# Course Syllabus of Engineering Mathematics 1

## Announcements:

Please note that all lectures, assignments and exams for this course are **in English**.

## 1. Class Information

**1) Class:** Engineering Mathematics 1

**2) Semester:** Spring 2012

**3) Time:** Mon. 09:30-11:00 a.m., Wed. 09:30-11:00 a.m.

**4) Location:** Room 302, Bldg. 43-1

**5) Instructor:** Prof. Kyu-Yeul Lee

Office: Room 208, Bldg. 34, E-mail: kylee@snu.ac.kr, Phone: (02)880-7327

Office Hours: Available before school and after school by appointment.

**6) Teaching assistants:**

Main assistant: Sol Ha (E-mail: hasol81@snu.ac.kr)

Other assistant: Namkug Ku (E-mail: knk80@snu.ac.kr)

Office: Room 308, Bldg. 34, Phone: (02)880-8378

## 2. Course Topics and Description:

The course is aimed at developing the basic Mathematical skills for Engineering students that are imperative for effective understanding of Engineering subjects. The topics introduced will serve as basic tools for specialized studies in many Engineering fields. There are four main sections: Ordinary Differential Equations(first-order ODEs, second-order linear ODEs, higher order ODEs, series solution of ODEs); Partial Differential Equations(basic PDEs, Fourier analysis); Linear Algebra (vectors, matrices) and Vector Calculus (differentiation and integration of vectors). Students should understand and be able to use the language and methods of mathematics in the description, analysis and design of engineering systems.

## 3. Lecture notes and References

### 1) Lecture notes (hand out):

- Lee, Kyu-Yeul, Open Course Ware(OCW) “Engineering Mathematics 2” in Korean, Seoul National University, Fall 2008.

### 2) References:

- Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, Inc., 2011.

- Dennis G. Zill, Warren S. Wright, Advanced Engineering Mathematics, 4th Edition, Jones & Bartlett Learning, 2009.

## 4. Grade Computation

- 1st Exam: 20%
- 2nd Exam: 20%
- Final Exam: 20%
- Homeworks[1)]: 30%
- Attendance and activities during class time[2)]: 10%

1) Homework will be assigned every Wednesday and will be collected before next Wednesday's class begins. Late homework will not be accepted.

2) Students should answer the question of the instructor correctly during class time.

Most instructions will be made only on the website, so check it frequently.

**Website**: http://asdal.snu.ac.kr

| | 1st Exam | 2nd Exam | Final Exam |
|---|---|---|---|
| Date | March 31th, 2012 (Saturday), 13:00~16:00 | May 12th, 2012 (Saturday), 10:00~13:00 | June 14th, 2012 (Thursday), 18:00~21:00 |
| Range of Exam | First-Order ODEs<br>Second-Order Linear ODEs<br>High Order Linear ODEs | Partial Differential Equations<br>Series Solutions of ODEs<br>Fourier Analysis<br>Systems of ODEs | Linear Algebra<br>Vector Calculus |

