## Suggested Schedule for DE1 lectures

(please confirm with your tutor as the timing of your tutorials might ask for a different timing): **W1**:

Videos on Picard's Theorem and its proof, i.e.

- 1.1 and 1.2
- 1.3

# W2:

Videos on Global Existence, continuous dependence and the Proof of Picard via CMT for 1<sup>st</sup> order ODEs, i.e.

- 1.4 Global Existence
- 1.5 continuous dependence
- 1.6 Proof of Picard via CMT

### W3:

Last part of chapter 1 and the first part of chapter 2 on Critical points, stability and linearisation of plane autonomous systems

- 1.7 Systems of ODEs and higher order ODEs
- 2.1 Critical points
- 2.2 stability and linearisation

## W4:

Plane autonomous systems, section 2.3 (3 videos) and section 2.4

- 2.3-1 Classification of critical points
- 2.3-2 Examples 1 and 2
- 2.3-3 Examples from population dynamics
- 2.4 Limit circles and Bendixson Dulac Theorem

## W5

Method of characteristics, videos on

- 3.1 Introduction
- 3.2 Characteristics
- 3.3 The Cauchy problem
- 3.4 Examples

# W6:

Later parts of the chapter on methods of characteristics for first order PDEs and introduction to second order PDEs, i.e.

- 3.5 and 3.6 Domain of definition and Cauchy data
- 3.7 Discontinuities in derivatives
- 4.1-part 1 Introduction to second order semilinear PDEs

# W7:

Second order semilinear PDEs, normal form and characteristics, i.e.

- 4.1 part 2: Normal form for hyperbolic PDEs
- 4.1 part 3: Normal form for elliptic and parabolic PDEs
- 4.2 characteristics for 2<sup>nd</sup> order PDEs
- 4.3 Well posedness

### W8:

Maximumprinciple

- 4.4 Maximum principle part 1: elliptic case
- 4.4 Maximum principle part 1: parabolic case

### Material needed for Problem sheets:

#### Sheet 1:

Questions 1 and 2: Can be solved before the lectures as it is revision of prelims Analysis Questions 3-5: Videos 1.1-1.5

### Sheet 2:

Questions 1 and 2: Videos 1.6 and 1.7 Questions 3 and 4: Videos on sections 2.1-2.3, statement of Theorem of Bendixson Dulac from 2.4

#### Sheet 3:

Questions 1 and 2: Videos on chapter 2 Questions 3-5: Videos on chapter 3

### Sheet 4:

Questions 1-4: Videos on sections 4.1-4.3 Questions 5 and 6: Videos on section 4.4 on maximum principle