



Course Plan

Course No.:

Time Division: 4hr Theoretical

Course Name: Combinatorial Optimization Problem **Semester & Year:** First, 2022 / 2023

Course Website:

Course Description:

This subject presents the: The Most applications of COP, like Travelling Salesman Problems (TSP), Aircraft Landing Problems (ALP) and Transposition Cipher problem (TCP) are introduced, with formulation and solving methods.

Course Intended Outcomes: This course describes what the word life needs? The COP is the most important optimization problems in many fields, Mathematics, Operations research, Algorithm theory and computational complexity theory, Artificial intelligence, Machine learning, Software engineering.

The most **specific problems** of COP: Assignment problem, Traveling salesman problem, Knapsack problem, Linear and Integer programming, Aircraft Landing problem, Nurse scheduling problem, Vehicle routing problem, Vehicle rescheduling problem, Time table problem ...etc.

Course Outline:

Week	Description depends on the Timing table (Theoretical & Practical)
1	Combinatorial Optimization Problem (COP).
2	<ul style="list-style-type: none">• CO concept, COP formulation, Solving Method for COP.• Algorithms and Complexity.
3	Solving Methods (Heuristics' and Exact): Genetic Algorithm (GA)
4	Travelling Salesman Problem (TSP) TSP Mathematical formulation, Representation of TSP.
5	Solving Methods for TSP: <ul style="list-style-type: none">• Minimizing Distance Method.• Branch and Bound Method.
6	<ul style="list-style-type: none">• Dynamics Programming / Held and Karp.• Tree Type Heuristic Method.
7	Solving TSP as A linear Programming Problem (LPP).
8	Examination 1.
9	Aircraft Landing Problem (ALP)
10	Single Runaway Formulation of ALP: ALP Constraints and Mathematical Formulation.
11	Techniques to Improve the Solution and Reduce the Computations for ALP
12	Special Cases of ALP. Solving ALP using Heuristics Solving ALP using CEM
13	Transposition Cipher Problem (TCP) Simple Transpositions, Cryptanalysis of TCP

	TCP Formulation
14	Solving TCP using Exact Methods: <ul style="list-style-type: none"> • Solving TCP using CEM. • Solving TCP using New BAB Method Successive Rules of DK for TCP
15	Examination 2.

Textbooks:

- [1]: Ding-Zhu et al, "*Handbook of Combinatorial Optimization*", Kluwer Academic Publishers, 1999.
 [2]: Bo Chen et al, "*Complexity, Algorithms and Approximability*", Handbook of Combinatorial Optimization, 1998.
 [3]: De Neufville et al, "*Airport Systems: Planning, Design, and Management*", McGraw-Hill, 2002.
 [4]: Mao, W., "*Modern Cryptography: Theory & Practice*", Upper Saddle River, NJ: Prentice Hall P (2004).

Suggested references:

- [1]: Akandwanaho. et al, "*Solving Dynamic Traveling Salesman Problem Using Dynamic Gaussian Process Regression*", Hindawi Publishing Corporation, Journal of Applied Mathematics, Vol. 2014, Article ID 818529.
 [2]: Mataija M., et al, "*Solving The Travelling Salesman Problem Using The Branch And Bound Method*", Zbornik Veleučilišta u Rijeci, Vol. 4, No. 1, pp. 259-270, 2016.
 [3]: Beasley, J. E., et al, "*Scheduling Aircraft Landings—The Static Case*", Transportation Science, 34, No. 2, pp.180–197, 2000.

Marking:

First Semester				Final Exam
1st exam	2nd exam	Practical	Activity	
12.5	12.5	----	5	70

Assignment/ Project	Description	Due Date	Marking
test	written exam	1/12/2022	3
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Instructor(s) information [معلومات الأستاذ]

Section: (Mathematics) ; Lecture Room: Electronic Course ; Office No.:

Instructor's Name: Dr. Faez Hassan Ali

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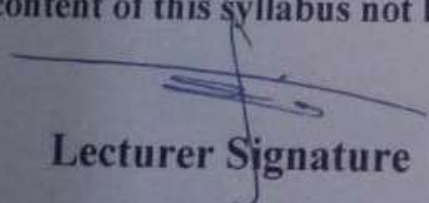
Office Hours : Sun.: [11 : 50 – 12 : 30]

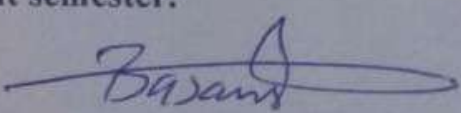
Wed.: [11 : 50 – 12 : 30]

NOTES:

Office Hour: Other office hours are available by appointment.

The content of this syllabus not be changed during the current semester.


Lecturer Signature


Chairman Signature