Course Description Form

Description of the location

This course description provides a concise summary of the main course features and expected learning outcomes.

The student must demonstrate that he or she has made the most of the learning opportunities.

Available. It must be linked to the program description.

Shatt al-Arab University	.1 Educational institution
Department of Computer Science	.2 Scientific Department/Center
Advanced smart applications	.3 Course Name/Code
My presence	4. Available forms of attendance
First and second semester 2024-2025	.5 Semester/Year
200 hours	6. Number of study hours (total)
August 5, 2025	.7 Date this description was prepared

8. Course Objectives •

Gain a comprehensive understanding of neural networks, including their structure, learning algorithms, and applications in various Areas.

• Delve into the concepts and algorithms of Genetic Algorithms (GAs), including their representation, selection, intersection, and mutation operators.

• Apply GAs to solve real-world optimization problems, such as the Traveling Salesman Problem (TSP), color mapping, and the eight-puzzle problem.

• Understand the principles and applications of swarm intelligence, including particle swarm optimization (PSO), colony optimization,

· Ants (ACO), and bee colony optimization algorithms

• This course provides a comprehensive introduction to advanced smart applications, covering a range of topics from networks Neural and genetic algorithms, and even swarm intelligence and fuzzy logic. Students will gain practical experience applying these techniques to solve real-world problems, using the MATLAB programming language.

9. Course outcomes, teaching, learning and assessment methods.

A- Cognitive Objectives

- 1. Understand advanced concepts of smart applications, including the Internet of Things, artificial intelligence, and machine learning. - 2. Understand the structure and design of smart systems and their operating mechanisms, from data collection to processing and decision-making. - 3. Know the latest smart application development technologies, frameworks, and programming tools used. - 4. Analyze user needs and transform them into executable software requirements. - 5. Understand data protection and security methods in smart applications, including encryption and identity verification. - 6. Identify future market trends and emerging technologies in the field of smart applications.

B- Course Skill Objectives This course aims to provide students with a set of practical and technical skills related to advanced smart applications. The most prominent of these skill objectives are: -:

1. Programming Skills • The ability to develop smart applications using modern languages and frameworks such as Python and JavaScript • Applying artificial intelligence (AI) and machine learning techniques in building applications • Integrating application programming interfaces (APIs) and cloud computing services into projects.

2. Smart System Design and Development Skills • Design smart solutions to address real-world problems using the Internet of Things (IoT) or data analytics. • Build interactive and effective user interfaces (UX/UI) for applications. • Improve application performance in terms of speed, efficiency, and resource consumption.

3. Data Analysis Skills: • Collecting data from multiple sources and processing it for use in decision-making. • Using data analysis tools such as Pandas, NumPy, and B Power. • Designing predictive models using deep learning techniques.

4. Skills Integration with Modern Technology • Connecting smart applications with smart devices and sensors. • Using Blockchain technologies in security and data storage. • Benefiting from cloud artificial intelligence services such as AI AWS, AI Google, and Azure Cognitive Services.

5. Skills Management Project & Teamwork • Managing work teams to develop group projects in a collaborative environment. • Documenting projects and presenting them in a professional manner.

6. Cybersecurity Skills: • Applying data encryption and protection methods in applications. • Testing application security against common attacks (such as SQL Injection, XSS, CSRF). • Adhering to security and privacy standards in software design.

C- Emotional and value goals

-1. Promote the spirit of creativity and innovation in designing smart solutions that meet societal needs and keep pace with technological developments. -2. Develop a commitment to professional ethics when developing applications, while taking into account user privacy and the protection of their data. -3. Promote collaborative work and team spirit in completing joint programming projects. -4. Instill the value of continuous learning to keep pace with developments in the field of artificial intelligence and smart technologies.

Teaching and learning methods

.1 Theoretical lectures

Introducing basic concepts and modern technologies in smart applications. ÿ

ÿ Presentation supported by oral explanation.

ÿ Use real-life examples.

ÿ Explaining the latest trends in artificial intelligence, the Internet of Things, and cloud applications.

