**Title (Units):** **COMP 7140 Algorithms for Optimization (3,3,0)**

**Course Aims:** To introduce the concepts and issues behind optimization problems, and the principles behind different optimization algorithms. Topics include both unconstrained and constrained optimization algorithms.

**Prerequisite:** Research Postgraduate Student Standing

**Course Intended Learning Outcomes (CILOs):**
Upon successful completion of this course, students should be able to:

| No. | Course Intended Learning Outcomes (CILOs) |
|---|---|
| | **Knowledge** |
| 1 | Explain the concepts and issues behind optimization problems. |
| 2 | Explain the principles behind different optimization algorithms. |
| 3 | Apply the algorithms to solve real problems. |
| | **Skill** |
| 4 | Implement computational algorithms for optimization. |

**Calendar Description:** To introduce the concepts and issues behind optimization problems, and the principles behind different optimization algorithms. Topics include both unconstrained and constrained optimization algorithms.

**Teaching and Learning Activities (TLAs):**

| CILOs | TLAs will include the following: |
|---|---|
| 1-3 | • Students will learn the concepts and issues behind optimization problems, and the principles behind different optimization algorithms via lectures, programming assignments, and exams. |
| 3-4 | • Students will gain the practical skills of implementing optimization algorithms to solve problems. |

**Assessment:**

| No. | Assessment Methods | Weighting | CILOs to be addressed | Remarks |
|---|---|---|---|---|
| 1 | Continuous assessment | 30% | 1-4 | Continuous assessments in the form programming assignments will be used to evaluate how well students have learned the concepts and principles of optimization algorithms, and how well they can apply the algorithms. |
| 2 | Examination | 70% | 1-3 | Examination will be used to evaluate the students' overall understanding and proficiency on the concepts and principles behind different optimization algorithms. |

**Assessment Rubrics:**

| | |
|---|---|
| **Excellent (A)** | • Achieve all four CILOs, demonstrating a thorough understanding and solid knowledge of optimization algorithms.<br>• Able to apply a variety of techniques for solving optimization problems. |
| **Good (B)** | • Achieve most of the four CILOs, demonstrating a good understanding and competent knowledge of optimization algorithms.<br>• Able to apply an appropriate technique for solving optimization problems. |
| **Satisfactory (C)** | • Achieve some of the four CILOs, demonstrating a basic level of understanding and knowledge of optimization algorithms.<br>• Able to provide solutions for simple optimization problems. |
| **Fail (F)** | • Achieve few of the four CILOs, with little understanding of optimization algorithms.<br>• Unable to provide solutions for simple optimization problems. |

**Course Intended Learning Outcomes and Weighting:**

| Content | CILO No. |
|---|---|
| I. Introduction to Optimization Problems | 1 |
| II. Linear Programming | 1-4 |
| III. General Optimization | 1-4 |

**References**: Walter Gander, Martin J. Gander and Felix Kwok. Scientific Computing – An Introduction Using Maple and Matlab, Springer Verlag, 2014
Dimitri P. Bertsekas. Convex Optimization Algorithms, Athena Scientific, 1st Edition, 2015
Stephen Boyd and Lieven Vandenberghe. Convex Optimization, Cambridge University Press, 1st edition, 2014

**Course Content in Outline:**

**Topic**

I. Introduction to Optimization

II. Linear Programming
A. The Exchange Algorithm
B. Linear Programming Methods
C. General Linear Programs

III. General Optimization
A. Classification of Optimization Problems
B. Mathematical Optimization
C. Unconstrained Optimization Methods
D. Constrained Optimization Methods