Syrian Arab Republic

Higher Institute for Applied Sciences and Technology

HIAST

Course Specification Document

Title	Ordinary Differential Equations

Credits	3.5 ECTS

Aims	This course aims to provide the student with knowledge and skills related to ordinary higher order differential equations and first order differential systems, and especially linear equations, and to find the analytical expression of solutions in important cases where it is possible, and to get student familiar with Cauchy-Lipschitz theorem and its applications.

Intended learning outcomes

On successful completion of this course, the student will be able to:

- Understand the formulation of Cauchy problem in differential equations, maximal and global solutions, and the theorem of existence and uniqueness of a solution to this problem, and the sufficient conditions for existence and uniqueness.
- Know the properties of the solutions of higher order linear differential equations and first order linear systems.
- Find the unique global solution to a first order linear differential system or a higher order linear differential equation satisfying initial conditions.
- Formulate the set of solutions of higher order linear differential equations and of first order linear systems with constant coefficients.
- Solve familiar differential equations like the first order linear equation and equations reducible to it.
- Solve the Euler equation.

Syllabus

- **First order scalar differential equations:** Maximal and global solutions on an interval, Cauchy problem, Analytical solution to some first order equations: linear, Bernoulli, separable.
- **Systems of first order linear differential equations:** Dimension of the solutions space of the homogeneous system, and finding a particular solution using a basis to this space, Resolving first order linear differential systems with constant coefficients.
- **Higher order linear differential equations:** Converting a higher order differential equation to a first order system, Resolving higher order equations with constant coefficients, and the Euler equation.
- **Cauchy-Lipschitz theorem in existence and uniqueness of a maximal solution:** General formulation of first order differential system, Local and maximal solutions of Cauchy, problem, and the sufficient conditions making these solutions global, examples.