Course Outline EE3CK3
Mathematics for Linear Systems
Fall, 2008

Instructors:

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Outline of Topics (subject to change):

1. **Determinants, Matrices, and Linear Algebra**(3)

   - Determinants
   - Minors, Cofactors, and Laplaces's Expansion D_n
   - Pivotal Condensation
   - Matrices
   - Elementary Matrix Algebra
   - The Systems of Linear Equations $\mathbf{Ax} = \mathbf{B}$
   - Linear Independence and the Rank of a Matrix
   - $\mathbf{Ax} = \mathbf{B}$ revisited
   - Linear Vectors Spaces
   - Characteristic Values and Vectors

2. **Complex Variables and Contour Integration** (10)

   - Arithmetic Operations
   - Functions of a Complex Variables
   - Derivatives of a Complex Function
   - Laplace's Equation
   - Laplace and Fourier Transforms
   - Integration in the Complex Plane
   - The Taylor Series
   - The Evaluation of Definite Integrals through Contour Integration

- The Evaluation of Real Definite Integrals over Infinite or Semi Infinite Intervals
- Essential Singularities. Branch Points
- The Laurent Expansion; More on Residues

3. **The Laplace Transform and its Inversion** (10)

- The Laplace Transform
- The Laplace Transform of Derivatives and Integrals
- Shifting Theorems
- Initial and Final Value Theorems
- The Impulse Function
- The Convolution Integral and Linear System Response
- The Laplace Transform of Periodic Functions
- The Laplace Inversion Theorem
- Heaviside's Expansion Theorem
- Further Applications of the Laplace Transform
- The Diffusion Equation
- Matrix Differential Equations

4. **The Fourier Transform and Applications** (10)

- From Fourier Series to Fourier Transform
- The Exponential Fourier Transform Pair
- Fourier Cosine and Sine Transforms
- Theorems for Fourier Transform Pairs
- Fourier Transforms of Discontinuous Functions
- Fourier-Bessel Integrals: Tow-Dimensional Fourier Transforms
- The Wave Equation
- The Laplace Inversion Theorem
- Filters
- Applications of Fourier Transforms to Amplitude-and Frequency-Modulated Signals

5. **Discrete Transforms** (4)

- Discrete Signals, Difference Euqations
- The Z-Transform
- Properties of the Z-Transform
- The Inverse Z-Transform

- Additional Applications of the Z-Transform
- The Discrete Fourier Transform

6. **Review** (2)

Teaching Assistants:

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Course Objectives:

This course serves as the foundation for most other subsequent courses in electrical, computer and biomedical engineering. After completion of this course, the student will have gained the introductory knowledge required for the remaining part of their curriculum.

Format: 3 lectures, 1 tutorial per week.

Please note that students who miss the midterm, and who have a valid excuse, will be subjected to an oral makeup test or a written test, at the discretion of the instructor. Those who do not have a valid excuse will be assessed zero for the midterm component of the final grade.

Assessment: (subject to change)
Final exam (3 hrs) 50%
2 midterm tests 18% (each)
2 assignments 5% (each)
Tutorial attendance 4% (random check)

Important: Students must pass the combined midterm/exam component separately to get a pass in the course. The midterm and exam will be combined with the weighting 36% on the midterm and 50% on the final. A grade of 50% in this combination must be attained to pass. Statistical adjustments (such as bell curving) will not normally be used.

Calculator:

Only the standard McMaster calculator can be used on tests and exams.

Resources:

Custom Courseware: Shlomo Karni and William J. Byatt, "Mathematical Methods in Continuous and Discrete Systems"
Notes: will be placed on the course website.

Announcements:

The instructor(s) reserves the right to choose the format (i.e. written or oral) of any deferred midterm or exam in this course. Please note that announcements concerning any type of graded material may be in any format (e.g., announcements may be made only in class). Students are responsible for completing the graded material regardless of whether they received the announcement or not. What this means is that if you skip class and an announcement for an assignment, test etc. is made in that class, then you are still responsible for that material. If you miss it, then you get zero.

Plagiarism

Academic dishonesty will be taken very seriously. Any copying of labs etc. will be reported to the Office of Academic Integrity. Both the copyee and the copyor will be reported. On the first offence, the standard penalty is a zero on the work in question. Subsequent offences are much more serious: the student is typically assigned an F in the course, with a transcript notation indicating the F is for academic dishonesty.

Policy Reminders

The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem, that cannot be resolved by discussion among the persons concerned, individuals are reminded they should contact the Departmental Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.

Students are reminded that they should read and comply with the Statement on Academic Ethics and the Senate Resolutions on Academic Dishonesty as found in the Senate Policy Statements distributed at registration and available at the senate office.

"Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic

dishonesty"), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at http://www.mcmaster.ca/senate/academic/ac$_{-\text{integrity}}$.htm

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work. (E.g., using previous years lab reports).
3. Copying or using unauthorized aids in tests and examinations.