

**Department offering the program**: Industrial electronics and Control Engineering **Department offering the course**: Industrial electronics and Control Engineering

**Course Specification**

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| **شعار وحدة الجودة1-Course basic information :** |
| **Course Code: AC450** | **Course Title:** Intelligent Control Systems | **Academic year:2015-2016****Level ( 4 )– Semester : 2** |
| **Department requirement** |  **Teaching hours: Lecture [3] - Tutorial [2] - Lab[0]** |
| **2- Course objectives** | 1. To demonstarate the concept of intelligent systems and their applications.
2. Providing an overview of various members of the consortiums in soft computing, namely fuzzy logic (FL), neural networks (NN), neuro-fuzzy as well as their application in modeling and control.
3. Allowing the students to compare between conventional control systems and intelligent control systems.
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| **3- Intended Learning Outcomes: (ARS)** | **Course (ILOs)** |
| **A- Knowledge and Understanding:** | A1) Explain concepts and theories of mathematics and sciences appropriate to intelligent control systems.A4) Explain principles of design including elements design, process and/or a system related to intelligent control systems.A8) Describe current engineering technologies as related to intelligent control systems.A12) Define contemporary engineering topics.A16) Interpret principles of analyzing and design of control systems with performance evaluation. | A1.1) Explain concepts of intelligent control systems. A1.2) Explain theories of mathematics and sciences appropriate to crisp sets and fuzzy set theory.A1.3) Explain theories of mathematics and sciences appropriate to fuzzy operation and relations.A1.4) Explain theories of mathematics and sciences appropriate to fuzzy compositional rules of inference.A1.5) Explain theories of mathematics and sciences appropriate to intelligent systems and neural networksA4.1) Explain principles of design including elements design, process and/or a system related to fuzzy logic control.A4.2) Explain principles of design including elements design, process and/or a system related to neuro control methods.A8.1) Describe current engineering technologies as related to fuzzy logic control .A8.2) Describe current engineering technologies as related to types of neural networks.A8.3) Describe current engineering technologies as related to fuzzy neural networks.A12.1) Define contemporary engineering topics in neuro control methods.A12.2) Define contemporary engineering topics in learning methods. A16.1) Interpret principles of analyzing of control systems with performance evaluation related to fuzzy neural networks. A16.2) Interpret principles design of control systems with performance evaluation between conventional control and fuzzy logic control. |
| **B- Intellectual Skills** | B1) Select appropriate mathematical and computer-based methods for modeling and analyzing problems related to intelligent control systems.B2) Select appropriate solutions for engineering problems based on analytical thinking related to intelligent control systems.B3) Think in a creative and innovative way in problem solving and design related to intelligent control systems.B5) Assess and evaluate the characteristics and performance of components, systems and processes related to intelligent control systems.B13) develop innovative solutions for the practical industrial problems | B1.1) Select appropriate mathematical methods for modeling analyzing problems using fuzzy set theory.B1.2) Select appropriate mathematical methods for modeling analyzing problems using fuzzy relations.B1.3) Select appropriate mathematical methods for modeling analyzing problems using neural networks.B1.4) Select appropriate mathematical methods for modeling analyzing problems using fuzzy neural networks.B2.1) Select appropriate solutions for engineering problems based on analytical thinking using fuzzy logic control.B2.2) Select appropriate solutions for engineering problems based on analytical thinking using neuro control methods.B2.3) Select appropriate solutions for engineering problems based on analytical thinking using fuzzy neural networks.B3.1) Think in a creative and innovative way in problem solving and design related to fuzzy logic control.B3.2) Think in a creative and innovative way in problem solving and design related to neuro control.B5.1) Assess the characteristics and performance of components, systems and processes related to fuzzy logic control.B5.2) Evaluate the characteristics and performance of components, systems and processes related to neuro control methods.B13.1) develop innovative intelligent solutions for the practical industrial problems  |
| **C- Professional Skills** | C1) Apply knowledge of mathematics, science, information technology, design, business context and engineering practice integrally to solve engineering problems.C3) Create and/or re-design a process, component or system, and carry out specialized engineering designs.C23) apply modern techniques skills and engineering tools to control systems | C1.1) Apply knowledge of science, design, business context and engineering practice integrally to solve fuzzy operation and relations problems.C1.2) Apply knowledge of science, design, business context and engineering practice integrally to solve fuzzy compositional rules of inference problems.C1.3) Apply knowledge of science, design, business context and engineering practice integrally to solve learning methods problems.C3.1) Create and/or re-design a process, component or system, and carry out specialized engineering designs related to fuzzy logic control.C3.2) Create and/or re-design a process, component or system, and carry out specialized engineering designs related to neuro control methods.C3.3) Create and/or re-design a process, component or system, and carry out specialized engineering designs related to fuzzy neural networks.C23.1) apply fuzzy logic control for industrial control systems C23.2) apply neural control for industrial control systemsC23.1) apply fuzzy neural control for industrial control systems |
| **D- General Skills** | D2) Work in stressful environment and within constraints.D7) Search for information and engage in life-long self learning discipline.D8) Acquire entrepreneurial skills.D9) Refer to relevant literatures. | D2.1) Work in stressful environment and within constraints when solving technical problems related to Crisp sets and fuzzy set theory.D2.2) Work in stressful environment and within constraints when solving technical problems related to fuzzy operation and relations.D2.3) Work in stressful environment and within constraints when solving technical problems related to fuzzy compositional rules of inference.D7.1) Search for information and engage in life-long self learning discipline in subjects related to fuzzy logic control.D7.2) Search for information and engage in life-long self learning discipline in subjects related to types of neural networks.D7.3) Search for information and engage in life-long self learning discipline in subjects related to neuro control methods.D8-1) Acquire entrepreneurial skills in subjects related to fuzzy logic control.D8-2) Acquire entrepreneurial skills in subjects related to analysis of learning methods.D9.1) Refer to relevant literatures in topics relevant to comparison between conventional control and fuzzy logic control.D9.2) Refer to relevant literatures in topics relevant to control systems applications. |
| **4- Course Contents** | Introduction - intelligent systems their applications - Crisp sets and fuzzy set theory - Fuzzy operation and relations - Fuzzy relations and compositional rules of inference - Fuzzy Logic Control (FLC) - Fuzzy like-PD - Fuzzy like-PI - Fuzzy like-PID - Comparison between conventional control and Fuzzy Logic Control - Neural networks introduction - Intelligent systems and Neural networks - Types of Neural networks - Analysis of learning methods - Neuro Control methods - Fuzzy Neural networks **-** Control systems application. |
| **5- Teaching and Learning Methods** | * Lectures
* Tutorials
* Research assignments
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| **6- Teaching and Learning Methods for disable students** | * Assign a teaching assistance to follow up the performance of this group of students.
* Repeat the explanation of some of the material and tutorials.
* Scheduled time in order to improve their skills.
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| **7- Student Assessment** |
| **a-Assessment Methods** | - Weekly sheet exercises at class room- Quizzes- Case study for more demonstration.- Mid-term, and final exams |
| **b- Assessment Schedule** | - Exercise sheet: Weekly- Quizz-1: Week no 5 - Mid-Term exam: Week no 8- Quizz-2: Week no 10- Final – term examination: Week no 16 to 18  |
| **c- Weighting of Assessment** | - Class tutorial and quizzes : 8 %- Mid-term examination: 16 % - Case study and/or practical exam: 0 %- Final – term examination: 68 % - Other types of assessment: 8 % Total 100 % |
| **8- List of text books and references:** |
| **A- Course notes** | There are lectures notes prepared in the form of a book authorized by the department. |
| **B- Text books** | Kwang H. Lee, First Course on Fuzzy Theory and Applications, Springer-Verlag Berlin Heidelberg, 2005. |
| **C- Recommended books** | [1] S. N. Sivanandam, S. Sumathi and S. N. Deepa, Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg, 2007. [2] Timothy J. Ross, FUZZY LOGIC WITH ENGINEERING APPLICATIONS, John Wiley & Sons Ltd, 2013,3rd edition.  |
| **D- Periodicals, Web sites ……etc** | [www.control-systems-principles.co.uk](http://)[www.**mathworks**.com](http://) |

