Description of the location

This course description provides a concise summary of the main features of the course and the learning outcomes expected of the student, demonstrating whether the student has made the most of the available learning opportunities. It must be linked to the course .description .The program

Shatt al-Arab University	1. Educational institution .
Department of Computer Science	2. Scientific Department \Center.
Advanced smart applications	3. Name/Code of the . headquarters
My presence	4. forms of Available . attendance
First and second semester 2024-2025	5. semester/year .
hours 200	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 fields.
- Delve into the concepts and algorithms of Genetic Algorithms(GAs) including , their representation, selection, intersection, and operators. Mutations.
- ApplyGAs 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)) .and ant colony optimizationACO and ,(.bee colony optimization algorithms
- This course provides a comprehensive introduction to advanced smart applications, covering a range of topics from networking .Neural and genetic algorithms, and even swarm intelligence and fuzzy logic Students will gain practical experience in applying these Technologies to solve real-world problems, UsingMATLAB programming language

Course outcomes, teaching, learning and assessment methods .9

A- Cognitive objectives

Understanding advanced concepts of smart applications , including the Internet of -1 Things, artificial intelligence, and machine learning.

Understanding the structure and design of smart systems and their working -2 mechanisms, from data collection to processing and decision-making.

Knowledge of the latest smart application development technologies , frameworks -3, and programming tools used.

Analyzing user needs and transforming them into executable software -4 .requirements

,Understanding data protection and security methods in smart applications -5 .including encryption and identity verification

Identifying future market trends and emerging technologies in the field of smart -6 .applications

B-Skill objectives of the course

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 Skills

- Ability to develop intelligent applications using modern languages and frameworks such as Python ,JavaScript
- Applying artificial intelligence(AI) and machinelearning techniques in building applications.
- Integrating APIsand cloud computing services into projects.

2. Smart System Design and Development Skills Design Skills

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

3. Data Analysis Skills Skills

- Collecting data from multiple sources and processing it for use in decision making.
- Use data analysis tools such asPandas ,NumPy ,Power B
- Design predictive models using deep learning techniques.

4. Integration skills with modern technology Skills

- Connecting smart applications with smart devices and sensors.
- Using Blockchain technologiesin security and datastorage .
- Leverage cloud AI services such asAWS AI ,Google AI ,Azure Cognitive Services .

5. Teamwork& Project Management Skills

- Managing work teams to develop group projects in a collaborative environment.
- Documenting projects and presenting them in a professional manner.

6. Cybersecurity Skills Skills
- Applying data encryption and protection methods in applications.
- Testing application security against common attacks(such asSQL Injection ,XSS ,CSRF).
- Commitment to security and privacy standards in software design.

C- Emotional and value goals

Promoting creativity and innovation in designing smart solutions that meet the -1 .needs of society and keep pace with technological developments

Develop a commitment to professional ethics when developing applications, while -2 .taking into account user privacy and protecting their data

Enhancing collaborative work and team spirit in completing joint software projects -3 .

Instill the value of continuous learning To keep pace with developments in the -4 field of artificial intelligence and smart technologies.

Teaching and learning methods

1. **Theoreticallectures**
- Introducing basic concepts and modern techniques in smart applications.
- Presentation supported by oral explanation.
- Use real-life examples.
- Explaining the latest trendsin artificial intelligence, the Internet of Things, and cloud applications .

2. **practical learning (Hands-on Learning**
- Training students to design and implement advanced smart applications.
- Coding Labs Labs) to build micro-projects.
- Practical application using languages and frameworks such asPython, TensorFlow , Flutter , or React Native.

3. **Project- Based Learning Learning**
- Enhance applied skills and problem solving.
- Assign students to build a fully integrated smart application (such as one that recognizes (images or relies on data analysis.
- Linking projects to real problems from the market or society.

4. **cooperative learning(Collaborative Learning**
- Enhancing teamwork and communication skills.
- Divide students into teams to carry out joint tasks or projects.
- Organize group discussions to solve programming problems.

5. **Problem- Based Learning Learning**
- Refine critical thinking skills and solve technical challenges.
- Present open-ended scenarios or problems to students.
- Asking them to propose innovative software solutions using smart technologies.

6. **Presentations& Discussions**
- Improve presentation and persuasion skills.
- Students give presentations on advanced smart technologies or applications.
- Organize discussion sessions to compare ideas and solutions.

7. **- Based Learning Learning**
- Experience realistic working environments without the real risks.
- Use simulation tools for IoT or AI systems.
- Test the performance of applications in a virtual environment before deploying them.

8. **Blended learning Learning**
- Combining traditional learning and e-learning
- In-class lectures + interactive online content.
- Use of educational platforms such asMoodle orGoogle 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 enhanced curriculum focuses not only on academic knowledge but also on developing general skills that enhance students' employability and personal development. These skills include:

1. **Analytical and problem-solving skills**

- Analyzing the behavior of swarm systems (such as ant colonies or bird flocks) and extracting mathematical rules from them.
- Design optimization algorithms Such asPSO orACO to solve real-world problems (such (as logistics delivery or energy management.

