Intelligent Algorithms

Course Definition

Information

Technology

Engineering

1. Basic Information:

Course Name	Intelligent Algorithms
Course Code	BIA601
Number of Presentational Sessions*	15
Number of Synchronous Sessions**	10
Number of Shorter Tests***	2
Number of Exams***	1
Theoretical Sessions Work Load (hrs.)	46
Practical Sessions Work Load (hrs.)	15
Credit Hours	5

*Each presentational session comprises both recorded lecture (1.5 hrs.) and interactive learning content (1.5 hrs.).

**Each synchronous session comprises the interactive lecture carried out in real time in a virtual class (1.5 hrs.).

***Each shorter test is 0.5 hr. long. The final exam is 2 hrs. long.

N.B.

Generally, each chapter requires two presentational sessions: one for the recorded content and one for the interactive content (unless the chapter is too long, in which case it may require more sessions) This note applies to synchronous sessions as well, where each chapter requires one synchronous session generally.

2. Prerequisites courses:

Course	Code
Artificial Intelligence	BAI501

3. Course Objectives:

The main aims of this course "Intelligent Algorithms" are:

- Study main intelligent algorithms.
- Apply intelligent algorithms on complex optimization problems.
- Best practices when coding intelligent algorithms.

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4. Learning Outcomes (LO):

By the end of this course, the learner is expected to acquire and learn the following subjects:

- Using dynamic programming to solve complex optimization problems.
- Understanding the space-time tradeoffs and its applications on many famous problems.
- Studying and coding genetic algorithms for complex optimization problems.
- Studying and coding swarms' algorithms for complex optimization problems.
- Studying and coding ant colony algorithms for complex optimization problems.

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5. Assessment Results:

Chapter Number	Chapter Title	General Objectives	Assessment Type				
			Interactive Content & Recorded Sessions	Applied Activities (Synch. Sessions)	Final Exam*/ Shorter Tests**	Presentations and Interviews***	Reports ***
CH1	Dynamic Programming	Comprehension –Analytical Thinking –Tools and Application Hands– On	√	√	√	√	√
CH2	Space Time Tradeoff	Comprehension –Analytical Thinking –Tools and Application Hands– On	√	√	√	√	√
CH3	Genetic Algorithms	Comprehension –Analytical Thinking –Tools and Application Hands– On	√	√	√	√	√
CH4	Particle Swarm Optimization	Comprehension –Analytical Thinking –Tools and Application Hands– On	√	√	√	√	√

CH5	Ant Colony Optimization	Comprehension –Analytical Thinking –Tools and Application Hands– On	√	√	√	√	√

*The final exam is two hours long and is given at the end of the course.

**Shorter tests are about 30 minutes long and are given after three or four lectures throughout the semester during synchronous sessions.

***Presentations, interviews, and reports are submitted once after each three or four lectures throughout the semester during synchronous sessions.

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6. Course Syllabus:

Chapter	Subject	Content	Number of Learning Objects	Number of synchronous Learning Objects
CH1	Dynamic Programming	1. Dynamic Programming Principles 2. Knapsack problem 3. Longest Common Subsequence problem 4. Assembly-line Scheduling problem	4	2
CH2	Space Time Tradeoff	1. Space-for-time tradeoffs 2. Horspool's Algorithm 3. Count Sort 4. Hashing	4	2
CH3	Genetic Algorithms	1. Genetic Algorithms 2. Genetic Algorithms Implementation in Python 3. Apply genetic algorithms to example problems.	3	1
CH4	Particle Swarm Optimization	1. Particle Swarm Optimization 2. PSO Implementation in Python	3	1

		3. Apply swarm algorithms to example problems.		
CH5	Ant Colony Optimization	1. Ant Colony Optimization 2. ACO Implementation in Python 3. Apply ant algorithms to example problems.	**3**	**1**

7. Practical Activity:

- **Tools and Labs:**

Tool Name	Description
Python, C#	Programming Languages

- **Practical Activities per Chapters:**

Chapter	Activities Type	Remarks
CH1	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☐ Experiment ☐ Other	
CH2	☑ Exercises ☑ Homework ☐ Webinars ☐ Project	

	☐ Experiment ☐ Other	
CH3	☑ Exercises ☑ Homework ☑ Webinars ☐ Project ☐ Experiment ☐ Other	
CH4	☑ Exercises ☑ Homework ☑ Webinars ☐ Project ☐ Experiment ☐ Other	
CH5	☑ Exercises ☑ Homework ☐ Webinars ☑ Project ☐ Experiment ☐ Other	

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8. References:

- García-Martínez C., Rodriguez F.J., Lozano M. (2018) Genetic Algorithms. In: Martí R., Pardalos P., Resende M. (eds) Handbook of Heuristics. Springer, Cham. https://doi.org/10.1007/978-3-319-07124-4_28.

- Roughgarden, Tim. Algorithms Illuminated: Algorithms for NP-hard Problems. Soundlikeyourself Publishing, LLC, 2020.

- http://www.swarmintelligence.org/tutorials.php