ICTP DIPLOMA PROGRAMME IN MATHEMATICS 2015-16

Ordinary Differential Equations
F. Villegas (10 lectures : 15 hrs)

Introduction

Some Basic Mathematical Models; Direction Fields
Solutions of Some Differential Equations
Classification of Differential Equations

First Order Differential Equations

Linear Equations; Method of Integrating Factors
Separable Equations
Modeling with First Order Equations
Differences Between Linear and Nonlinear Equations
Autonomous Equations and Population Dynamics
First Order Difference Equations

Second Order Linear Equations

Homogeneous Equations with Constant Coefficients
Solutions of Linear Homogeneous Equations; the Wronskian
Complex Roots of the Characteristic Equation
Repeated Roots; Reduction of Order
Nonhomogeneous Equations; Method of Undetermined Coefficients
Variation of Parameters
Mechanical and Electrical Vibrations
Forced Vibrations

Higher Order Linear Equations

General Theory of nth Order Linear Equations
Systems of First Order Linear Equations

Systems of Linear Algebraic Equations; Linear Independence, Eigenvalues, Eigenvectors
Basic Theory of Systems of First Order Linear Equations
Homogeneous Linear Systems with Constant Coefficients
Complex Eigenvalues

Nonlinear Differential Equations and Stability

The Phase Plane: Linear Systems
Autonomous Systems and Stability
Locally Linear Systems