Course Specification

(Postgraduate)

Course Title:	Search Algorithms & Optimizations
Course Code:	501822-3
Program:	Master in Artificial Intelligence
Department:	Computer Science
College:	Computers and Information Technology
Institution:	Taif University
Version:	V2
Last Revision Date:	5 May 2024

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A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☒ Required		☐ Elective	
3. Level/year at which this course is offered: (Year: 1, Level: 1)				
4. Course general Description:				
Heuristic optimization algorithms are artificial intelligence search methods that can be used to find the optimal decisions for designing or managing a wide range of complex systems. This course describes a variety of (meta) heuristic search methods including simulated annealing, tabu search, genetic algorithms, genetic programming, dynamically dimensioned search, and multi-objective methods. Algorithms will be used to find values of discrete and/or continuous variables that optimize system performance or improve system reliability. Students can select application projects from a range of application areas. The advantages and disadvantages of heuristic search methods for both serial and parallel computation are discussed in comparison to other optimization algorithms.				
5. Pre-requirements for this course (if any)**:**				
None.				
6. Co-requirements for this course (if any)**:**				
None.				
7. Course Main Objective(s):				
The objectives of this course are as follows: ▪ **Identify, understand, formulate, and solve optimization problems.** ▪ **Understand the concepts of stochastic optimization algorithms.** ▪ Analyze and adapt modern optimization algorithms.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**36**	**80%**
2	E-learning	**9**	**20%**
3	Hybrid ▪ Traditional classroom ▪ E-learning	**0**	**0%**
4	Distance learning	**0**	**0%**

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**-**
3.	**Field**	**-**
4.	**Tutorial**	**-**
5.	**Others (specify): Mid-Term and Final Exams**	**-**
	Total	**45**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Understand the concepts of stochastic optimization algorithms.	**K1**	Lecture, Brainstorming, Discussion	**Direct:** Quiz, Exam **Indirect:** Survey
1.2	Identify, understand, formulate, and solve optimization problems	**K1**	Lecture, Brainstorming, Discussion	**Direct:** Quiz, Exam **Indirect:** Survey
2.0	**Skills**			
2.1	Analyze and adapt modern optimization algorithms.	**S1**	Lecture, Problem Solving	**Direct:** Exam, Quiz, Assignment **Indirect:** Survey
2.2	Implement modern optimization algorithms.	**S2**	Lecture, Project, Problem Solving	**Direct:** Exam, Quiz, Assignment **Indirect:** Survey
2.3	Evaluate the modern optimization algorithms.	**S2**	Lecture, Project, Problem Solving	**Direct:** Exam, Quiz, Assignment **Indirect:** Survey
3.0	**Values, autonomy, and responsibility**			
3.1	Function effectively as a member or leader of a team engaged in activities appropriate to the field of data mining.	**V2**	Discussion, Problem Solving	**Direct:** Project, Presentation **Indirect:** Survey

C. Course Content:

No	List of Topics	Contact Hours
1.	Introduction, Constraints, Satisfiability	3
2.	Hard Problems	9
3.	Local Search	6
4.	Genetic Algorithms	6
5.	Tabu Search	6
6.	Comparison of Algorithms	6
7.	Multi-Objective Optimization	6
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Mid-Term Exam	5th week	25%
2.	Project Implementation	10th week	10%
3.	Project Report	10th week	10%
4.	Student Presentation	12th week	5%
5.	Final Exam	15th Week	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	▪ Optimization modelling: a practical approach ▪ Operations research: applications and algorithms
Supportive References	▪ To be provided in the classroom.
Electronic Materials	▪ To be provided in the classroom.
Other Learning Materials	▪ Links provided by the instructor. ▪ Handouts and Presentations Slides prepared by the instructor. ▪ Blackboard.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ Classroom (20 students/class) ▪ Computer labs

Items	Resources
Technology equipment (Projector, smart board, software)	▪ Video projector / data show ▪ White board
Other equipment (Depending on the nature of the specialty)	▪ To be announced during the course!

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students Coordinator	Indirect (Course exit survey) Indirect (Feedback from Course Coordinator)
Effectiveness of students assessment	Faculty member Coordinator	Indirect (Feedback from Faculty member) Indirect (Feedback from Course Coordinator)
Quality of learning resources	Students Faculty member Coordinator Council Curriculum Committees	Indirect (Course exit survey) Indirect (Feedback from Faculty member) Indirect (Feedback from Course Coordinator) Indirect (Feedback from council) Indirect (Feedback from Graduate Committees)
The extent to which CLOs have been achieved	Students Faculty member Coordinator Curriculum Committees	Indirect (Course exit survey) Indirect (Feedback from Faculty member/ Course Coordinator/ Graduate Committee)
Other	-	-

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**GRADUATE PROGRAMS COMMITTEE – CS DEPT.**
REFERENCE NO.	**V2**
DATE	**5/5/2024**

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