On-line course materials

MATH10232 - Calculus and Applications B

Year: 1 - **Semester:** 2 - **Credit Rating:** 15

Requisites

Prerequisites
MATH10212 Linear Algebra B

Aims

This course unit aims to introduce students to ordinary differential equations, primarily covering methods of solution and applications to physical situations.

Brief Description

The unit will cover first and second order ordinary differential equations including classification and standard solution methods. Applications will be drawn from the field of classical mechanics, but no prior experience in mechanics is expected or required. Matlab will be used to illustrate some of the ideas and methods.

Learning Outcomes

On completion of this unit successful students will be able to solve first order and second order linear problems and first order separable equations analytically. Use substitution methods and power series methods to find solutions. Be able to investigate solutions using direction fields and Euler's method. Have used Matlab as a mathematical tool and used differential equations to solve problems in mechanics and other applications.

Syllabus

1.Introduction: concept of mathematical modeling; definition and classification of ordinary differential equations; order; linear and autonomous equations.

2.First-order ordinary differential equations: separable, graphical and numerical solutions; initial conditions; direction fields; Euler's method; use of Matlab; existence and uniqueness of solutions; integrating-factor methods; power series; substitution methods for nonlinear equations; phase plane and stability; population modelling.

3.Higher-order ordinary differential equations: general solution of linear, second-order equations; initial and boundary conditions; homogeneous equations; particular integrals; method of undetermined coefficients; harmonic oscillators; resonance; coupled systems; phase portraits; substitution methods for nonlinear equations; plane autonomous systems; predator-prey systems.

4.Mechanics: particle kinematics in Cartesian and polar coordinates; Newton's laws; forces; Newton's law of gravitation; work and energy; motion along a line (potential wells); equilibrium and stability; simple systems of particles; simple pendulum; compound pendulum; double pendulum.

Teaching & Learning Process (Hours Allocated To)

Lectures	Tutorials/ Example Classes	Practical Work/ Laboratory	Private Study	Total
33	11	0	106	150

Assessment and Feedback

Assessment:

Coursework; Weighting within unit 15%

Supervision; Weighting within unit 10%

Two hours and half end of semester examination; Weighting within unit 75%

Further Reading

James Stewart, Calculus, Early Transcendentals, Thomson, 5th Edition, International Student Edition, 2003.

C. H Edwards, Elementary differential equations with boundary value problems, Pearson Prentice Hall, 2004.

Staff Involved

Dr Joel Daou - Lecturer

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