Suggested Syllabus Math 290 A-B-C

A: Dynamical systems.

B: Perturbation and Asymptotic Methods.
Introduction to asymptotic approximations, examples of regular and singular perturbations. Initial value problems for ODEs. Methods of multiple scales and averaging. Boundary value problems for ODEs. The WKB method, turning points and matched asymptotic expansions. High frequency wave propagation. Homogenization and effective medium theory.

C: Calculus of variations.

Part A:
Books:
Schedule:
Introduction to dynamical systems. Examples. (3 weeks) [A] Chapter 1,3 and Notes. Existence and uniqueness of solutions. (1 week) [A] Chapter 2.

Introduction to bifurcation: Types of bifurcations and exchange of stability (2 weeks) [L] Chapter2 I-III. Bifurcation of stationary solutions. Bifurcation of periodic solutions. (3 weeks) [L] Chapter2 IV-VI.

Part B:
Books:


Schedule:

Introduction to asymptotic approximations. Method of stationary phase. Regular and singular perturbations. (2 weeks) [H] Chapter 1 and [B-0] Chapter 1.


Wave propagation the WKB method. (2 weeks) Notes.

Homogenization. (1 week) [H] Chapter 5.

**Part C:**

Books:

[C-H] Courant and Hilbert: Methods of Mathematical Physics, Vol. I.


Schedule:

Basic problems in calculus of variations. Direct methods. (2 weeks) [W] chapter 1 and [C-H] chapter 4 section 1, 2.


The second variation and the Legendre condition. Weak minimum and strong minimum. (3 weeks) [W] chapter 4, 5.

The Hamiltonian and Hamilton-Jacobi equations. (1 week) [W] chapter 6 and [C-H] chapter 4 section 10.

Variational problems with subsidiary conditions. (1 week) [W] chapter 10 and [C-H] chapter 4 section 7.