<table>
<tr><td colspan="2">DEREE COLLEGE SYLLABUS FOR: CSC 4334 OPTIMIZATION THEORY AND PRACTICE 3/0/3</td></tr>
<tr><td colspan="2">(New Course Fall 2026)
UK LEVEL: 6
UK CREDITS: 15</td></tr>
<tr><td>PREREQUISITES:</td><td>ITC 2088 Introduction to Programming
ITC 3006 Mathematics for Computing
MA 2105 Applied Calculus</td></tr>
<tr><td>CATALOG DESCRIPTION:</td><td>Linear and Non-Linear Programming; Discrete Optimization; Integer Programming; Resource Allocation Models; Decision-Making; Optimization Modelling; Computational Methods; Applied Optimization.</td></tr>
<tr><td>RATIONALE:</td><td>This course introduces students to key ideas and practical methods in optimization, showing how real problems in finance, technology, and everyday decision-making can be expressed and solved using mathematical models. Students learn when and how to use linear, non-linear, and discrete optimization tools, explore the strengths of basic solution methods, and gain hands-on experience with modern software to find efficient solutions to resource allocation and planning problems. The focus is on understanding how different optimization approaches work, comparing their usefulness, and applying them to realistic cases.</td></tr>
<tr><td>LEARNING OUTCOMES:</td><td>As a result of taking this module, the student should be able to:
1. Model financial, techno-economic, network flow and other search problems as Linear, Non-Linear, or Discrete Optimization formulations.
2. Evaluate the importance of Linear Programming for solving resource-allocation problems.
3. Assess the effectiveness of the SIMPLEX method in Linear Programming.
4. Compare barrier and penalty methods for Non-Linear Optimization and gradient-based first-order methods.
5. Apply advanced solvers such as CPLEX and GUROBI to common optimization problems</td></tr>
<tr><td>METHOD OF TEACHING AND LEARNING:</td><td>In congruence with the teaching and learning strategy of the college, the following tools are used:
Lectures and class discussions.
Laboratory practical sessions.
Homework assignments.
Office hours held by the instructor to provide further assistance to students.
Use of library facilities for further study and preparation for the exams
Use of the Blackboard course management platform to further support communication, by posting lecture notes, assignment instruction, timely announcements, formative quizzes and online submission of assignments</td></tr>
<tr><td>ASSESSMENT:</td><td>Summative:<table><tr><td>1st assessment: Midterm exam
problem modelling formulations, algorithm-related questions</td><td>30%</td></tr><tr><td>2nd assessment: Portfolio
collection of in-class activities, quizzes, short tasks completed throughout the semester including progress milestones of summative assessments</td><td>10%</td></tr><tr><td>Final assessment: Final project
developing a program for solving a particular optimization problem</td><td>60%</td></tr></table></td></tr>
</table>

	Formative: Take-home short problems **0%** The formative assessments aim to shape teaching and prepare students for the summative assessments. The 1st summative assessment tests the LOs 1,2 and 3. The 2nd summative assessment tests the LOs 1-5. The final summative assessment tests the LOs 1-5. The final grade for this module will be determined by averaging all summative assessment grades, based on the predetermined weights for each assessment. If students pass the comprehensive assessment that tests all Learning Outcomes for this module and the average grade for the module is 40 or higher, students are not required to resit any failed assessments
INDICATIVE READING:	**REQUIRED READING:** 1. Kochenderfer, M. J., & Wheeler, T. (2019). *Algorithms for optimization*. MIT Press. **RECOMMENDED READING:** 1. Bertsimas, D., & Dunn, J. (2019). *Machine learning under a modern optimization lens*. Dynamic Ideas. 2. Christou, I. T. (2011). *Quantitative methods in supply chain management: Models and algorithms* (Chapter 1). Springer.
INDICATIVE MATERIAL: *(e.g. audiovisual, digital material, etc.)*	**REQUIRED MATERIAL**: N/A **RECOMMENDED MATERIAL**: N/A
COMMUNICATION REQUIREMENTS:	Daily access to the course's site on the College's Blackboard CMS and the acg email. Effective communication using proper written and oral English. Use of word processing and/or presentations software for documentation and presentation of deliverables and the final project.
SOFTWARE REQUIREMENTS:	• MS-Office and Blackboard CMS • Python 3.10+ • SCIP
WWW RESOURCES:	• www.scipopt.org • https://developers.google.com/optimization • www.gurobi.com
INDICATIVE CONTENT:	Introduction to Mathematical Modelling • Objectives and constraints • Continuous variables and linear optimization problems • Discrete variables and combinatorial problems • Non-linear optimization problems Linear Programming • Modelling problems as linear programs • Tableau methods for linear programming • The Simplex method • Duality in linear programming Non-Linear Programming • Convexity and optimization

	• First-order optimality conditions, including the Farkas Lemma and Karush-Kuhn-Tucker (KKT) Theorem • Approximate line-search and the Armijo rule Mixed-Integer Programming • Branch-and-Bound methods • Metaheuristic approaches, including Genetic Algorithms, Tabu Search, and GRASP • Optimization tools and software, including GUROBI, CPLEX, SCIP, GLPK, OR-Tools, and Excel Solver