideas involving each of the following:

- numerical algorithms for each of the topics listed in the course description
- discuss convergence and error analysis on these algorithms
- the advantages and disadvantages of the methods studied
- using computers and mathematical software to solve problems

TEXT: *Numerical Analysis, 8th edition, by Burden and Faires, 2005, Thomson, Brooks/Cole, ISBN 0-534-39200-8*

SOFTWARE: *The primary software packages used in this course will be C, Maple, Matlab, and Sage.*

ASSESSMENT: *All assessment will be based on both the correctness and quality of your work, including the quality of your presentation.*

Assessment Category	*Weight*
Homework	*15%*
Projects	*5%*
Midterm tests	*35%*
Final examination	*40%*

Grade	*Percent*	*Grade*	*Percent*	*Grade*	*Percent*	*Grade*	*Percent*
A	*91-100%*	*B*	*83-85%*	*C*	*70-74%*	*D*	*58-62%*
A-	*89-90%*	*B-*	*80-82%*	*C-*	*65-69%*	*D-*	*55-57%*
B+	*86-88%*	*C+*	*75-79%*	*D+*	*62-64%*	*F*	*0-54%*

HOMEWORK: *Homework assignments will be given each week, and these will be due each Friday at the beginning of class. However, you may turn in your assignment as late as 3 PM on Friday without penalty. Papers submitted later than 3 PM on Friday will not be accepted. All solutions should be presented clearly and should include documentation of the solution process. Assignments should be folded lengthwise and clearly labeled on both the outside and on the inside of the first page of your homework. Some of these homework assignments will require the use of computer software.*

PROJECTS: *Two computer projects will be assigned. These will require the use of C or Matlab, or possibly other environments with prior permission of the instructor.*

MIDTERM TESTS: *These in-class tests will cover both lectures and homework.*

FINAL EXAMINATION: *This test is scheduled for Wednesday, March 17 from 8 to 9:50 AM. Attendance is required, so make your travel plans early with this appointment in mind.*

CLASS ATTENDANCE: *Students are expected to attend all classes. In addition, students are expected to give their full attention to the class discussions, and to be courteous, respectful, and supportive of the learning environment. Cell phones, computers, personal organizers, and all other electronic devices are not to be used by students during class. Modifications in the homework assignments or test schedule may be announced in class.*

ACADEMIC INTEGRITY: *Some collaboration on homework is allowed, but the work you submit for grading must be your own. Any type of cheating on a test or examination, including but not limited to copying another students work or using unauthorized notes or electronic equipment, will result in a zero grade for the test or a failing grade for the quarter, and possibly further disciplinary action taken by the Associate Vice President for Academic Administration.*

DISABILITIES: *If you have a physical and/or learning disability and require accommodations, please contact your instructor or the Special Services office at 527-2090. This syllabus is available in alternative print formats upon request. Please ask your instructor.*

TENTATIVE SCHEDULE: *Subject to possible change.*

Week	*Topic*	*Assmt*	*Exercises to Work*
1	*Introduction* *Numerical errors and computer arithmetic* *IEEE Example* *Using Maple, examples* *Algorithms (pdf)* *Algorithms (maple)* *Rate of convergence – continuous* *Rate of convergence – discrete* *Biscection method*	*H1*	*Section 1.1 #1a,3c,5,14* *1.2 #1a,3c,12,15a,16a*
2	*Fixed-point iteration* *Maple example* *Newton's method* *Maple example* *Newton and secant Maple example)* *Order of convergence*	*H2*	*Section 1.3 #1a,6a,7d,8,14;* *For additional delicious exercises click here.* *Section 2.1 #3b,6b,12*
3	*Multiple zeros and Newton* *Polynomial Evaluation* *Synthetic division* *Example of Newton's method with Horner's Rule*	*H3*	*Section 2.2 #6,11a,15* *Section 2.3 #6b,8b* *Section 2.4 #1a,3a,11*
4	*Muller's method* *Muller example Maple example – complex* *Lagrange interpolation* *Lagrange example – Maple* *Lagrange example with function – Maple* *Divided differences* *Divided differences details* *Test #1 Suggested review exercises*	*H4*	*Section 2.6 #2a,3a;* *3.1 #1a,3a,5a,9a,30* *(replace "feasible" with* *"more accurate");*
5	*Differentiation,Example* *Richardson's extrapolation* *Example* *Numerical integration* *Example*	*H5*	*Section 3.2 #1a,11,13* *(replace "third order forward differences")* *with "third divided differences."),17* *Section 4.1 #5a,7a,24,27* *(use at most 12 significant digits)*
6	*Romberg integration* *Example* *Adaptive quadrature, Example* *Example*	*H6*	*Section 4.2 #1b,2b,9;* *Section 4.3 #1a,3a,5a,7a,15,20;* *Section 4.4 #1a,3a,11b;*
7	*Differential equations* *Euler's method* *Maple example* *Test #2 Suggested review exercises* *Runge-Kutta methods* *Second-order RK example* *Fourth-order RK example*	*H7*	*For homework problems, click here.*

TENTATIVE SCHEDULE: *Subject to possible change.*

Week	*Topic*	*Assmt*	*Exercises to Work*
8	*Systems of differential equations* *Maple example*	*H8*	*Section 5.1 #1a,2a (If the theorem doesn't apply, say so and justify your claim.),3a* *Section 5.2 #1c,11 (Use h=0.2, 0.1, .05, .001, .0001, .00001 with 6 significant digits.)* *Section 5.4 #1a,13a*
9	*Cubic spline interpolation* *Drawing example* *Parametric spline example* *Hermite spline example* *Bezier spline example* *Test #3. Friday, Suggested review exercises*	*H9*	*Section 5.9 #1a (one step if done without automated program);* *Section 3.4 #3c,5c,11,29;*
10	*Error control* *Runge-Kutta-Fehlberg example – Maple* *Multi-step methods* *A Maple derivation*		*Section 3.5 #2ad* *Section 5.5 #2a (one step if done by hand, use hmax=0.2)* *Section 5.6 #3b (Change instructions – Use AB 4-step to predict and AM 3-step to correct. Click here for starting values.)*
11	*Final Exam, Suggested review exercises* *Wednesday, March 17,* *8-9:50 AM*		