Aims

The course aims to provide the necessary mathematical tools from Linear Algebra, Laplace Transform theory, Analytic Geometry and the use of MATLAB computer program for second-year science and engineering courses. It builds on the previous Mathematics for Engineers and Scientists 1-3 courses

Syllabus

Laplace Transform: Laplace Transforms, Inverse Laplace Transforms, Solving Differential Equations (DEs) and Systems of DEs with Laplace Transforms. *(8 lectures)*

Analytic Geometry: Vector Algebra, Scalar and Vector Products, Lines and Planes, Derivatives of Scalar and Vector Functions, Directional Derivatives, Linear Approximation of Curves, Tangent Planes, Grad, Div, Curl. *(7 lectures)*

Linear Algebra: Systems of Linear Equations, Gaussian Elimination, Vectors and Matrices, Matrix Algebra, Inverse Matrices, Determinants, Eigenvectors and Eigenvalues, Applications to Differential Equations, Diagonalization of Matrices. *(16 lectures)*

Teaching and Assessment

Contact Hours: 3 lectures and 1 tutorial per week
Assessment: 15% by class tests or other continuous assessment
85% by end of module 2-hour exam
Resit Type: exam

By the end of the course, students should be able to:

- understand the basic terminology of liner algebra, Laplace transforms and analytic geometry.
- solve systems of linear equations by the method of Gaussian elimination.
- invert a matrix both by using Gaussian elimination and by computing cofactors.
- compute determinants, solve eigenvalue problems.
- understand how eigenvalue problems may arise in practical applications.
- diagonalize matrices.
- perform Laplace transforms and inverse Laplace transforms for most common functions.
- apply Laplace transforms to solve DEs and systems of DEs.
- perform basic vector operations.
- write equations of lines and planes and find angles between lines and planes.
- compute partial and directional derivatives of scalar and vector functions.
- write equations for piecewise approximation of curves and equations of tangent planes.
- apply Grad, Div and Curl operators.
- use MATLAB to: perform matrix and vector operations, solves systems of linear equations, find eigenvalues and eigenvectors of matrices, perform Laplace and inverse Laplace transforms, solve DEs.