**9-Course Contents - ILOs Matrix**

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| **D- General and transferable skills** | **C- Professional and practical skills** | **B- Intellectual skills** | **A- Knowledge & Understanding** | **Week** | **Content Topics** |
|  |  |  | A1 | 1 | Introduction to intelligent systems and their applications |
| D2 |  | B1 | A1 | 2 | Crisp sets and fuzzy set theory |
| D2 | C1 | B1 | A1 | 3 | Fuzzy operation and relations  |
| D2 | C1 |  | A1 | 4 | Fuzzy compositional rules of inference |
| D7 ,D8 | C3,c23 | B2, B3, B5 | A4 | 5-6 | Fuzzy Logic Control (FLC)* Fuzzy like-PD
* Fuzzy like-PI
* Fuzzy like-PID
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| D9 |  |  | A16 | **7** | Comparison between conventional control and Fuzzy Logic Control  |
|  |  | B1 | A1,A8 | 8 | Neural networks introduction |
| D7 |  |  | A8 | 9-10 | Types of Neural Networks |
| D8 | C1 |  | A12 | 11 | Analysis of learning methods |
| D7 | C3,C23 | B2, B3, B5 | A4,A12 | 12 | Neuro Control methods |
|  | C3,C23 | B1, B2, B13 | A8, A16 | 13 | Fuzzy Neural networks |
| D9 | C23 | B13 | A16 | 14-15 | Control systems applications |

**10-Teaching and Learning Methods - ILOs Matrix**

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| **Teaching and Learning Methods** | **A- Knowledge & Understanding** | **B- Intellectual skills** | **C- Professional and practical skills** | **D- General and transferable skills** |
| **Lectures** | A1, A4, A8, A12, A16 | B1, B2, B3, B5, B13 |  |  |
| **Tutorials.** | A1, A4, A8, A12, A16 | B1, B2, B3, B5, B13 | C1,C3 |  |
| **Exercises** | A1, A4, A8, A12, A16 | B1, B2, B3, B5, B13 | C23 | D2, D7,D8, D9 |
| **Labs and/or case studies** |  |  |  |  |
| **Reports and assignments** | A1, A4, A8, A12, A16 | B1, B2, B3, B5, B13 | C1,C3,C23 | D2, D7,D8, D9 |

**11-Assessment Methods - ILOs Matrix**

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| **Assessment Methods** | **A- Knowledge & Understanding** | **B- Intellectual skills** | **C- Professional and practical skills** | **D- General and transferable skills** |
| **Weekly sheet exercises** |  | B1, B2, B3, B5, B13 | C1,C3 |  |
| **Reports** |  |  | C1,C3 | D2, D7,D8, D9 |
| **Quizzes** | A1, A4, A8, A12, A16 | B1, B2, B3, B5, B13 | C23 |  |
| **Laboratory exam** |  |  |  |  |
| **Midterm, and Final Written exams** | A1, A4, A8, A12, A16 | B1, B2, B3, B5, B13 |  |  |



Authorized from department board at 13/9/2015

Authorized from college board at 04/10/2015

**Course Coordinator Head of Department**

Prof . Nabila El-Rabaie  Asso. Prof. Mohamed El-Barwany

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