Its benefits in the labor market:

- Ability to address complex problems in fields such as artificial intelligence, robotics, and automation.

2. innovation Creative thinking and

- Encourage students to suggest new applications of swarm intelligence or fuzzy logic (such (as use 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 a drone swarm simulation) that require task allocation and coordination.
- Presentations explaining 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

- UsingPython to Implement Swarm Intelligence Algorithms
- Familiarity with systems simulation tools(such asMATLAB

Its benefits in the labor market:

- Increase employment opportunities in jobs such as "Machine Learning Engineer" or Intelligent Systems Developer"."

5. project management

- Divide projects into phases (planning, implementation, evaluation) with deadlines.
- Use tools likeTrello orGitHub to manage your 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 swarm intelligence (e.g., combining it with deep learning).
- Weekly challenges to solve problems using emerging technologies.

Its benefits in the labor 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 inPSO).
- Analyze the data generated by the simulation using simple statistics.

Its benefits in the labor market:

- Useful in roles such as "data analyst" or "AI researcher."

Course structure .10

week	watches	Required learning outcomes	Unit name/topic	Learning method
first	4		Review of Artificial Intelligence	• In-person lectures • Practical laboratory lectures • Reports Tests
second	4		Introduction to Neural Networks	• In-person lectures • Practical laboratory lectures • Reports Tests
third	4		Understanding Learning Methods and Neural Network Architecture	• In-person lectures

				• Practical laboratory lectures • Reports Tests
Fourth	4		Single Layer Perceptron (SLP)	• In-person lectures • Practical laboratory lectures • Reports Tests
Fifth	4		Back-Propagation Network (BPN)	• In-person lectures • Practical laboratory lectures • Reports Tests
Sixth	4		The Hopfield Network	• In-person lectures • Practical laboratory lectures • Reports Tests
Seventh	4		Bidirectional Associative Memory (BAM)	• In-person lectures • Practical laboratory lectures • Reports Tests

eighth	4		another neural network	• In-person lectures • Practical laboratory lectures • Reports Tests
Ninth	4		Introduction to Genetic Algorithms	• In-person lectures • Practical laboratory lectures • Reports Tests
tenth	4		A Step-by-Step from Theory to Practice by Examples	• In-person lectures • Practical laboratory lectures • Reports Tests
eleventh	4		GA in Travelling Sales Man Problem Solving	• In-person lectures • Practical laboratory lectures • Reports Tests
twelfth	4		GA in color mapping Problem Solving	• In-person lectures • Practical laboratory lectures

				• Reports Tests
thirteenth	4		GA in the 8 Puzzle Problem Solving	• In-person lectures • Practical laboratory lectures • Reports Tests
fourteenth			mid-exam	
fifteenth	4		Swarm Intelligence	• In-person lectures • Practical laboratory lectures • Reports Tests
sixteenth	4		Particle Swarm Optimization (PSO)	• In-person lectures • Practical laboratory lectures • Reports Tests
seventeenth	4		Ant Colony Algorithm	• In-person lectures • Practical laboratory lectures • Reports Tests
eighteenth	4		Bee Colony Algorithm	• In-person lectures

				• Practical laboratory lectures • Reports Tests
nineteenth			mid-exam	
twenty	4		Introduction to Fuzzy Logic	• In-person lectures • Practical laboratory lectures • Reports Tests
twenty-one	4		Classical and Fuzzy Sets	• In-person lectures • Practical laboratory lectures • Reports Tests
twenty two	4		Operations on Fuzzy Sets	• In-person lectures • Practical laboratory lectures • Reports Tests
twenty-three	4		Fuzzy Arithmetic	• In-person lectures • Practical laboratory lectures • Reports

				Tests
twenty-four	4		Membership Function	• In-person lectures • Practical laboratory lectures • Reports Tests
twenty-five	4		Linguistic Variables	• In-person lectures • Practical laboratory lectures • Reports Tests
twenty-six			mid-exam	
twenty-seven	4		Applications of Fuzzy Logic	In-person lectures

Infrastructure .11	
Intelligent systems and machine learning, Dr. Ahmed Tariq Sadiq	Required textbooks -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
Platforms likeCoursera andUdemy for complementary training courses	,b) Electronic references, websites .etc

Curriculum development plan .12

- ❖ Update theoretical content:

1. Integrating the latest developments in swarm intelligence:

- Add topics like:
  - a) Integration of swarm intelligence and deep learning(Swarm Deep Learning).
  - b) Applications of swarm 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:

- Add topics like:
  - a) Fuzzy Systems-.
  - b) Fuzzy logic applications in self-driving cars.
  - c) Use of fuzzy logic in healthcare (e.g., disease diagnosis).

عميد الكلية	رئيس القسم	مدرس المادة