## **Applied Dynamical Systems**

## Prof. Marco Squassina

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

Learn the basics of discrete and continuous dynamical systems. The intended learning outcomes include knowing the rudiments for qualitatively analysing the Cauchy problem.

***COURSE CONTENT***

Revision of the Cauchy problem; examples and applications; Sturm-Liouville problems; one-dimensional classical minimum problems;planar linear models, classification of linear stability; non-linear models; omega limit sets; applications of the linearisation method or Lyapunov function; periodic solutions; Dulac and Poincarè Bendixson criteria; bifurcation of balances; classical models from biology; from local to global; polar coordinates and global stability; conservative, gradient and Hamiltonian systems; examples of heterocline and homocline orbits. Topological equivalence in both linear and nonlinear cases; Poincare-Bendixson's Theorem.

***READING LIST***

M. Squassina - S. Zuccher, *Introduzione all'analisi qualitativa dei sistemi dinamici discreti e continui,* Springer, vol. 96, 2016.

 L. Barreira -C. Valls, *Ordinary Differential Equations: Qualitative Theory,* Springer, 2012.

***TEACHING METHOD***

Lectures.

***ASSESSMENT METHOD AND CRITERIA***

A written exam.

The student's assessment and their resultant mark will be based on the ability to summarise and analyse the notions imparted.

***NOTES AND PREREQUISITES***

The teaching is theoretical in nature but a number of exercises on the theorems demonstrated in class will be carried out. The course prerequisite is a knowledge of basic Analyses and linear Algebra.

*Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.*