MATH 230 (L1): Introduction to Numerical Methods

Instructor: **Office:** 3478; **Email**: magan@ust.hk; Prof. Jianping Gan Tel: 7421; Office hour: Wed: 16:30-17:30 16:30-17:20 Tue, and Thu., Class schedule: Venue: 2464 Teaching Assistants: Jingjing Wang (maariel@ust.hk); Kin Ping Chan (ckpaa@ust.hk) **TA sessions:** 15:00-15:50 T1a, Fri. rm2463 (Wang) T1b, Wed., 10:30am-11:20am, rm 4006 (Wang); Office hour: Wed. 11:30-12:30 rm3214 T1c. Fri. 18:00-18:50 rm2463 (Chan) Office hour: Fri.,16:00-18:00, rm1018

Textbook:

Numerical Analysis, 8th ed., by Burden, R.L. and Faires J. D., Thomson Brooks/Cole. http://www.as.ysu.edu/~faires/Numerical-Analysis

Grading:

<u>Mid-term</u> : 30%, Venue (TBD), 19:00-20:30, March 23, 2010

<u>Final</u> : 70%, All materials taught in the whole semester will be tested, including those already tested in the midterm exam. But focus will be on those topics not covered in the midterm exam.

(Exams are closed books and notes, and no formula sheets are provided. However, you are allowed to bring one 3in x 5in note card (front and back) to write whatever you think helpful or necessary. Calculators approved by Hong Kong Examinations and Assessment Authority (香港考試及評核局) are allowed. Use 5-digit rounding arithmetic in all calculations.)

Assignments: Assigned and graded, but not marked. Solutions will be provided.

Topics:

Introduction to computational world (Chapter 1) **Root Finding** (Chapter 2)

Root Finding (Chapter 2)

- Bisection method (2.1)
- Fixed-point iteration (2.2)
- Newton's method, Secant method (2.3)

Interpolation (Chapter 3)

- Interpolation and the Lagrange (interpolating) polynomial (3.1)
- Divided differences and Newton's interpolatory divided-difference formula (3.2)

Least Squares Data Fitting (chapter 8)

• Least squares data fitting--data fitting, modes, normal equation (8.1)

Numerical Differentiation and Integration (Chapter 4)

- Numerical differentiation--forward, backward, and central finite differences (4.1)
- Elements of numerical integration (4.3)
- Composite rules (4.4)
- Gaussian quadrature--Gaussian node points, weights (4.7)

Solution of Ordinary Differential Equations (Chapter 5)

• Euler's method (5.2)

Solving Linear Systems (Chapters 6 & 7)

- Gauss elimination--multipliers, Gauss elimination, back substitution, pivoting (6.1 6.2)
- LU factorization--LU, forward substitution (6.5)
- Iterative methods--matrix splitting, Jacobi method, Gauss-Seidel method, SOR method (7.3)