Department of Information Systems Engineering

College of Erbil Technical Engineering

University of Erbil Polytechnic

Subject: Optimization

Course Book – MSc- Second Semester

Lecturer's name Shahab Wahhab Kareem

Academic Year: 2023/2024

Course Book

1. Course name	**Optimmization**
2. Lecturer in charge	
3. Department/ College	**Information Systems Engineering**
4. Contact	**e-mail: Shahab.karim@epu.edu.iq** **Tel: (optional)**
5. Time (in hours) per week	**Theory: 3**
6. Office hours	
7. Course code	
8. Teacher's academic profile	Shahab Wahhab Kareem I received my BSc in Control and Computer Engineering from University of Technology Baghdad in 2001, and MSc in Software Engineering from Salahadeen University in 2009. He is a Ph.D in Yasar University Izmir, Turkey 2020. My research interests include Machine learning and Big data. I'm a lecturer at the Information System Eng. (ISE) Department (2011-till now)
9. Keywords	

10. Course overview:

This course provides an in-depth theoretical treatment of classical and modern optimization methods that are relevant in data science. The emphasis is on the motivations and design principles behind the algorithms, on provable performance bounds, and on the mathematical tools and techniques to prove them. The goal is to equip students with a fundamental understanding about why optimization algorithms work, and what their limits are. This understanding will be of help in selecting suitable algorithms in a given application, but providing concrete practical guidance is not our focus. Optimization algorithms should not be used blindly, by confusing the optimization problem being solved with the ground truth. The optimization problem helps to solve a learning problem, and the latter is the ground truth. The same learning problem can in principle be modeled with many different optimization problems. What counts in the end is whether the result of the optimization is useful towards learning.

11. Course objective:

By the end of this course the student should:

This course is designed for graduate students in Information System Engineering who need to know about optimization and the essentials of numerical algorithm design and analysis. My intent is to help them design algorithms for Machine Learning and Data Analysis in their own research

12. Student's obligation

Homework assignments will be a mix of paperwork and machine problems. Written homework should be finished individually, discussions with peers or instructor is allowed, but copying or any other type of cheating is strictly prohibited. You will be given one week to finish the written homework. Some of the machine problems are designed for teamwork and due day may vary. Any late submission will incur a 15% penalty for that assignment.

13. Forms of teaching

داتاشۆ و پاوەرپۆینت، سەر تەختەڕەش، تەختەی سپی، هتد

14. Assessment scheme

Both midterm and final exams will be closed-book written exams. The coverage of each exam will be discussed before the exam. A review session will be given one week before the exam. The format of exam questions include True/False question, short answer questions, and short essay questions. The length of the exams will between 75-150 minutes in class.

15. Student learning outcome:

1. Understand the fundamentals of optimization methods
2. Apply appropriate optimization algorithm to solve a problem
3. Implement optimization algorithms

16. Course Reading List and References:

- *Algorithms for Optimization,* Mykel J. Kochenderfer, Tim A. Wheeler, MIT Press, 2019. ISBN: 0262039427
- *A First Course in Optimization Theory,* Rangarajan K. Sundaram, Cambridge University Press, 1996. ISBN:
- 0521497701
- *Think Julia: How to Think Like a Computer Scientist,* Ben Lauwens and Allen Downey, O'Reilly, 2019. ISBN:
- 9352138295

17. The Topics:

Lecturer's name

Lecturer's name
ex: (2 hrs)

ex: 1/10/2019

Week No.	Syllabus (Theoretical and Practical in C++ or JAVA)
1	• An introduction to Optimization • P, NP, and NP-Complete • Reduction • Search I • Search II • Divide-and-Conquer • ***Evolutionary Algorithms*** • Dynamic Programming • Natural Evolution • **Greedy Technique**

	• Particle Swarm optimisation • **Biologically Inspired Computation** • Natural **Inspired Computation**	