2. Hands-on Learning

·ÿ Training students to design and implement advanced smart applications. ÿ Coding labs to build mini-projects.

ÿ Practical application using languages and frameworks such as Flutter, TensorFlow, Python, or Native React.

3. Project-Based Learning

ÿ Enhancing applied skills and problem solving.

ÿ Assign the student to build an integrated smart application (such as an application that recognizes images or relies on data analysis).

ÿ Linking projects to real problems from the market or society.

.4 Collaborative Learning

ÿ Enhancing teamwork and communication skills.

ÿ Divide the students into teams to carry out joint tasks or projects.

ÿ Organizing group discussions to solve programming problems.

.5 Problem -Based Learning

ÿ Sharpen critical thinking skills and solve technical challenges.

Present open-ended scenarios or problems to students. ÿ

ÿ Asking them to propose innovative software solutions using smart technologies.

.6 Discussions & Presentations

ÿ Improve presentation and persuasion skills.

Students give presentations on advanced smart technologies or applications. ÿ

ÿ Organizing discussion sessions to compare ideas and solutions.

.7 Learning Based **-Simulation**

ÿ Experience realistic working environments without the real risks.

ÿ Use simulation tools for IoT or AI systems.

ÿ Test the performance of applications in a virtual environment before deploying them.

8. Blended Learning

ÿ Combining traditional learning and e-learning

ÿ In-class lectures + interactive online content.

ÿ Use educational platforms such as Moodle or Google Classroom to distribute materials and track progress.

Evaluation methods

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	2hr	50% (50)	16	All
Total, assessment			100% (100 Marks)		

D - General and transferable skills (other skills related to employability and personal development).

The developed curriculum focuses not only on academic knowledge, but also on developing general skills that enhance employability and development.

Student personal. These skills include:

1. Analytical and problem-solving skills •

Analyze the behavior of swarm systems (such as ant colonies or bird flocks) and extract mathematical rules from them.

• Design optimization algorithms such as PSO or ACO to solve realistic problems (such as logistics delivery or energy management).

Its benefits in the labor market:

• The ability to address complex problems in fields such as artificial intelligence, robotics, and automatic control.

2. Creative thinking and innovation

• Encourage students to suggest new applications for computational intelligence or fuzzy logic (such as using them in smart games or

Digital health(.

• Design open-ended projects (e.g., “How would a swarm of firefighting robots operate in a forest?”).

Its benefits in the labor market:

• Enhancing innovation capacity in sectors such as financial technology (Fintech) and smart cities.

.3 Teamwork and Communication

• Group projects (such as drone swarm simulation) that require task distribution and coordination.

• Presentations to explain practical results using technical and simple terms.

Its benefits in the labor market:

• Ability to work in multidisciplinary teams (developers, engineers, data analysts).

4. Programming and technical skills •

Using Python to implement swarm intelligence algorithms • Familiarity

with systems simulation tools (such as MATLAB)

Its benefits in the labor market:

• Increase employment opportunities in jobs such as “Machine Learning Engineer” or “Intelligent Systems Developer.”

5. Project Management

• Dividing projects into stages (planning, implementation, evaluation) with setting deadlines.

• Use tools like Trello or GitHub to manage software tasks.

Its benefits in the labor market:

• Ability to manage technical projects from start to finish.

.6 Adapting to changing technology

• Discuss the latest research in cyber intelligence (such as combining it with deep learning).

· • Weekly challenges to solve problems using emerging technologies that

have benefits in the job market:

• Staying abreast of rapid developments in fields such as artificial intelligence and robotics.

.7 Quantitative and mathematical skills

• Applying mathematical optimization equations (such as velocity update equations in PSO).

• Analyze the data resulting from the simulation using simple statistics.

Its benefits in the labor market:

• Useful in roles such as “Data Analyst” or “AI Researcher.”

