

**Program Description**

One of the goals of scientific inquiry is to understand the processes of nature on a quantitative basis. In pursuit of this goal, mathematicians create models to represent the order they observe, and in turn devise mathematical methods for interpreting and solving these models. This program will provide a thorough and engaging introduction to such mathematical methods and the associated techniques of model building. In fall quarter, we covered differential equations, linear algebra and multivariable calculus and their various applications in physics and economics. In winter quarter we will consider non-linear systems and their role in cyclical, chaotic and self-organizing behavior. We will cover partial differential equations and their applications in physical systems. There will also be an introduction to the calculus of variations with applications to finding optimal curves and surfaces. In addition to the theoretical work, we will also discuss questions of a more philosophical and historical nature. Is mathematics discovered or created? What role do mathematical models play in representing reality, and who were the people behind the important developments in calculus.

**Prerequisites (from Fall Quarter):**

Ordinary Differential Equations, Linear Algebra, Multivariable Calculus, Mathematica

**Winter Topics (with credits):**

Partial Differential Equations (5), Non-linear Dynamics (5), Vector and Variational Calculus (4), History of Mathematics, Student Projects (2)

**Winter Schedule**

Monday	Tuesday	Wednesday	Thursday
9:30-12:00 Non-Linear Dynamics Lecture  Sem II E2109	9:30 -12:00 Partial Differential Equations Lecture  Sem II E2109	9:30-12:00 Non Linear Dynamics Lecture and Workshop  Sem II E2109	9:30-12:00 Partial Differential Equations Lecture and Workshop  Sem II E2109
Lunch			
1:00-3:00 Variational Calculus (5 Weeks) Seminar/Presentati ons (5 Weeks)  Sem II E2109	1:00-2:30 Vector Calculus Lab II 2242  2:30-4:00 Computer Lab CAL East	1:00-3:00 Optional Tutorials	

### **Required Texts for Winter Quarter**

(These will be available in the book store, but will be cheaper to buy secondhand online)

- Nonlinear Dynamics and Chaos:  
With Applications to Physics, Biology, Chemistry, and Engineering  
by Steven H. Strogatz  
ISBN: 0738204536  
Publisher: Perseus Books (2001)
- Applied Partial Differential Equations, 4th Edition  
by Richard Haberman  
ISBN: 0130652431  
Publisher: Prentice Hall (2003)
- Div, Grad, Curl, and All That: An Informal Text on Vector Calculus, 4th Edition  
by H. M. Schey  
ISBN: 0393925161  
Publisher: W. W. Norton & Company; (2005)
- Perfect Form: Variational Principles, Methods, and Applications in Elementary Physics  
by Don S. Lemons  
ISBN: 06910-2663-7  
Publisher: Princeton Univ Pr (1997)
- e: The Story of a Number  
by Eli Maor  
Publisher: Princeton University Press (May 4, 1998)  
ISBN: 0691058547

### **Other Supplies**

- Mathematica: We will be making use of Mathematica software in the computer labs. Students can use this software in the Computer Applications Lab which is open 9:00 am -10:00 pm during the week. If you plan to do most of your work at home you should obtain the student version from Wolfram Research.
- Graphing Calculator with Symbolic Algebra (eg TI89)

### **Faculty Information**

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### **Website**

The following program website has much more detailed information and will be updated regularly.: <http://academic.evergreen.edu/curricular/methods06/>