ENGG1410C: Linear Algebra and Vector Calculus for Engineers
(2016-17 Term 2)

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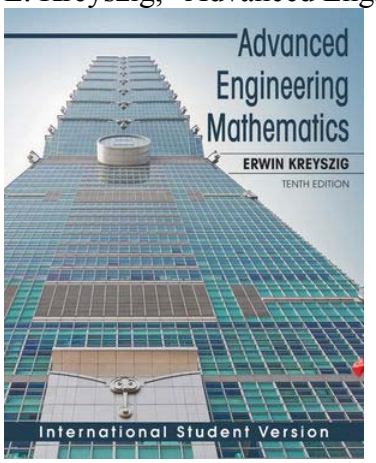
Course Objective
To convey *fundamental concepts* in *Linear Algebra* and *Vector Calculus* which are key mathematical tools for many fields of engineering. The course builds upon the mathematical training students acquired in MATH1510 on one-variable calculus and its simple multivariable variation. Vector integral calculus. Green's theorem, Gauss's theorem, stokes theorem

Textbook
E. Kreyszig, "Advanced Engineering Mathematics," Wiley, 10th edition, Aug. 2011



Course Coverage
Part A Ordinary Differential Equations (ODEs): Ch. 1-6
Part B Linear Algebra. Vector Calculus: Ch. 7-10
Part C Fourier Analysis. Partial Differential Equations (PDEs): Ch. 11-12
Part D Complex Analysis: Ch. 13-18
Part E Numeric Analysis Ch. 19-23
(Green Parts are not covered in the present course)

Course Schedule and Reading Assignment
Linear Algebra
Chapter 7. Linear Algebra: Matrices, Vectors, Determinants, Linear Systems (~4 weeks)
LA.1 7.1 Matrices, Vectors; Addition and Scalar Multiplications
7.2 Matrix Multiplication
LA.4 7.3 Linear Systems of Equations; Gauss Elimination
LA.2 7.4 Linear Independence; Rank of a Matrix
LA.4 7.5 Solutions of Linear Systems: Existence, Uniqueness

LA.2 7.6 For Reference: Second- and third-Order Determinants
7.7 Determinants; Cramer's Rule
LA.4 7.8 Gauss-Jordan Elimination
LA.1 7.8 Inverse of a Matrix;
20.2 LU-Factorization, Matrix Inversion
LA.3 7.9 Vector Spaces, Inner Product Spaces; Linear Transformation

Chapter 8. Matrix Eigenvalue Problems (~3 wks)
LA.5 8.1 The Matrix Eigenvalue Problem; Determining Eigenvalues and Eigenvectors
8.2 Some Applications of Eigenvalue Problems
LA.3 8.3 Symmetric, Skew-Symmetric, and Orthogonal Matrices
LA.5 8.4 Eigenbases; Diagonalization; Quadratic Forms

Vector Calculus
Chapter 9. Vector Differential Calculus: Grad, Div, Curl (~3 weeks)
VC.1 9.1 Vectors in 2-Space and 3-Space
9.2 Inner Product (Dot Product)
9.3 Vector Product (Cross Product)
9.4 Vector and Scalar Functions and Their Fields; Vector Calculus; Derivatives
VC.2 9.5 Curves; Arc Length
9.6 Calculus Review: Functions of Serval Variables
9.7 Gradient of a Scalar Field; Directional Derivatives
9.8 Divergence of a Vector Field
9.9 Curl of a Vector Field

Chapter 10. Vector Integral Calculus, Integral Theorems (~4 weeks)
VC.3 10.1 Line Integrals (VC.3)
10.2 Path Independence of Line Integrals (VC.3)
10.3 Double Integrals (VC.3)
10.4 Green's Theorem in the Plane (VC.3)
10.5 Surfaces for Surface Integrals (VC.3)
10.6 Surface Integrals (VC.3)
10.7 Triple Integrals, Divergence Theorem of Gauss (VC.3)
10.9 Stokes's Theorem (VC.3)

Reference for Supplementary Reading
- Michael D. Greenberg, "Advanced Engineering Mathematics". 2nd edition, Prentice Hall, 1988

Assessment Scheme

Homework Assignments (6)	20%
Mid-term Exam	30%
Final Exam	50%

Lecture/Tutorial

Lecture	Wednesday Thursday	1:30PM - 2:15PM 2:30PM - 4:15PM	LSK LT2 LSB LT1
Tutorial	Tuesday	4:30PM - 6:15PM	LSB LT1