10. Course structure

Learning method	Unit name/topic	Outputs Learning required	watches	The week

• In-person lectures • Practical lectures In the lab • Reports • Tests	Review of Artificial Intelligence			The first
• In-person lectures • Practical lectures In the lab • Reports • Tests	Introduction to Neural Networks			the second
• In-person lectures • Practical lectures In the lab • Reports • Tests	Understanding Learning Methods and Neural Network Architecture			the third
• In-person lectures • Practical lectures In the lab • Reports • Tests	Single Layer Perceptron (SLP)			Fourth
• In-person lectures • Practical lectures In the lab • Reports • Tests	Back-Propagation Network (BPN)			Fifth
• In-person lectures • Practical lectures In the lab • Reports • Tests	The Hopfield Network			Sixth
• In-person lectures • Practical lectures In the lab • Reports • Tests	Associative Memory Bidirectional (BAM)			Seventh
• In-person lectures	network neural other			The eighth

• Practical lectures In the lab • Reports • Tests				
• In-person lectures • Practical lectures In the lab • Reports • Tests	Introduction to Genetic Algorithms			Ninth
• In-person lectures • Practical lectures In the lab • Reports • Tests	A Step-by-Step from Theory to Practice by Examples			tenth
• In-person lectures • Practical lectures In the lab • Reports • Tests	GA in Travelling Sales Man Problem Solving			eleventh
• In-person lectures • Practical lectures In the lab • Reports • Tests	GA in color mapping Problem Solving			twelfth
• In-person lectures • Practical lectures In the lab • Reports • Tests	GA in the 8 Puzzle Problem Solving			thirteenth
	exam mid			fourteenth
• In-person lectures • Practical lectures In the lab • Reports • Tests	Intelligence Swarm			fifteenth
• In-person lectures	PSO (Optimization Swarm Particle).			sixteenth

• Practical lectures In the lab • Reports • Tests				
• In-person lectures • Practical lectures In the lab • Reports • Tests	Ant Colony Algorithm			Seventh ten
• In-person lectures • Practical lectures In the lab • Reports • Tests	Bee Colony Algorithm			The eighth tenth
	exam mid			nineteenth
• In-person lectures • Practical lectures In the lab • Reports • Tests	Introduction to Fuzzy Logic			twenty
• In-person lectures • Practical lectures In the lab • Reports • Tests	Classical and Fuzzy Sets			Twenty-one
• In-person lectures • Practical lectures In the lab • Reports • Tests	Operations on Fuzzy Sets			twenty two
• In-person lectures • Practical lectures In the lab • Reports • Tests	Arithmetic Fuzzy			twenty-three
• In-person lectures	Function Membership			twenty-four

• Practical lectures In the lab • Reports • Tests				
• In-person lectures • Practical lectures In the lab • Reports • Tests	Linguistic Variables			twenty-five
	exam mid			twenty-six
	Applications of Fuzzy Logic			twenty seven

11. Required	
Intelligent systems and machine learning, Dr. Ahmed Tariq Sadiq	infrastructure prescribed books-1
James M. Keller et al., “Fundamentals of Computational Intelligence: Neural Networks, Fuzzy Systems, and Evolutionary Computation,” Wiley-IEEE Press, 2016	Main References (Sources) 2
- Swarm Intelligence: From Natural no Artificial Systems (Bonabeau et al.). - Fuzzy Logic with Engineering Applications (Timothy J. Ross).	A(Recommended books and references) scientific journals, reports, etc.
b) Electronic references, websites, platforms such as Coursera and Udemy for complementary training courses	

12. Curriculum Development Plan
ÿ Update the theoretical content: 1. Integrating the latest developments in swarm intelligence: • Add topics such as: a) Integration between swarm intelligence and deep learning. b) Applications of cyber intelligence in the Internet of Things (IoT) and smart cities. c) Using swarm intelligence in Big Data Analytics. • Updated application examples to include: a) Drone delivery systems, such as Google's Project Wing. b) Serpentine robots in precision agriculture. .2 Deepening the concepts of fuzzy logic:

• Adding topics such as: (Neuro-Fuzzy Systems). (ab) Applications of fuzzy logic in self-driving cars. (c) Using fuzzy logic in healthcare (such as disease diagnosis).