Perturbation theory and asymptotics MSM3A05a/MSM4A05a

Lecturer Details	Dr. Jamal Uddin Room 112	*Tel:* (0121) 414 2916 *E-mail:* uddinj@maths.bham.ac.uk

Course Objectives

By the end of this module students should be able to demonstrate an understanding of the methods used to obtain asymptotic expansions of integrals and of solutions to ordinary differential equations.

Course Description

This course provides an introduction to the concepts and techniques of perturbation analysis and its applications. Such techniques are important in almost every branch of applied mathematics especially those where exact analytic solutions are not available and numerical solutions are difficult to obtain.

Delivery

22 hrs of lectures and 5 hrs of example classes. Lectures take place on Wednesdays (10 am) and Fridays (9 am) in Lecture Room C. Example classes are help fortnightly in LRC on Thursdays at 1 pm.

Assessment

20% based on work during the semester and the rest on a 3 hr written examination for the double module in the summer term. There will be two continuous assessments (each worth 5%) and a class test worth 10%.

Syllabus

Introduction to asymptotic analysis
- gauge function, asymptotic series and expansions

Asymptotic expansion of integrals
- Laplace's method, Watson's Lemma, Method of stationary phase, Method of steepest descent

Singular perturbation theory
- Matched asymptotic expansions, Van Dyke's matching principle

Multiple scales analysis
- Linstedt-Poincare technique

WKB theory for ordinary differential equations
- WKB approximation, turning points

Recommended Reading

- *Perturbation Methods*' by E.J. Hinch, Cambridge University Press, 1991.
- *Introduction to Perturbation Techniques*' by A. H. Nayfeh, Wiley-VCH, 1993.
- *Applied Asymptotic Analysis*' by P. D. Miller, American Mathematical Society, 2006.
- *Differential Equations*' by A. C. King, J. Billingham and S.R. Otto, Cambridge University Press, 2003.