Philadelphia University

Faculty of Engineering & Technology – Mechatronics Department

First Semester 2023/2024

Course Details:

Title: **Intelligent Control Systems** (0640734)

Prerequisite:

Credit Hours: 3 credit hours (16 weeks per semester, approximately 45 contact hours)

Textbooks:

- Intelligent Control Systems Using Soft Computing Methodologies, By: Ali Zilouchian & Mo Jamshidi, CRC Press, 2001, ISBN:0-8493-1875-0. Available online: https://b-ok.asia/book/593496/3c6d6e?regionChanged=&redirect=7850341
- Intelligent Control Systems with LabVIEW, By: Pedro Ponce-Cruz, Fernando D. Ramírez-Figueroa, Springer, 2010, ISBN 978-1-84882-683-0. Available online: https://b-ok.asia/book/812190/493ebf?regionChanged=&redirect=7855146

References:

- Leszek Rutkowski, "Flexible Neuro-Fuzzy Systems: Structures, Learning and Performance Evaluation", Kluwer Academic Publishers, USA, 2004.
- Mihir Sen, "Lecture notes on Intelligent Systems", 2006, Available online: http://www3.nd.edu/~msen/Teaching/IntSyst/IntSystNotes.pdf.
- Nguyen, Prasad, Walker, and Walker, "A First Course in Fuzzy and Neural Control", Chapman Hall /CRC Press 2003.
- Eric A. Wan, "Control Systems: Classical, Neural, and Fuzzy, Lecture Notes" , Available online: http://www.ifko.ktu.lt/~raimund/SWOT_FCM/LECTURE%20NOTES.pdf

Course Description: The main objective of this course is to cover the principles and design methods of intelligent control systems. It covers the fundamentals of intelligent systems, fuzzy logic, neural networks and genetic algorithms. The design principles of intelligent controllers and their applications to mechatronics systems will be covered in this course.

Website: http://www.philadelphia.edu.jo/academics/kaubaidy/page.php?id=7

Instructor: Prof. Kasim M. Al-Aubidy

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Office: Engineering building, Room 6713, Ext: 2504

Class hours: Saturday: 14:00-16:00 + Online Lecture

Office hours: Saturday & Monday: 12:00-14:00

Course Outlines:

Week	Topic
1	An introduction to classical and intelligent control systems.
2	Intelligent systems and applied artificial intelligence.
3	Intelligent control concepts.
4	Artificial neural networks: fundamentals.
5	Artificial neural networks: architectures.
6	Artificial neural networks: applications.
7	Introduction to fuzzy logic.
8	Fuzzy control and stability.
9	Control applications of fuzzy logic.
10	Neuro-fuzzy controller: theory and design.
11	Neuro-fuzzy controller: applications.
12	Probabilistic and evolutionary algorithms.
13	Optimization of intelligent systems using GA.
14	Intelligent control systems: research paper analysis
15	Intelligent control systems: design methods.
16	Project discussion

Course Learning Outcomes with reference to ABET Student Outcomes:

Upon successful completion of this course, the student should:

1.	Identify intelligent control systems, and the components of the system	[h, j]
2.	Be able to design and implement an intelligent algorithms and systems	[a, b, c, e]
3.	Understand the basic tools and techniques of intelligent control systems	[a, b]
4.	Understand the operation of MC-based intelligent systems	[a]
5.	Implementation of intelligent algorithms for real-time mechatronics systems	[a, b, c]
6.	Have the ability to modify intelligent algorithms for control systems	[e]

Assessment Guidance:

Evaluation of the student performance during the semester (total final mark) will be conducted according to the following activities:

Sub-Exams: The students will be subjected to two scheduled written exams, first exam and second exam during the semester. Each exam will cover materials given in lectures in the previous 3-4 weeks.

Assignments: Each student must submit three assignments that cover subject topics and have added value to the lectures..

Projects: The project is an implementation of a simple embedded system. It is divided into three graded phases, Design, Simulation, and Implementation. Each student should work individually on the project and it should be submitted before or on a set agreed date.
Cheating by copying homework or assignments from others is strictly forbidden and punishable by awarding the work with zero mark.

Collective Participation: Brain storming and collective discussions will be carried out during any lecture. Individual student will be assessed accordingly.

Final Exam: The students will undergo a scheduled final exam at the end of the semester covering the whole materials taught in the course.

Grading policy:

Mid Exam	30%
Projects	20%
Assignments	10%
Final Exam	40%
Total:	100%

Attendance Regulation:

The semester has in total 45 credit hours. Total absence hours from classes and tutorials must not exceed 15% of the total credit hours. Exceeding this limit without a medical or emergency excuse approved by the deanship will prohibit the student from sitting the final exam and a zero mark will be recorded for the course. If the excuse is approved by the deanship the student will be considered withdrawn from the course.

October, 2023