Course Title and Code	CS348 – Optimization Techniques

I. Course Identification and General Information:

Course Title	Optimization Techniques	Course Code	CS348	Pre-requisite	MATH329
Department	Computer Science	Course Level	8	Credit Hours	3 (3+0)

II. Course Description/Topics: The following course topics will be covered.

- Unconstrained optimization theory. Convex functions and convex sets.
- Algorithms for unconstrained optimization (Steepest descent; Newton method; Conjugate gradient methods).
- Constrained optimization theory (Kuhn-Tucker conditions). Special problems: Linear programming Quadratic Programming. Algorithms for constrained optimization.
- Since this is a course on optimization techniques, you will need to be able to program with high level programming languages (*e.g.*, C/C++, Java, C#).

III. Course Outcomes: Summary of the main learning outcomes for students enrolled in the course.

- Show the ability to solve optimization problems for both constrained and unconstrained cases.
- Explain the differences between constrained and unconstrained optimization problems.
- State the standard forms of the main optimization problems such as unconstrained case, linearly-constrained case, non-linearly-constrained case, quadratic case.
- Define and properly apply the conditions of optimality such as First-Order Necessary Conditions (FONC), Second-Order Necessary Conditions (SONC), Second-Order Sufficient Conditions (SOSC) and First-Order Sufficient Conditions (FOSC) in both constrained and unconstrained case.
- Apply mathematical procedures to recursively solve unconstrained optimization problems using the steepest (or gradient) method, newton method and conjugate gradient method.
- Discuss and interpret results obtained for each optimization problem solution.
- Develop computer programs written in high-level language such as C/C++, Java or C# to solve simple optimization problems and compare results given by MATLAB Optimization Toolbox™.

IV. Required Text

- Baldick, R. "Applied Optimization Formulation and Algorithms for Engineering Systems", Cambridge University Press, 2006.

V. References

- Wright, S. and J. Nocedal "Numerical Optimization", 2nd Edition, Springer, 2007