1. **Instructors**
   
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   *Name:* Liu, Haixia (L3)  
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   *Name:* Wong, Ka Yue Daniel (L4/L5)  
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2. **Tutors**
   
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Name: Li, Ting (T5C/D)  
Contact Details: Room 3214, tel: ext-7467, email: tlial@ust.hk

3. Meeting Time and Venue

Lectures:

Date/Time: L1: Monday, Wednesday, and Friday (12:00 – 12:50)  
Venue: LTG

Date/Time: L2: Monday, Wednesday, and Friday (13:30 – 14:20)  
Venue: LTG

Date/Time: L3: Monday, Wednesday, and Friday (09:00 – 09:50)  
Venue: LTG

Date/Time: L4: Monday and Wednesday (10:30 – 11:50)  
Venue: Room 2502

Date/Time: L5: Monday (15:00 – 16:20) and Friday (10:30 – 11:50)  
Venue: Room 2502

Tutorials:

Date/Time: T1A: Fri (18:00-18:50); T1B: Mon (09:30-10:20); T1C Thu (18:00-18:50); T1D Mon (18:00-18:50)  
Venue: T1A: Room 3584; T1B: Room 5560; T1C: Room 4480; T1D: Room 3584

Date/Time: T2A: Thu (15:00-15:50); T2B: Wed (15:00-15:50); T2C: Tue (09:30-10:20); T2D: Mon (09:30-10:20)  
Venue: T2A: G003 (CYT); T2B: G003 (CYT); T2C: Room 3584; T2D: G003 (CYT)

Date/Time: T3A: Tue (18:00-18:50); T3B: Tue (09:30-10:20); T3C: Thu (16:30-17:20); T3D: Mon (17:30-18:20)  
Venue: T3A: Room 3584; T3B: Room 4480; T3C: G003 (CYT); T3D: Room 5562

Date/Time: T4A: Tue (12:00-12:50); T4B: Mon (18:00-18:50); T4C: Mon (15:00-15:50); T4D: Mon (09:30-10:20)  
Venue: T4A: Room 5562; T4B: Room 3588; T4C: G003 (CYT); T4D: Room 3588

Date/Time: T5A: Mon (16:30-17:20); T5B: Tue (10:30-11:20); T5C: Wed (15:00-15:50); T5D: Fri (15:00-15:50)  
Venue: T5A: Room 5562; T5B: Room 3588; T5C: Room 3584; T5D: Room 3588

4. Course Description

Credit Points: 3
Pre-requisite: A passing grade in AL Pure Mathematics / AL Applied Mathematics; OR MATH 1014; OR MATH 1018; OR MATH 1020; OR MATH 1024
Exclusion: MATH 2121, MATH 2131, MATH 2350

Brief Information/synopsis:
This course covers the basic concepts and computation techniques of linear algebra that are essential for various applications in science and engineering subjects.

5. Intended Learning Outcomes
On successful completion of this course, students are expected to be able to:

<table>
<thead>
<tr>
<th>No.</th>
<th>ILOs</th>
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<tbody>
<tr>
<td>1</td>
<td>Explain the core theories and concepts of a system of linear equations.</td>
</tr>
<tr>
<td>2</td>
<td>Manipulate the basic algebra and computation techniques of matrices and determinants.</td>
</tr>
<tr>
<td>3</td>
<td>Describe the basic terminologies appeared in vector spaces and inner product spaces.</td>
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<tr>
<td>4</td>
<td>Formulate the concept and properties of eigenvalues and eigenvectors of a matrix.</td>
</tr>
<tr>
<td>5</td>
<td>Operate the diagonalization process and the Gram-Schmidt process, and to recognize their applications</td>
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6. Assessment Scheme
a. Examination duration: 1.5 hrs Mid-term Test / 3 hrs Final Examination

b. Percentage of coursework, examination, etc.:

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Assessing Course ILOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>10% Online Webwork Exercises</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>30% Mid-term Test</td>
<td>1, 2</td>
</tr>
<tr>
<td>60% Final Examination</td>
<td>1, 2, 3, 4, 5</td>
</tr>
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c. The grading is assigned based on students’ performance in assessment tasks/activities.

7. Student Learning Resources
Course Webpage: http://www.math.ust.hk/~malung/2111.html

8. Teaching and Learning Activities
Scheduled activities: Weekly 4 hrs (lecture + tutorial)
Online Webwork Exercises: (~3hrs/week self-study) https://webwork.math.ust.hk
The MATH Support Center (Rm 2612AB, walk-in access): tutors will be around providing learning support
Open hours: Mon-Fri (except holidays), 11am – 7pm. http://www.math.ust.hk/~support

9. Course Schedule (~36 lecture hours)
Keyword Syllabus:
- **Chap 1 Systems of Linear Equations** (~10 hours)
  (i) Systems of Linear Equations; (ii) Row Reduction and Echelon Forms; (iii) Vector Equations; (iv) The Matrix Equation $Ax = b$; (v) Solution Sets of Linear Systems; (vi) Linear Independence; (vii) Linear Transformations; (viii) The Matrix of a Linear Transformation.
• Chaps 2 and 3  **Matrix Algebra and Determinants**  (~8 hours)
  (i) Matrix Operations; (ii) Matrix Inverse; (iii) Characterizations of Invertible Matrices;
  (iv) Introduction to Determinants; (v) Properties of Determinants;
  (vi) Cramer's Rule, Volume, and Linear Transformations

• **Chap 4  Vector Spaces**  (~6 hours)
  (i) Vector Spaces and Subspaces; (ii) Null Spaces, Column Spaces, and Linear Transformations;
  (iii) Linearly Independent Sets and Bases; (iv) Coordinate Systems;
  (v) Dimension of a Vector Space and Rank of a Matrix.

• **Chap 5  Eigenvalues and Eigenvectors**  (~4 hours)
  (i) Eigenvectors and Eigenvalues; (ii) The Characteristic Equation; (iii) Diagonalization;
  (iv) Applications to Dynamical Systems and Differential Equations.

• **Chap 6  Inner Product Spaces**  (~6 hours)
  (i) Inner Product, Length, and Orthogonality; (ii) Orthogonal Sets; (iii) Orthogonal Projections;
  (iv) The Gram-Schmidt Process; (v) Least-Squares Problems; (vi) Applications to Linear Models.

• **Chap 7  Symmetric Matrices and Quadratic Forms**  (~2 hours)
  (i) Diagonalization of Symmetric Matrices; (ii) Quadratic Forms and the Principal Axes Theorem.