## Math 251 Class Outline <br> CAMOSUN COLLEGE MATHEMATICS DEPARTMENT

## Calendar Description

This course is restricted to students in the Engineering Bridge (UVic) program. Topics: complex numbers, linear systems and matrices, matrix operations, determinants, vectors in 2-space and 3-space, vector spaces, linear dependence and independence, orthogonality, eigenvalues and eigenvectors and linear transformations. Engineering applications are provided throughout the course.

## Course Information

| Instructors: <br> e-mails: <br> web site: | Drs. Peter J. Trushel and Chi-Ming Leung <br> trushel@camosun.bc.ca and leungc@camosun.bc.ca |
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| ebb tools: <br> Offices: | $\underline{\text { http://www.camosun.bc.ca/~trushel/math251 }}$ |

## Objectives

To learn the concepts, techniques and applications associated with vectors and matrices.

## Text

Howard Anton and Chris Rorres, Elementary Linear Algebra, Edition 8E, Wiley, 1997.

## Evaluation

Assignments $10 \%$

Two term tests: $40 \%$
Comprehensive final exam: $50 \%$

## Percentage to Letter Grade Conversion

## Percentage Letter Grade

| 95 to 100 | A+ |
| :--- | :--- |
| 90 to 94 | A |
| 85 to 89 | A- |
| 80 to 84 | B+ |
| 75 to 79 | B |
| 70 to 74 | B- |
| 65 to 69 | C+ |
| 60 to 65 | C |
| 50 to 59 | D |
| below 50 | F |

## Outline

## Complex Vector Spaces

| Text(Week) | Hours Topic |  |
| :--- | :--- | :--- |
| $10.1(1)$ | 1 | Complex Numbers |
| $10.2(1)$ | 1 | Modulus; Complex Conjugate; Division |
| $10.3(1)$ | 2 | Polar Form; DeMoivre's Theorem |
| Total hours | 4 |  |

## System of Linear Equations and Matrices

| Text(Week) | Hours Topic |  |
| :--- | :--- | :--- |
| $1.1(1)$ | read | Introduction to Systems of Linear Equations |
| $1.2(2)$ | 2 | Gaussian Elimination |
| $1.3(2)$ | 1 | Matrices and Matrix Operations |
| $1.4(2)$ | 2 | Inverses; Rules of Matrix Arithmetic |
| $1.5(2,3)$ | 2 | Elementary Matrices and a Method for Finding A ${ }^{-1}$ |
| $1.6(3)$ | 1 | Further Results on Systems of Equations and Invertibility |
| $1.7(3)$ | 1 | Diagonal, Triangular, and Symmetric Matrices |
| Total hours | 9 |  |

## Determinants

| Text(Week) | Hours Topic |  |
| :--- | :--- | :--- |
| $2.1(3)$ | 1 | The Determinant Function |
| $2.2(3)$ | 1 | Evaluating Determinants by Row Reduction |
| $2.3(3)$ | 1 | Properties of the Determinant Function |
| $2.4(4)$ | 1 | Cofactor Expansion; Cramer's Rule |
| Total hours | 4 |  |

## Vectors in 2-Space and 3-Space

| Text(Week) | Hours Topic |  |
| :--- | :--- | :--- |
| $3.1(4)$ | 1 | Introduction to Vectors (Geometric) |
| $3.2(4)$ | 1 | Norm of a Vector; Vector Arithmetic |
| $3.3(4)$ | 2 | Dot product; Projections |
| $3.4(4,5)$ | 2 | Cross Product |
| $3.5(5)$ | 2 | Lines and Planes in 3-Space |
| Total hours | $\mathbf{8}$ |  |

## Euclidean Vector Spaces

| Text(Week) | Hours Topic |  |
| :--- | :--- | :--- |
| $4.1(5)$ | 1 | Euclidean $\mathbf{n}$-Space |
| $4.2(5)$ | 2 | Linear Transformations from $\mathbf{R}^{\mathrm{n}}$ to $\mathbf{R}^{\mathrm{m}}$ |
| Total hours | $\mathbf{3}$ |  |

OUTLINE (continued)

## General Vector Spaces

| Text(Week) | Hours $\quad$ Topic |  |
| :--- | :--- | :--- |
| $5.1(6)$ | 1 | Real Vector Spaces |
| $5.2(6)$ | 1 | Subspaces |
| $5.3(6)$ | 2 | Linear Independence |
| $5.4(6,7)$ | 2 | Basis and Dimension |
| $5.5(7)$ | 2 | Row Space, Column Space, and Nullspace |
| $5.6(7)$ | 2 | Rank and Nullity |
| Total hours | $\mathbf{1 0}$ |  |

## Inner Product Spaces

| Text(Week) | Hours Topic |  |
| :--- | :--- | :--- |
| $6.1(7,8)$ | 2 | Inner Products |
| $6.2(8)$ | 2 | Angle and Orthogonality in Inner Product Spaces |
| $6.3(8)$ | 2 | Orthonormal Bases; Gram-Schmidt Process |
| $6.4(8,9)$ | 2 | Best Approximation; Least Squares |
| $6.5(9)$ | 2 | Orthogonal Matrices; Change of Basis |
| Total hours | $\mathbf{1 0}$ |  |

## Eigenvalues, Eigenvectors

| Text(Week) | Hours Topic |  |
| :--- | :--- | :--- |
| $7.1(9)$ | 2 | Eigenvalues and Eigenvectors |
| $7.2(9,10)$ | 2 | Diagonalization |
| Total hours | 4 |  |

## Linear Transformations

| Text(Week) | Hours Topic |  |
| :--- | :--- | :--- |
| $8.1(10)$ | 1 | General Linear Transformations |
| $8.2(10,11)$ | 2 | Kernel and Range |
| $8.4(11)$ | 2 | Matrices of General Linear Transformations |
| Total hours | $\mathbf{5}$ |  |

## Additional Topics

| Text(Week) | Hours Topic |  |
| :--- | :--- | :--- |
| $11.1(11)$ | 1 | Constructing Curves and sufaces through Specified Points |
| $9.2(11)$ | 1 | Geometry of Linear Operators on $\mathbf{R}^{2}$ |
| $9.3(11)$ | 1 | Least Squares Fitting to Data |
| Total hours | $\mathbf{3}$ |  |
|  |  |  |
| Lecture |  | $\mathbf{6 0}$ hours |
| Holidays |  | $\mathbf{4}$ hours |
| $2^{\text {nd }}$ Midterm |  | $\mathbf{2}$ hours |
| Total |  | $\mathbf{6 6}$ hours |