Examination Dates

Midterm	March 14, 2017 (Using Tutorial Slots)
Final	Centralized, TBD

Tutors and Office Hours

Name	**Office**	**Office Extension**	**Email address**	**Office Hour**
Chen Yu	ERB313	56107426	1155089925@link.cuhk.edu.hk	Mon, 3-5pm
He Changran	ERB411	39438046	hechangran@link.cuhk.edu.hk	Th. 2-4pm
Liang Dong	ERB411	39438046	dliang@mae.cuhk.edu.hk	Tue 2-4pm
Song Chen	AB1, 1st/F		1155088240@link.cuhk.edu.hk	Wed 2-4pm
Wang Dongping	ERB322	39438040	dpwang@mae.cuhk.edu.hk	Fri 3-5pm

Course Learning Outcomes

It is desired that students acquire the following skills from taking the course:

1. Competent in understanding the roles and connections between matrices and vectors, linear equation solving, linear algebra and vector calculus
2. Able to formulate solutions to practical applications in engineering and economics using mathematical skills
3. Able to use special matrices such as triangular, diagonal, and orthogonal matrices
4. Able to understand Gauss elimination and Gauss-Jordan method and their relationship with elementary matrices for different types of matrix factorization and decomposition
5. Competent in using vectors and vector space for interpreting matrix rank and the different solutions to linear equations
6. Able to apply methods of vector calculus, including Jacobian, divergence, Green's and Stokes' theorems

Course website

Refer to Blackboard for latest lecture notes, assignments, grade information, announcements etc.

Student/Faculty Expectations
Students are encouraged to note and adhere to the document "Student/Faculty Expectations on Teaching and Learning" at http://www.erg.cuhk.edu.hk/Student-Faculty-Expectations.

A. STUDENT EXPECTATIONS: Students have the right to expect:
1. a positive, respectful, and engaged academic environment inside and outside the classroom;
2. classes offered at regularly scheduled times without undue variations, and to receive before term-end adequate make-ups of canceled classes;
3. to receive a syllabus including an outline of the course objectives, content and schedule, evaluation criteria, and any other requirements;
4. to consult with teacher and course tutors outside of usual classroom times through regularly scheduled office hours;
5. to have reasonable access to University facilities and equipment in order to complete course assignments and/or objectives;
6. to have access to guidelines on University's definition of academic misconduct within any course;
7. to have reasonable access to grading instruments and/or grading criteria for individual assignments, projects, or exams and to review graded material in a timely fashion;
8. to consult with each course's faculty member regarding the petition process for graded coursework.

B. FACULTY EXPECTATIONS: Teachers have the right to expect:
1. a positive, respectful, and engaged academic environment inside and outside the classroom;
2. students to appear for class meetings in a timely fashion;
3. to select qualified course tutors and the right to delegate responsibilities to these individuals;
4. students to appear at office hours or a mutually convenient appointment for official matters of academic concern;
5. full attendance at examination, midterms, presentations, and laboratories, with the exception of approved absences or emergency;
6. students to be prepared for class, appearing with appropriate materials and having completed assigned readings and homework;
7. full engagement within the classroom, including meaningful focus during lectures, raising questions, and class participation (avoid conversation or phone-calls not related to the lecture topic at hand);
8. to cancel class due to emergency situations and to cover missed material during subsequent class meetings;
9. students to act with integrity and honesty.

Academic Honesty

CUHK places high importance on honesty in academic work submitted by students, and adopts a policy of **zero tolerance** on cheating and plagiarism. Related offence will lead to disciplinary action including termination of studies at the University.

- Plagiarism is the act of using the work of others as one's own
- CUHK places very high importance on honesty in academic work submitted by students
- Related offence will lead to disciplinary action including termination of studies
- All student assignments submitted via VeriGuide for checking
- Teachers shall report all cases of plagiarism, or suspected cheating in examinations, to the disciplinary committees in Faculty and University level

Please refer to the following web link for details:

- University: Academic and Quality Section – document "Honesty in Academic Work: A Guide for Students and Teachers" at http://www.cuhk.edu.hk/policy/academichonesty/
- Faculty of Engineering – document "Guidelines to Academic Honesty" at http://www.erg.cuhk.edu.hk/upload/ENGG_Discipline.pdf