

<p>Kingdom of Saudi Arabia Ministry of Higher Education Qassim University College of Engineering</p>		<p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p>
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Intelligent Control Systems

College: Engineering

Department: Mechanical Engineering

First: Course Definition

1- Course Code: ME 663

2- Units : 3 credit hrs

3 – Semester:

4 -Prerequisite

5- Co-requisite

6- Location (if not on main Campus):

Second: Course Objectives

- *Gaining an understanding of the functional operation of a variety of intelligent control techniques and their bio-foundations*
- *Study of control-theoretic foundations (e.g., robustness, stability,..)*
- *Using of the computer for simulation and evaluation.*
- *Gaining "hands-on" working knowledge of the main techniques of intelligent control and an introduction to some promising research directions.*
- *Use of the computer for simulation and evaluation*

Third: Course Specifications

1- Topics to be covered		
Subject	No of Weeks	Units
Fundamental of control theory (e.g. Robustness, nonlinearity, stability)	2	6
Introduction to intelligent control techniques and their bio-foundations	1	3
Fuzzy logic control	2	6
Fuzzy and expert control	2	6

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Artificial neural network	2	6
Neuro-fuzzy systems,	2	6
Using genetic algorithms in optimizing intelligent control system,	2	6
Applications on mechanical and electromechanical systems	2	6

2- Course components (Total hrs in the Semester)

Lecture	Exercise or lab	Other
45	---	

3- Intended Learning Outcomes of the Course (ILO's)

a. Knowledge

i) Description of the knowledge to be acquired:

- Understanding the concepts of stability, linearity, and robustness.
- Understanding the main components of fuzzy control systems such as fuzzification, rules inference, defuzzification.
- Understanding the principles of neural networks and their applications in automatic control.
- Understanding the principles of bio-search techniques

ii) Teaching strategies to be used to develop that knowledge

- Lectures and tutorials
- Home assignments
- Open class discussions and forums
- Case study report using data collection, internet search, numerical computation, simulation, and reporting
- Matlab sessions

iii) Methods of assessment of knowledge acquired

- Home assignments
- Quizzes
- Midterm Exams
- Term Project
- Final Exam

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b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

- Ability to design and implement fuzzy logic controllers (FLC).
- Ability to design and implement neuro-based systems for control and pattern recognition.
- Ability to use the neural network to tune FLC parameters.
- Ability to use the evolutionary algorithms to optimize FLC and neural network.

ii) Teaching strategies to be used to develop these cognitive skills

- Lectures and tutorials
- Home assignments
- Open class discussions and forums
- Case study report using data collection, internet search, numerical computation, simulation, and reporting
- Matlab sessions

iii) Methods of assessment of students cognitive skills

- Home assignments
- Quizzes
- Midterm Exams
- Term Project
- Final Exam

c. Interpersonal Skills and Responsibility

i) Description of the interpersonal skills and capacity to carry responsibility to be developed

- Team work in Term project and Assignments

ii) Teaching strategies to be used to develop these skills

- Home assignments (group)
- Open class discussions and forums

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- Case study report using data collection, internet search, numerical computation, simulation, and reporting

iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

- Home assignments.
- Quizzes.
- Term Project.

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain

- Ability to use the internet to search for specific information in the area of intelligent control systems.
- Ability to use the available numerical computational tools such as Matlab and Simulink to design and analyze neuro-fuzzy systems
- Ability to use the modern presentation techniques to demonstrate the students' ideas and work.

ii) Teaching strategies to be used to develop these skills

- Lectures.
- Assignments, at home.
- Case study report using data collection, internet search, numerical computation, simulation, and reporting

iii) Methods of assessment of students numerical and communication skills

- Home assignments.
- Term Project.

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required

ii) Teaching strategies to be used to develop these skills

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iii) Methods of assessment of student's psychomotor skills

4- Student Assessment Schedule

Assessment	Assessment task (test, group project, examination etc.)	Week due	Weight of
1	Quiz 1	Week 2	4%
2	Quiz 2	Week 4	4%
3	Quiz 3	Week 6	16%
4	Mid Term Exam1	Week 7	15%
5	Case Study Term project & Regular Assignments	Week 8	5%
6	Quiz 4	Week 9	4%
7	Quiz 5	Week 11	4%
8	Mid Term Exam2	Week 13	15%
9	Quiz 6	Week 14	4%
10	Final Exam	Week 16	50%

5- Student Support

- Arrangements for availability of faculty for individual student consultations and academic advice. (include amount of time faculty are available each week.
- Three (3) Office hours per week are offered by the instructor to aid the students and support them.

6- Learning Resources

i) Essential Books (References)

1. Ponce-Cruz, Pedro, Ramírez-Figueroa, Fernando D., "Intelligent Control Systems with LabVIEW™, 1st Edition, 2010.
2. Kevin M. Passino and Stephen Yurkovich, "Fuzzy Control", Addison Wesley Longman, Menlo Park, CA, 1998.

ii) Course Notes

Course notes will be prepared in handled to the students through the web

iii) Recommended Books

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3. Antsaklis P.J., Passino K.M., eds., "An Introduction to Intelligent and Autonomous Control", Kluwer Academic Publishers, Norwell, MA, 1993.
4. A. Meystel, James S. Albus, "Intelligent Systems: Architecture, Design and Control", Sep 2001, Publisher: John Wiley & Sons Inc.
5. C. J. Harris, C.G. Moore, M. Brown, "Intelligent Control: Aspects of Fuzzy Logic and Neural Nets" , Aug 1993, World Scientific Pub Co Inc, World Scientific Series in Robotics and Automated Systems, Vol 6

iv) Electronic Books & Web Sites:

www.mathworks.com

v) Periodicals

- IEEE Conferences and Journals
- Journal of Intelligent & Robotic Systems
- Journal of Intelligent & Fuzzy Systems

7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Questionnaire,
- Observing the students opinions recorded in the college student sit
- Appeal box
- Carrying out extensive questioners by a sample of the distinguished students just after the graduation from the college

ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Periodical review of the teaching methods by both the department council and the education affairs vice dean
- Questionnaire,
- Observing the students opinions recorded in the college student site.

iii) Processes for Improvement of Teaching

- Evaluation of the course outlines by external staff member from outside the university

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- Periodical contact with the different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines .

iv) Processes for verifying standards of student achievement (e.g. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)

- Check marking of a sample of student work by an independent faculty member

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

- Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university).
- Consequently, actions are to be taken to improve the course delivery when necessary.
- Review of the course objectives, outcomes and curriculum each 2 years.