Module Title: Engineering Mathematics V
Code: MAU33E01

Level: Junior Sophister Credits: 5
Prerequisites: None

Lecturer: Dr. Joe Ó hÓgáin
johog@maths.tcd.ie

Terms: Semester 1 Duration: 12 Weeks

Lectures/week: 3 Total 33
Tutorials/week: 1 Total 11

Aims/Objectives: Engineering mathematics V is a one-semester module available to all JS Engineering streams and continues and extends the material from the previous mathematical modules in the first and second years-1E1, 1E2, 2E1 and 2E2. The emphasis is on the development of analytical techniques.

Syllabus

1. Fourier Methods:

definition of Fourier series for a piecewise continuous function on a symmetric interval;

even and odd half-range expansions;

definition of Fourier transform;

calculation of Fourier transform for various functions.

2. Partial Differential Equations:

the heat equation;

the wave equation;

Laplace's equation;

separation of variables;

application of Fourier analysis to initial and boundary value problems;

d'Alembert's solution of the wave equation.

3. Linear Programming:

formulation of linear optimization problems;

standard and canonical form;

use of the simplex and the two-phase simplex methods in solving such problems;

the geometry of the simplex method;

the dual of a linear programming problem;

the use of the Duality theorems in solving linear programming problems.

Recommended Text: Advanced Engineering Mathematics, E. Kreyszig

Learning Outcomes: Upon completion of this module, students will be able to:

1. Calculate the coefficients of the Fourier series for a variety of functions and use them to solve various differential equations.

2. Calculate Fourier transforms of simple functions and apply the Fourier transform

to solve the heat and wave equations over infinite domains.

3. Solve the heat, wave and Laplace equations for a variety of boundary conditions, using separation of variables and Fourier methods.

4. Solve linear optimization problems using the simplex and two-phase simplex methods.

5. Find the dual of a linear programming problem and use the Duality theorems to solve such problems.

Teaching Strategies: The teaching strategy is a mixture of lectures and problem-solving tutorials. Whilst the format of lectures is conventional, some interaction and discussion is common and the students are encouraged to ask questions. In tutorials all students work on problems which practice and apply the methods introduced in the lectures. Discussion of problems in small groups is encouraged and facilitated.

Assessment Modes: Assessment for this module is carried out by means of a written two-hour examination at the end of the semester and continuous assessment. The subject mark is based on 80% for the result of the written examination and 20% for the continuous assessment element.