MATH0081 (Theory of Traffic Flow)

Year:	2019–2020
Code:	MATH0081
Level:	Masters
Value:	15 UCL credits (= 7.5 ECTS credits)
Term:	2
Structure:	3 hour lectures per week
Assessment:	90% examination, 10% coursework
Lecturer:	Prof BG Heydecker (Centre for Transport Studies) and Dr E Buldakov (Civil, Environmental and Geomatic Engineering)

Course Description and Objectives

Transport systems provide an essential facility for citizens to fulfill their contemporary ways of life by supporting and facilitating their safe and convenient travel. Consulting firms and local authorities employ teams of professional staff to plan, design, improve, manage and operate these systems in ways that help to make cities better places for people to live. The methods used by them rely on mathematical representations of travel and traffic flow, which covers the detailed movement of traffic along individual roads and through particular junctions. Beyond this, they also represent the choices made by individual travellers and the ways in which these generate patterns of traffic movement across whole cities.

Course MATH0081 provides an introduction to the various kinds of mathematical modelling that are used in transport studies. Examples of modelling at each of the levels of detail of individuals and of population flows are considered. Mathematical models are developed from first principles and related to more widely applicable techniques of operational research. This illustrates the merits of mathematical analysis and modelling for design and operation of practical systems.

Recommended Texts

Three relevant books are:

(i) Daganzo, C. F., *Fundamentals of Transportation and Traffic Operations*, Pergamon (1997).

(ii) Bell, M. G. H. & Iida, Y., *Transportation Network Analysis*, Wiley (1997).

(iii) Ortuzar, J. de D. & Willumsen, L. G., *Modelling Transport*, Wiley (2011).

Wider background is provided by *Transport in the Urban Environment*, Institution of Highways and Transportation (1997), especially Chapters 8, 32, 40.

Detailed Syllabus

- Traffic on the open road — speed, flow, density, capacity and wave phenomena.
- Queuing in traffic — models of arrival and departure and their implications.
- Signal-controlled road junctions — capacity, delay and the optimisation of signal timings.
- Travel between different parts of a city — modelling in terms of optimisation.
- Route choice and assignment of traffic to networks — modelling in terms of optimisation.