

# ELL702: Nonlinear Systems

July 23, 2017

## 1 Syllabus

1. Introduction to non-linear systems, special features of nonlinear systems, Mathematical preliminaries
2. First and second order systems, vector fields and phase plane analysis
3. Existence and uniqueness of solutions of ODEs
4. Stability in Lyapunov's sense, Lyapunov's theorems, Invariance
5. Limit cycles, Bendixson criterion, Poincare-Bendixson criterion
6. Signals and operators, Norms
7. Input output stability,  $L_2$  stability
8. Lure's problem, Sector bound non-linearities,
9. Passivity, Small gain theorem, Popov and Circle criterion
10. Describing function method
11. Non-linear systems on manifolds