Mansoura University

Faculty of Computers and Information Sciences

Course Specifications of

Robotics– CS434P

University: Mansoura University **Faculty**: Computer and Information Sciences

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Program on which the course is given: General

Department offering the course: Department of **Computer Science**

Academic year/ Level: Forth Year

Date of specification approval:

A- Basic Information

Title : Robotics **Code :** CS434P

Credit Hours : 3 **Lecture :** 2 **Tutorial :** --- **Practical :** 2

B- Professional Information

1- Overall Aims of the Course

To give an appreciation of the issues that arise when designing complete, physically embodied autonomous agents, introduce the most popular methods for controlling autonomous mobile robots, give hands on experience of engineering design ,and to encourage independent thought on possible cognitive architectures for autonomous agents

2- Intended Learning Outcomes of the course (ILOs)

By completing this course successfully, the student will be able to:

a- Knowledge and Understanding

The student should acquire the knowledge and understanding of:

a1 Essential facts, concepts, principles and theories relating to computing and information and computer applications as appropriate to the program of study. a2 Modeling and design of computer-based systems bearing in mind the trade-offs.

a3 Tools, practices and methodologies used in the specification, design, implementation and evaluation of computer software systems.

a5 Essential facts, concepts, principles and theories relating to computing and information and computer applications as appropriate to the program of study. a10 Current developments in computing and information research. a13 Use high-level programming languages.

a17 Show a critical understanding of the principles of artificial intelligence, image, and pattern recognition.

a19 Select advanced topics to provide a deeper understanding of some aspects of the subject, such as hardware systems design, object-oriented analysis and design, and artificial intelligence, and parallel and concurrent computing.

b- Intellectual Skills

The student should be able to:

b1 Analyze computing problems and provide solutions related to the design and construction of computing systems.

b2 Realize the concepts, principles, theories and practices behind computing and information as an academic discipline. b4 Analyze, propose and evaluate alternative computer systems and processes taking into account limitations, and quality constraints.

b6 Evaluate the results of tests to investigate the functionality of computer systems.

b9 Evaluate research papers in a range of knowledge areas.

b11 Perform comparisons between (algorithms, methods, techniques...etc).

b12 Perform classifications of (data, results, methods, techniques, algorithms..etc.).

b13 Identify attributes, components, relationships, patterns, main ideas, and errors.

b14 Summarize the proposed solutions and their results.

b15 Restrict solution methodologies upon their results.

b17 Identify a range of solutions and critically evaluate and justify proposed design solutions.

c- Professional and Practical Skills

The student should be able to:

c1 Operate computing equipment, recognizing its logical and physical properties, capabilities and limitations.

c4 Apply computing information retrieval skills in computing community environment and industry.

c5 Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material c11 Perform independent information acquisition and management, using the scientific literature and Web sources. c14 Prepare technical reports, and a dissertation, to a professional standard; use IT skills and display mature computer literacy.
c19 Identify any risks or safety aspects that may be involved in the operation of computing equipment within a given context. c21 Prepare technical reports, and a dissertation, to a professional standard..

d- General and Transferable Skills The student should be able to:

d1 Demonstrate the ability to make use of a range of learning resources and to manage one's own learning. d2 Demonstrate skills in group working, team management, time management and organizational skills. d3 Show the use of information-retrieval..

3- Contents

No	Course Content	Lecture	Practical	Total
1	Introduction : What is robotics?, Robotics and AI, Embedded Systems, Agent-Task-Environment model , Embodied Systems , Synthetic approaches to science	**1**	**---**	**2**
2	Sensors and signal processing : Common sensors and their properties , I/O signal processing , Animate vision	**1**	**---**	**2**
3	Planning approaches to robot control & robot Kinematics and Dynamics	**1**	**---**	**2**
4	Control Theory : Linear control problems , Modelling robot processes using control theory , Limitations of control theory	**3**	**---**	**6**
5	Probability Based Approaches: Markov Decision Processes (MDPs) , Analysis of robot processes as MDPs , Dynamic Programming approaches to control , Partially Observable Markov Decision Processes , Hidden Markov Models	**3**	**---**	**6**
6	Behavior-Based Control : The subsumption architecture , Hybrid architectures , Formalising behavior based control	**3**	**---**	**6**
7	Adaptive approaches to robot control : Reinforcement learning for control, Learning maps	**2**	**---**	**4**
8	Evolutionary approaches	**2**	**---**	**4**
9	Case studies and Applications	**2**	**---**	**4**
10	ROS=robotic operating system (Lab sessions)	**---**	**10**	**36**

	Total Hours			**46**

4- Assessment Schedule

Assessment Method	No.	Description	Week No.	Weight (%)
Assignment	1	Report	4	5
Written Exams	2	Midterm Exam	7	5
Lab exam	3	mobile app evaluation	11	20
Oral Exam	4	Oral questions	11	10
Written Exams	5	Final Exam	14	60
Total				100

5- List of references 5.1 Course Notes

- Lecture handouts delivered to students at the end of each lecture.
- Materials are available at http://m.el-dosuky.com/course.php?c=robotics

5.2 Essential Books (Text Books)

- Autonomous Robots,From Biological Inspiration to Implementation and Control, by George A. Bekey, MIT PRESS, 2005

6- Facilities Required for Teaching and Learning -

Data show.

Course Content/ILO Matrix

Course Content	a1	a2	a3	a5	a10	a13	a17	a19	b1	b2	b4	b6	b9	b11	b12	b13	b14	b15	b17	c1	c4	c5	c11	c14	c19	c21	d1	d2	d3
Introduction	•			•		•		•																					
Sensors	•	•	•			•	•	•	•		•											•	•					•	•
Planning	•		•																		•	•							
Control Theory	•	•	•			•		•					•	•	•	•	•	•	•	•		•							
Probability Approaches	•	•	•	•		•		•		•			•	•	•	•	•	•	•			•	•						
Behavior-Based Control	•	•	•		•				•	•	•	•										•						•	•
Adaptive& Evolution approaches	•	•		•	•				•	•	•	•	•	•	•	•	•	•	•			•						•	•
Case studies and Applications		•		•	•	•		•	•		•									•	•				•				

ROS		●	●				●	●					●	●	●	●	●			●	●	●	●	●	●	●	●	●	

Learning Method/ILO Matrix

Course Content	a1	a2	a3	a5	a10	a13	a17	a19	b1	b2	b4	b6	b9	b11	b12	b13	b14	b15	b17	c1	c4	c5	c11	c14	c19	c21	d1	d2	d3
Lectures	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●		●
Practical			●	●				●	●					●	●	●	●	●			●	●	●	●	●	●	●	●	●

Assessment Methods/ILO Matrix

Course Content	a1	a2	a3	a5	a10	a13	a17	a19	b1	b2	b4	b6	b9	b11	b12	b13	b14	b15	b17	c1	c4	c5	c11	c14	c19	c21	d1	d2	d3
Assignment			●	●				●	●					●	●	●	●	●			●	●	●		●		●	●	
Midterm		●		●	●		●		●	●	●	●	●										●						●
Oral Exam		●		●		●	●	●	●					●	●	●	●	●					●						
Lab Exam		●	●				●	●					●	●	●	●	●			●	●	●	●	●	●	●	●	●	
Final Exam	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			

Course Coordinator: M. A. El-dosuky
Head of Department: Prof. Samir El-mougy
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