האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

NUMERICAL METHODS - 71980

Last update 14-10-2018

HU Credits: *4*

Degree/Cycle: *2nd degree (Master)*

Responsible Department: *Environmental Economics & Management*

Academic year: *0*

Semester: *2nd Semester*

Teaching Languages: *Hebrew*

Campus: *Rehovot*

Course/Module Coordinator: *Dr. Anna Gourevitch*

Coordinator Email: *anna.gourevitch@mail.huji.ac.il*

Coordinator Office Hours:

Teaching Staff:

Dr.

Course/Module description:

Numerical Solution of Introduction to numerical methods: approximation of functions by polynomials, interpolation and spline. Approximate solution of systems of linear equations. Numerical integration. Numerical solution of ordinary and partial differential equations. Introduction to analytical solution of partial differential equations. The programming language of the course is Matlab.

Course/Module aims:

The course goal is to teach the mathematical basis required for numerical solutions of mathematical problems, with an emphasis on solution of ordinary and partial differential equations.

Learning outcomes - On successful completion of this module, students should be able to:

Approximate functions by polynomials and by piecewise polynomial functions. Find approximate solutions for linear equations. Present and numerically solve ordinary differential equations with initial conditions. Present partial differential equations with initial conditions and boundary conditions, and solve them numerically using the appropriate differences method. Check stability, consistence, and convergence of suggested numerical methods for solution of problems with initial-boundary conditions.

Attendance requirements(%):

100

Teaching arrangement and method of instruction: Lecture and exercises

Course/Module Content:

1. Interpolation and the Lagrange polynomial
2. Cubic Spline interpolation
3. Linear systems of Equations. Gauss elimination. Iterative Techniques.
4. Numerical Integration. Newton-Cotes method
5. Numerical methods for ordinary differential equations:
a) One-step methods: Euler. Higher-order Taylor's methods, Runge-Kutta.
b) Multistep methods: Predictor-Corrector
c) Convergence, Consistency and Stability of solution.
d) Stiff differential equations

6. Partial differential equations:
Part A : Analytic solution of partial differential equations
1. Classification of linear PDE of second order.
2. Well posed problem: Initial and boundary conditions.
3. Steady-state solution.
4. Laplace transform.
Part B : Numerical solution of partial differential equations
1. Solution of Parabolic PDE: Explicit finite differences Methods.
2. Implicit finite differences Methods (Crank Nicolson).
3. Approximation of the boundary conditions.
4. Convergence, Consistency and Stability of the numerical solution.

Required Reading:
None

Additional Reading Material:
(1) Boyce-Diprima-Elementary Differential Equations and Boundary Value Problems.
(2) Burden & Faires- Numerical Analysis.
(3) Farlow-Partial Differential Equations for Scientists and Engineers.
(4) Smith-Numerical Solution of Partial Differential Equations: Finite Differences Methods.

Course/Module evaluation:
End of year written/oral examination 100 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 0 %
Reports 0 %
Research project 0 %
Quizzes 0 %
Other 0 %

Additional information: