1. Course Name: Advanced Intelligent Search

2. Course Code:

3. Semester / Year: 2nd semester / 2024-2025

4. Description Preparation Date: Feb. 2025

5. Available Attendance Forms:

6. Number of Credit Hours (Total) / Number of Units (Total)

60

7. Course administrator's name (mention all, if more than one name)

Name: Prof. Dr. Alia Karim Abdulhassan
Email: alia.k.abdulhassan@uotechnology.edu.iq

8. Course Objectives

Course Objectives	provides a background to metaheuristics algorithms to solve complex optimization problems in a diverse range of application domains. Students learn to solve real-world examples of problems and solutions demonstrate how metaheuristics are applied in such fields as bioinformatics, engineering design, scheduling, and so on.

9. Teaching and Learning Strategies

Strategy	Books, resources (internet and library), lectures reinforced with an illustrative example. Theoretical lectures, laboratory labs, practical tasks, using modern equipment to present practical ideas to students (data show, electronic board)

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2 hrs classroom 2 hrs lab	3,5,6,7	1- Introduction 2-Heuristics 3-The Water Jug Problem: Working Backward 4-Search Algorithms and Puzzles 5-Combinatorial explosion 6-Advanced Intelligent Search	Classroom Lab	Attendance + homework
2	2 hrs classroom 2 hrs lab	3,5,6,7	1-A* and D* Algorithms 2-A* Algorithm Properties 3-The A* Search 4 -the 3-PUZZLE to illustrate A* search 4- D-Star (*D**),Algorithm	Classroom Lab	Attendance + homework

			5- D* algorithm is the dynamic A*		
3	2 hrs classroom 2 hrs lab	3,5,6,7	1- Advanced Intelligent Search_Common Concepts 2. Optimization Models. 3. Metaheuristics methods classification	Classroom Lab	Attendance + homework
4			4. Main Common Concepts for Metaheuristics 5. Encoding: example 6. 0bjective function :example	Classroom Lab	Attendance + homework
5	2 hrs classroom 2 hrs lab	3,5,6,7	1.Single Solution Metaheuristics 2. Common Concepts 3. Single solution Metaheuristic Basic Methods • Local search: Neighbor selection strategy. • Tabu search: Tabu list, aspiration criteria, medium- and long-term memories. • Simulated annealing, threshold accepting: Annealing schedule. • Iterated local search: Perturbation method, acceptance criteria. • Variable neighborhood search: Neighborhoods for shaking and neighborhoods for local search.	Classroom Lab	Attendance + homework
6	2 hrs classroom 2 hrs lab	3,5,6,7	1. Local search 2.A Local Search Algorithm. 3.Selection of the Neighbor 4.Local search family 5- TABU SEARCH 6-Algorithm tabu search 7-Using the Tabu search algorithm to solve the Travelling Salesman problem	Classroom Lab	Attendance + homework
7	2 hrs classroom 2 hrs lab	3,5,6,7	1-Simulated Annealing Search 2-Algorithm simulated annealing 3- General schema for a simulated annealing algorithm. 4-Example:Using the simulated annealing algorithm to solve the Travelling	Classroom Lab	Attendance + homework

8	2 hrs classroom 2 hrs lab	3,5,6,7	1-Threshold Accepting (TA) 2-Threshold Accepting Algorithm 3-Variable Neighborhood Search (VNS) 4-Variable Neighborhood Descent (VND) 5-Variable Neighborhood Descent Algorithm 6-General Variable Neighborhood Search	Classroom Lab	Attendance + homework
9	2 hrs classroom+2 hrs lab	3,5,6,7	7-Variable Neighborhood Search Algorithm 8-Example:A traveling salesman needs to visit 5 cities 9-Greedy Randomized Adaptive Search Procedure (GRASP) 10-The Greedy Randomized Algorithm	Classroom Lab	Attendance + homework
10	2 hrs classroom 2 hrs lab	3,5,6,7	1- Smoothing Methods 2- Smoothing Methods template algorithm 3- Smoothing operation. 4- Example Smoothing operation for the TSP. 5- Noisy Method	Classroom Lab	Attendance + homework
11	2 hrs classroom 2 hrs lab	3,5,6,7	1- Population-Based Metaheuristics (P-Metaheuristics) 2- Evolutionary Algorithm 3-A generation in evolutionary algorithms.	Classroom Lab	Attendance + homework
12	2 hrs classroom 2 hrs lab	3,5,6,7	1- the template for the an Evolutionary Algorithm. 2- Common Concepts for Evolutionary Algorithms	Classroom Lab	Attendance + homework
13	2 hrs classroom 2 hrs lab	3,5,6,7	1-Memetic Algorithm 2-Memetic Algorithm 3-Genetic Algorithm 4.Popular genetic operators 5- selection, crossover (recombination), and mutation. 6-roulette wheel selection method	Classroom Lab	Attendance + homework
14	2 hrs classroom 2 hrs lab	3,5,6,7	1-Genetic algorithm search 2- Example: GA to direct robot to a goal.	Classroom Lab	Attendance + homework
15	2 hrs classroom 2 hrs lab	3,5,6,7	Course Exam	–	marks

11. Course Evaluation	
Final Exam (60%) Quizzes (10%) Laboratory (15%) Term Tests (15%)	
12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	-
Main references (sources)	1-Stephen Lucci and Danny Kopec. ARTIFICIAL INTELLIGENCE IN THE 21ST CENTURY: A Living Introduction 2/E . Copyright ©2016 by MERCURY LEARNING AND INFORMATION 2- Talbi, El-Ghazali, " Metaheuristics : from design to implementatio Copyright ©2009 by John Wiley & Sons, Inc. Published by John Wile Sons, Inc., Hoboken, New Jersey Published simultaneously in Canada.
Recommended books and references (scientific journals, reports…)	-
Electronic References, Websites	

Course Description Form