Soft Computing
Syllabus of (M.Sc) Postgraduate (2024-2025)
Second Course of Control and Computer Engineering
Course Instructor: Assist Prof. Dr. Muna Hadi Saleh

No.	Subjects: Two hours for each lecture	No. of week
1	Introduction to soft computing, definitions, Soft Computing: Theory and Applications, Hard Computing. Soft Computing related to other fields. Soft computing techniques; Intelligent Computing & CIT, AI & Soft Computing	**1**
2	Optimization Techniques. Search Space, Nondeterministic Polynomial (NP)-hard Problems, Genetic Algorithms history, Biological Background, Applications of GA. Operators of GA: Population size, encoding of a Chromosome, Crossover, Selection operation, Fitness Function, Stopping criteria termination condition, Examples	**1**
3	Crossover and Mutation types with examples. Types of selection methods with codes; Examples. Encoding Types and examples.	**1**
4	Simple Genetic Algorithms SGA: Representations, Operators, SGA reproduction cycle.	**1**
5	Real Applications: the MAXONE problem Travelling Salesman Problem.	**1**
6	General Genetic Algorithms GGAs using Random methods.	**1**
7	Exam	**1**
8	Introduction to Fuzzy Logic; Why Use Fuzzy Logic, Logical Fuzzy Operations, Examples. Additional Fuzzy Operators, Examples. Fuzzy set theory, logic operators, and geometry Fuzzy Algebra operator; Fuzzy relations, Examples	**1**
9	Membership Functions in the Fuzzy Logic; Operations, Real Application. Fuzzy Inference Systems (FIS); Components of Fuzzy system, Fuzzification, Defuzzification. Types of Defuzzification.	**1**
10	Mamdani-type fuzzy inference; Components of Fuzzy system, Real application.	**1**
11	Sugeno-Type Fuzzy Inference; Components of Fuzzy system, Real application Comparison between both inference methods with real application	**1**
12	Controller Structure, Fuzzy Control System Real Applications; Fuzzy Air Conditioner, Inverted Pendulum, Extended System of inverted pendulum,	**1**
13	MATLAB Fuzzy Toolkit Example	**1**
14	Exam	**1**
15	Seminars	**1**

References:

1. Fakhreddin O. Karray and Clarence de Silva, “Soft computing and intelligent system design”, Pearson, 2004.
2. Hung T. Nguyen, Naddipuram R. Prasad Carol L. Walker. Elbert A. Walker “A first course in fuzzy and neural control”, A CRC Press Company, 2003.
3. Devendra K. Chaturvedi,” Soft Computing Techniques and its Applications in Electrical Engineering,” Springer, 2008.
4. Structure-Specified Real Coded Genetic Algorithms with Applications, 2010
5. Internet resources.