UNIVERSITY OF CALGARY

FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 331 Advanced calculus for scientists

(see Course Descriptions for the applicable academic year: http://www.ucalgary.ca/pubs/calendar/)

Syllabus:

Topics	**Number of hours**
Functions of several variables, partial derivatives, continuity, partial derivatives, differentials and gradient. The chain rule, the tangent plane, directional derivatives, examples of partial differential equations	5
First order ordinary differential equations. Separable, linear and exact equations. Second and higher order linear equations with constant coefficients, the idea of separation of variables. Systems of linear equations with constant coefficients.	12
Double integrals in polar coordinates. Triple integrals, cylindrical and spherical coordinates. Parametric curves, Vector Fields, conservative vector fields, curl and divergence of a vector field. Line integrals, Green's theorem. Curl, divergence, Gauss theorem, Stokes theorem	11
Elements of combinatorics: permutations with and without repetitions, the notion of probability, a probability density function and the normal distribution	3
Orthogonal functions. The notion of direct and inverse Fourier Transform. Basic properties: linearity, behaviour at infinity. Application to frequency analysis	5
TOTAL HOURS	**36**

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. compute first and higher order partial derivatives, apply the chain rule and polar coordinates, check whether a given function is a solution of a partial differential equation or not;
2. solve first order linear, separable and exact equations, identify exact differentials, apply techniques for first order equations to practical models in natural sciences;
3. find solutions to higher order linear homogeneous ordinary differential equations;
4. write a system of linear first order differential equations in a matrix form and find the general solution for homogeneous systems with constant coefficients using eigenvalues and eigenvectors;
5. evaluate double and triple integrals using a change of variables, compute a curl and a divergence of a vector field, distinguish between conservative and non-conservative fields, evaluate line integrals and apply theorems of Green, Gauss and Stokes;
6. estimate probabilities of an event in a finite sample space, apply normal distribution;
7. identify orthogonal functions, connect the Fourier Transform with the frequency domain representation of a function.