Scientific Computing (I002421)

Valid as from the academic year 2019-2020

Course Specifications

Lecturers in academic year 2019-2020
Verwaeren, Jan
LA26 lecturer-in-charge

Course offerings and teaching methods in academic year 2019-2020
A (year) Dutch seminar: practical PC room classes lecture 36.25 h 15.0 h

Offered in the following programmes in 2019-2020
Bachelor of Science in Bioscience Engineering (main subject Agricultural Sciences) 5 A
Bachelor of Science in Bioscience Engineering (main subject Cell and Gene Biotechnology) 5 A
Bachelor of Science in Bioscience Engineering (main subject Chemistry and Food Technology) 5 A
Bachelor of Science in Bioscience Engineering (main subject Environmental Technology) 5 A
Bachelor of Science in Bioscience Engineering (main subject Forest and Nature Management) 5 A
Bachelor of Science in Bioscience Engineering (main subject Land and Water Management) 5 A
Joint Section Bachelor of Science in Bio-Engineering 5 A

Teaching languages
Dutch

Keywords
Scientific computing, programming, algorithms, data structures, MATLAB

Position of the course
In this course students learn the basic principles of structured and modular programming within the scientific computing environment MATLAB. By solving integrated exercises they learn to put these principles into practice.

Contents

Part I: Programming in MATLAB: Introduction to scientific programming
1.1. Elementary data types
1.2. Floating point numbers
1.3. Built-in functions
1.4. Logical operations
1.5. Conditional execution
1.6. Repetitive execution
1.7. Functions
1.8. Data-visualisation
1.9. Import and export of data
1.10. Debugging

Part II: Interdisciplinary laboratories within the knowledge setting of the bio-engineering students: The goal of these laboratories is two-fold: to be able to implement a software solution for an extensive problem, and to acquire the additional programming skills and knowledge of algorithms and data structures necessary thereto. Ample attention is paid to accurate, efficient and elegant code. The subjects of these

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laboratories are selected annually from a broader list of topics.
A non-exhaustive list is:
- Visualisation of hydrological data and soil texture data: use of graphical functions and graphical handles,
- Exercises on the table of Mendelejev: use of cell arrays, search and sorting algorithms, operations on strings and the notion of time-complexity
- Bio-informatics: query DNA sequences using regular expressions, manipulation of DNA sequences and the use of a frequency table
- Automated determination of trees: reading, manipulating and writing text and binary files, and using image processing functions from the Image Processing Toolbox
- Modelling planetary trajectories: implementation and visualisation of movements and the use of animations
- Mathematical analysis: numerical differences, integration, optimization, interpolation and curve fitting
- Linear algebra: working with large matrices, sparse matrices, systems of equations, eigenvalue determination, diagonalization
- Fractals, use of strings, working with L-systems, generation and visualization of fractals
- Zoology: use of and searching in cell arrays, use of frequency tables, design of a quiz app
- Game Of Life: use of cellular automata, implementation of transition functions, visualization

Initial competences
Knowledge of the Windows operating system and basic computer skills.

Final competences
The students are capable of translating a problem description into an algorithmic design (choice of data structures, flow control structures, functions and scripts) and to implement (validation and debugging included) the solution in the scientific computing environment MATLAB.

Conditions for credit contract
Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract
This course unit cannot be taken via an exam contract

Teaching methods
Lecture, self-reliant study activities, lecture: plenary exercises, seminar: practical PC room classes

Learning materials and price
PDF presentations of the theory lectures (part 1) and the introductory lectures to the laboratories (part 2) on Minerva. Laboratory note book (integrated theory and exercises).

References

Course content-related study coaching
The laboratory note book allows the student to solve the exercises at his/her own pace in the PC room. There is continuous guidance during the practical exercises. The solutions to the general exercises are made available as soon all students have submitted theirs through the Indianio web tool.

Evaluation methods
end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period
Written examination, open book examination

Examination methods in case of periodic evaluation during the second examination period
Written examination, open book examination

Examination methods in case of permanent evaluation
Written examination, open book examination

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Possibilities of retake in case of permanent evaluation examination during the second examination period is possible

Extra information on the examination methods
Open book examination in the PC rooms

Calculation of the examination mark
NPGE after 1st semester: 50% of total
PGE after 2nd semester: 50% of total.
Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.