## COURSE NUMBER & COURSE TITLE: ME 300 MATLAB and its application in Engineering

<table>
<thead>
<tr>
<th>INSTRUCTOR:</th>
<th>Xiaofeng, Hu</th>
<th>Credits:</th>
<th>3</th>
<th>Language of instruction:</th>
<th>Chinese / English</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shengxian Shi</td>
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<thead>
<tr>
<th>REQUIRED COURSE OR ELECTIVE COURSE:</th>
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<tr>
<td>TERMS OFFERED:</td>
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<thead>
<tr>
<th>COURSE STRUCTURE/SCHEDULE:</th>
<th>Normal lecture</th>
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<tbody>
<tr>
<td>Computer based exercise</td>
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<tr>
<th>PRE-REQUISITES:</th>
<th>Advanced Mathematics</th>
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<tr>
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<td>Linear Algebra</td>
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<tr>
<th>ASSESSMENT TOOLS:</th>
<th>Class attendance—10%</th>
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<tbody>
<tr>
<td></td>
<td>Assignments—20%</td>
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<tr>
<td></td>
<td>Project design—40%</td>
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<td>Final term—30%</td>
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<tr>
<th>PROFESSIONAL COMPONENT:</th>
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<tr>
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<td>Engineering Design-1 credit</td>
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### TEXTBOOK/READING LIST

**Text book**

1. 《MATLAB 基础及在运筹学中的应用》，王翼，机械工业出版社，2012

**Reading list**


### COURSE DESCRIPTION:

Matlab is one of the most widely used high-level computing languages; it provides users a friendly and interactive environment for algorithm development, data visualisation, data analysis, and numeric computation. With its extensive libraries of mathematical and graphical routines, Matlab is widely used in areas such as signal and image processing, communications, control design, test and measurement, financial modelling and analysis, and computational biology. This course provides a progressively gentle introduction to Matlab. It is designed to give students fluency in Matlab, including fundamentals of Matlab, programming, solving mathematic equations with Matlab, data visualisation etc. Besides normal lecturing, this course also provides student computer based exercise, which ensures student understand and master the key knowledge of Matlab.

### COURSE OUTCOMES [Related ME Program Outcomes in brackets]

After successful completion of this course, students should be able to:

1. Become familiar with fundamental operations in Matlab (A4.2)
2. Perform statistical data analysis, data interpolation by Matlab, solve differentiation equation with Matlab (A5.2)
3. Acquire a reasonable level of competence in designing optimization algorithms, solve linear programming, constrained and unconstrained optimization problems by Matlab (A5.4)
4. Apply Matlab to solve practical engineering problems (A4.2、A5.2、A5.4、B2、B4、C2、C4)
5. Master used skills in Matlab programming, code debugging (A4.2、A5.2、C2)

### RELATED ME PROGRAM OUTCOMES:

A2. Analytical technology
A4 Modern Engineering Tools

| PREPARED BY: | Xiaofeng Hu, Shengxian Shi | REVISION DATE: | Nov. 20, 2012 |
MATLAB and its application in Engineering Course Syllabus

COURSE INSTRUCTORS

<table>
<thead>
<tr>
<th>Name: Shengxian Shi</th>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office: Room 533, Building A</td>
<td>Office:</td>
</tr>
<tr>
<td>Email: <a href="mailto:kirinshi@sjtu.edu.cn">kirinshi@sjtu.edu.cn</a></td>
<td>Email:</td>
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TEXTBOOK

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READING REFERNCE


COURSE PRE-REQUISITES

Advanced Mathematics, Linear Algebra

COURSE LEARNING OBJECTIVES

After successful completion of this course, students should be able to:
1. Become familiar with fundamental operations in Matlab (A4.2)
2. Perform statistical data analysis, data interpolation by Matlab, solve differentiation equation with Matlab (A5.2)
3. Acquire a reasonable level of competence in designing optimization algorithms, solve linear programming, constrained and unconstrained optimization problems by Matlab (A5.4)
4. Apply Matlab to solve practical engineering problems (A4.2, A5.2, A5.4, B2, B4,
5. Master used skills in Matlab programming, code debugging (A4.2, A5.2, C2)

**SCHEDULE**

1. Matlab Fundamentals (6 lessons)
   1.1 Introduction to Matlab
   1.2 Arithmetic operations and variable assignment
   1.3 Vector and matrix
      1.3.1 Fundamentals
      1.3.2 Elementary matrix operations
      1.3.3 Matrix inversion
      1.3.4 Systems of linear equations
      1.3.5 Eigenvalues and eigenvectors
      1.3.6 Matrix transpose special matrices
      1.3.7 Functions which perform element-by-element operations on matrices
      1.3.8 Functions length, size, sum, mean, max, min
   1.4 Data input and output
   1.5 Logical operations

2. Programs (6 lessons)
   2.1 Script files
   2.2 Function files
   2.3 Control structures
      2.3.1 Some useful commands
      2.3.2 Conditional control structures
      2.3.3 Repetitive control structures
      2.3.4 The for loop
      2.3.5 The while loop
   2.4 Graphics
      2.3.1 2-D & 3-D plots
      2.3.2 Fractals and chaos
      2.3.3 Making movies

3. Mathematics in Matlab (6 lessons)
   3.1 Character strings
   3.2 Symbolic math
   3.3 Numerical integration
   3.4 Numerical differentiation
   3.5 Statistical analysis and simulation
      3.5.1 Random samples from a uniform distribution
      3.5.2 Random samples from a Gaussian distribution
      3.5.3 Simple statistical analysis
      3.5.4 Functions to calculate mean and standard deviation of data
   3.6 Representation of polynomials in Matlab
      3.6.1 Solving polynomial equations
3.6.2 Fitting a polynomial to data
3.6.3 Multiplication and division of polynomials
3.7 Curve fitting
4 Optimization algorithms in Matlab (9 lessons)
   4.1 Introduction to the optimization toolbox
   4.2 Fundamentals of the optimization algorithms
   4.3 Solving optimization problems
   4.4 Linear programming
   4.5 Constrained and unconstrained optimization
   4.6 Continuous and discrete optimization
5 Applications (3 lessons)
   5.1 Digital image processing by Matlab
   5.2 Numerical solution of the heat transfer equation
6 Computer based programming exercise (9 lessons)
   6.1 Exercise on Matlab fundamentals (3 lessons)
   6.2 Exercise on Matlab programming (3 lessons)
   6.3 Exercise on optimization algorithms in Matlab (3 lessons)
7 Project design (9 lessons)
   7.1 Decipher a coded message from James Bond (007)
   7.2 Simulation on the trajectory of a high speed mixer head
   7.3 Predicting flow rate of Huangpu river by using data fitting and interpolation

TEACHING STYLE
1. Normal lecture
2. Classroom exercise and discussion
3. Computer based exercise

STUDENT’S LEARNING STYLE
1. Students presentation during some of session break
2. Course projects to be done during the term. Teamwork is highly encouraged in and after class discussion and team projects
3. Assignment
4. A final exam

GRADING FORMAT AND POLICY

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<tr>
<td>3</td>
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<td>4</td>
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