MTH356e Advanced Mathematical Optimization

Level: 3

Credit Units: 5 Credit Units

Language: ENGLISH

Presentation Pattern: EVERY JAN

E-Learning: BLENDED - Learning is done MAINLY online using interactive study materials in Canvas. Students receive guidance and support from online instructors via discussion forums and emails. This is supplemented with SOME face-to-face sessions. If the course has an exam component, this will be administered on-campus.

Synopsis:

MTH356e will provide undergraduates with an understanding of the common algorithms used in nonlinear optimization. The topics covered are of central importance for many applications in data science and data analytics. The course gives a comprehensive introduction to the gradient method and that of constrained nonlinear programming. Additionally, the course covers how such algorithms are implemented using the software Baron. MTH356e will be paired with MTH355e so that students upon the completion of both courses receive a better comprehension of the contents in the specialist field of Optimization.

Topics:

- Basic Iterative Schemes to Solve Systems of Nonlinear Equations
- Convergence of Simple Iterative Methods of Nonlinear Equations
- Grid Search Method
- Golden Section Search
- Alternating Variable Search Method for a Minimum
- Steepest Descent Search Method for a Minimum
- Conjugate Direction Methods
- Stopping Criteria for the Iteration Methods
- Equality Constrained Models
- Newton-Lagrange Method
- Conversion to Equality Constraints
- Conditions for a Local Minimiser

Textbooks:

Frederic S. Hiller & Gerald J. Lieberman.: Introduction to Operations Research (eTextbook) 10th Edition McGraw-Hill
ISBN-13: 9781307348163-AA

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Learning Outcome:

- Solve single nonlinear equations and systems of nonlinear equations.
- Interpret the convexity of sets and functions.
- Determine the existence and uniqueness of solutions to a given nonlinear programming problem.
- Show the necessary and sufficient optimality conditions for a given nonlinear programming problem.
- Apply various numerical algorithms to solve nonlinear programming problems.
- Analyze the convergence of various gradient-based iterative methods.

Assessment Strategies:

Continuous Assessment Component	**Weightage (%)**
PRE-CLASS QUIZ	2
PRE-CLASS QUIZ	2
PRE-CLASS QUIZ	2
COMPUTER MARKED ASSIGNMENT	8
TUTOR-MARKED ASSIGNMENT	16
Sub-Total	**30**

Examinable Component	**Weightage (%)**
Written Exam	70
Sub-Total	**70**

Weightage Total **100**