| Week | Parts | Regular Lectures | | | | Supplementary Lectures | |
|---|---|---|---|---|---|---|---|
| | | Monday | | Wednesday | | Wednesday | |
| | | Date | Time: 09:30-11:00 | Date | Time: 09:30-11:00 | Date | Time: 18:00-20:50 |
| 1 | ODEs (Ch.1~3) | 3/5 | Ch.01 First-Order ODEs<br>- Basic Concept, Separable ODEs | 3/7 | Ch.01 First-Order ODEs<br>- Exact ODEs, Linear ODEs | | |
| 2 | | 3/12 | Ch.02 Second-Order Linear ODEs<br>- Homogeneous Linear ODEs of Second Order<br>- Modeling of Mass-Spring-Damper System | 3/14 | Ch.02 Second-Order Linear ODEs<br>- Linearize, Linear Model, Linearly Independent<br>- Basic Solution, Linear Combination | 3/14 | First-Order ODEs<br>Second-Order Linear ODEs |
| 3 | | 3/19 | Ch.02 Second-Order Linear ODEs<br>- Boundary Value Problems | 3/21 | Ch.02 Second-Order Linear ODEs<br>- Euler-Cauchy Equation | | |
| 4 | | 3/26 | Ch.02 Second-Order Linear ODEs<br>- Variation of Parameters | 3/28 | Ch.03 High Order Linear ODEs<br>- Beam Theory | 3/28 | Second-Order Linear ODEs<br>High Order Linear ODEs |
| 5 | PDEs (Ch.12) | 4/2 | Ch.12 Partial Differential Equations (PDEs)<br>- Heat Equation, Wave Equation | 4/4 | Ch.12 Partial Differential Equations (PDEs)<br>- Laplace Equation, Fourier Series | | |
| 6 | | 4/9 | Ch.12 Partial Differential Equations (PDEs)<br>- Laplacian in Polar Coordinates<br>- Fourier-Bessel Series | 4/11 | Ch.12 Partial Differential Equations (PDEs)<br>- Laplace Equation in Cylindrical and Spherical Coordinates<br>- Fourier-Legendre Series | 4/11 | Partial Differential Equations (PDEs) |
| 7 | Series Solution (Ch.5) | 4/16 | Ch.05 Series Solutions of ODEs<br>- Bessel Equation, Bessel Functions | 4/18 | Ch.05 Series Solutions of ODEs<br>- Legendre Equation, Legendre Polynomials | | |
| 8 | Fourier Analysis (Ch.11) | 4/23 | Ch.11 Fourier Analysis<br>- Sturm-Liouville Boundary Problem | 4/25 | Ch.11 Fourier Analysis<br>- Eigen Function, Orthogonality | 4/25 | Series Solutions of ODEs<br>Fourier Analysis |
| 9 | | 4/30 | Ch.11 Fourier Analysis<br>- Convolution Integral<br>- Fourier Transform | 5/2 | Ch.11 Fourier Analysis<br>- Discrete Fourier Transform(DFT)<br>- Fast Fourier Transform(FFT) | | |
| 10 | Systems of ODEs (Ch.4) | 5/7 | Ch.04 Systems of ODEs<br>- Systems of ODEs as Models in Engineering Applications<br>- Basic Theory of Systems of ODEs | 5/9 | Ch.04 Systems of ODEs<br>- Constant-Coefficient Systems, Phase Plane Method<br>- Criteria for Critical Points, Stability | 5/9 | Fourier Analysis<br>Systems of ODEs |
| 11 | Linear Algebra (Ch.7~8) | 5/14 | Ch.07 Linear Algebra: Matrices, Vectors, Determinants, Linear Systems<br>- Linear Systems of Equations, Gauss Elimination<br>- Linear Independence, Rank of a Matrix, Vector Space | 5/16 | Ch.07 Linear Algebra: Matrices, Vectors, Determinants, Linear Systems<br>- Determinants<br>- Inverse of a Matrix, Gauss-Jordan Elimination | | |
| 12 | | 5/21 | Ch.08 Linear Algebra: Matrix Eigenvalue Problems<br>- The Matrix Eigenvalue Problems<br>- Eigenvalues and Eigenvectors | 5/23 | Ch.08 Linear Algebra: Matrix Eigenvalue Problems<br>- Symmetric, Skew-Symmetric, and Orthogonal Matrices<br>- Eigenbases, Diagonalization, Quadratic Forms | 5/23 | Linear Algebra |
| 13 | Vector Calculus (Ch.9~10) | 5/28 | 석가 탄신일(공휴일) | 5/30 | Ch.09 Vector Differential Calculus<br>- Inner Product, Vector Product, Derivatives<br>- Curves, Arc Length, Curvature, Torsion | | |
| 14 | | 6/4 | Ch.09 Vector Differential Calculus<br>- Gradient of a Scalar Field, Directional Derivative<br>- Divergence/Curl of a Vector Field | 6/6 | 현충일 | | |
| 15 | | 6/11 | Ch.10 Vector Integral Calculus<br>- Line Integrals<br>- Green's Theorem in the Plane | 6/13 | Ch.10 Vector Integral Calculus<br>- Surface Integrals<br>- Divergence Theorem of Gauss<br>- Stokes' Theorem | 6/13 | Vector Calculus |