

Course Information and policies for  
ME 6000  
Computational Methods in Engineering  
Aug-Nov 2015

Instructors

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## Course Content<sup>1</sup>

### **Approximations (Self-Study)**

Accuracy and precision, definitions of round off and truncation errors, error propagation.

### **Linear algebraic equations (SN)**

Formulations and solution of linear algebraic equations, Gauss elimination, LU decomposition, iteration methods (Gauss-Siedel), convergence of iteration methods, Eigen values and Eigen vectors.

### **Solution of non-linear equations (SPV)**

Bisection method, Fixed point iteration, Newton Raphson method, Solution of a set of non-linear equations

### **Interpolation methods (SPV)**

Newton's divided difference, interpolation polynomials, Lagrange interpolation polynomials

### **Differentiation and integration (SPV)**

High accuracy differentiation formulae, extrapolation, derivatives of unequally spaced data, Gauss quadrature and integration

### **Transform techniques (SN)**

Continuous Fourier series, frequency and time domains, Laplace transform, Fourier integral transform, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT)

### **Differential equations (RK)**

Initial and boundary value problems, Eigen value problems, solution to elliptic and parabolic equations, partial differential equations

### **Regression methods (RK)**

Linear and non-linear regression, multiple linear regression, general linear least squares

### **Statistical methods (SN)**

Statistical representation of data, modeling and analysis of data, test of hypotheses

### **Introduction to optimization methods (RK)**

Local and global minima, Line searches, Steepest descent method, Conjugate gradient method, Quasi Newton method, Penalty function

Solution to practical engineering problems using software tools.

## Grading Policy

- Quiz-1 (on 07-September-2015): **15%**
- Quiz-2 (on 12-October-2015): **15%**
- Assignments (dates will be announced in the class): **30%**<sup>2</sup>
  - Approximately one assignment for each topic
- Final Exam (on 18-November-2015): **40%**
- **The pass mark for this course is absolute and it is 40%.**
- The grading for this course could be also absolute. Students will be intimated about this decision before Quiz-1.

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<sup>1</sup>Various text books or reference books are mentioned at the end of this document. Students are encouraged to go through these books in addition to the lecture notes.

<sup>2</sup>There will be a viva which determines the total assignment marks

## **Honor Code**

- Students are expected to carry out INDIVIDUAL home works/assignments in its literal sense.
- Late submission of assignments will be penalized.
- 85% attendance is required as per institute norms to be allowed to write the final exam.
- Group assignments (if any) should be carried out with equal load distribution amongst the members of the group.
- Students are expected to report their difficulties in understanding the subject matter as early as possible to receive additional help apart from lectures.
- Each assignment is a potential ladder for next grade. It is not unlikely that students get a lower grade for being short of one mark!
- Please enter your details at the following link: <http://goo.gl/forms/t18yn8FjGK>

## **Class Schedule**

The course is in slot A and is a 10 credit (3(L)-1(T)-6(OC)-10) course. Details about the tutorial session will be announced in the beginning of second week. The organization of lectures will be made clear in the first week depending on the number of students in the class.

The lecture hours will be as follows:

- Monday 8:00 - 8:50
- Tuesday 12:00 - 12:50
- Thursday 11:00 - 11:50
- Friday 10:00 - 10:50

## **References**

- [1] S. P. Venkatesan, *Computational Methods in Engineering*, Ane Books India, New Delhi, 2014.
- [2] Gilbert Strang, *Computational Science and Engineering*, Wellesley-Cambridge Press, Wellesley, 2007.
- [3] Steven C. Chapra, *Applied Numerical Methods with MATLAB for Engineers and Scientists*, 3<sup>rd</sup> edition, Tata-Mcgraw Hill, New Delhi, 2012.
- [4] Steven C. Chapra and Raymond P Canale, *Numerical Methods for Engineers*, 5<sup>th</sup> edition, Tata-Mcgraw Hill, New Delhi, 2007.
- [5] Robert J. Schilling and Sandra L. Harris, *Applied Numerical Methods for Engineers using Matlab and C*, Brooks/Cole, Pacific Grove, 2000.
- [6] Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, *Probability and Statistics for Engineers and Scientists*, 7<sup>th</sup> edition, Pearson Education, Singapore, 2002.