

Model No.12

Course Specifications : Robot Engineering

University : Benha university

Faculty : Faculty of Engineering at Shoubra

Department : Electrical Engineering Department

1- Course Data

Course Code : ECE 447

Course Title : Robot Engineering

Study Year : Fourth Year

Specialization :

Teaching Hours:

Lecture : 4

Tutorial : 2

Practical :

2- Course Aim

For students undertaking this course, the aims are to:

2.1- Analyze and design various robotic systems.

3- Intended Learning Outcomes of Course (ILOS)

a- Knowledge and Understanding

On completing this course, students will be able to:

- a- 1 - Describe principles of design including elements design, process and/or a system related to Robotics..(a5)
- a- 2 – Demonstrate methodologies of data collection interpretation and solving robotics problems. (a6).
- a- 3 - Describe principles of analyzing and design of robotic systems. (a20)

b- Intellectual Skills

At the end of this course, the students will be able to:

- b- 1 - Select appropriate mathematical methods for robotics modeling .(b1)
- b- 2 - Combine different ideas, views, and knowledge of robotic systems from a range of sources.(b5)
- b- 3 - Assess and evaluate the characteristics and performance of robotics systems and processes. (b6)

c- Professional Skills

On completing this course, the students are expected to be able to:

- c- 1 - Professionally merge the engineering knowledge and understanding to improve robotic design.(c2)
- c- 2 - Create and re-design a process, component or system, and carry out specialized robotic designs. (c3)
- c- 3 - Use a wide range of analytical tools, techniques, equipment, and software packages pertaining to the robotics .(c6)

d- General Skills

At the end of this course, the students will be able to:

- d- 1 - Collaborate effectively within multidisciplinary team.(d1)
- d- 2- Work in stressful environment and within constraints.(d2)

4- Course Contents

| No. | Topics | No of hours |
|-----|---------------------------------------|-------------|
| 1 | Introduction. | 4 |
| 2 | Coordinate systems and transformation | 4 |
| 3 | Robot kinematics& inverse kinematics | 4 |
| 4 | Robot dynamics | 4 |
| 5 | motion path planning | 4 |
| 6 | robot motion control | 4 |
| 7 | Basic Sensors | 4 |
| 8 | Advanced Sensors | 4 |
| 9 | Actuators | 4 |
| 10 | Robot Programming | 4 |
| 11 | Robot Vision | 4 |
| 12 | Advanced Algorithms | 4 |

5- Teaching and Learning Methods

- 5.1-Modified Lectures
- 5.2- Practical training / laboratory
- 5.3- Class activity
- 5.4- Case study
- 5.5- Assignments / homework

6- Teaching and Learning Methods of Disables

- 6.1- nothing .

7- Student Assessment

a- Student Assessment Methods

| | |
|---|---|
| 1 | Assignments to assess knowledge, intellectual and general skills. |
| 2 | Quiz to assess knowledge, intellectual. General skills |
| 3 | Mid-term exam to assess knowledge, intellectual skills. |
| 4 | Final exam to assess knowledge, intellectual. General skills |

b- Assessment Schedule

| No. | Assessment | Week |
|-----|------------------|--------------|
| 1 | on | 2, 5, 9, 11 |
| 2 | Quizzes on | 4, 6, 10, 12 |
| 3 | Mid-term exam on | 8 |
| 4 | Final exam on | 15 |

c- Weighting of Assessments

| Assessment | Weight |
|------------------------|--------|
| Mid_Term Examination | 13 % |
| Final_Term Examination | 67 % |
| Oral Examination | 0 % |
| Practical Examination | 0 % |
| Semester work | 20 % |

| | |
|---------------------------|-------|
| Other types of assessment | 0 % |
| Total | 100 % |

8- List of References

a- Books

1- Thomas Bräunl, "Embedded Robotics," 3rd ed., Springer-Verlag Berlin Heidelberg, 2008.

b- Recommended Books

1- EVERETT, H.R. Sensors for Mobile Robots, AK Peters, Wellesley MA, 1995.

c- Web Sites

1- <http://robotics.usc.edu>

2- <http://servomagazine.com>

- Course Coordinator : Dr. Ashraf Mohammed Hafez Ghoneim

Head of Department : Prof. Dr. Sayed Aboo-Elsood Ward

Model No.11A

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University : Benha university

Faculty : Faculty of Engineering at Shoubra

Department : Electrical Engineering Department

Matrix of Knowledge and Skills of the course

| No. | Topics | week | Basic Knowledge | Intellectual Skills | Professional Skills | General Skills |
|-----|---------------------------------------|-------|-----------------|---------------------|---------------------|----------------|
| 1 | Introduction. | 1 | a1,a3 | | | |
| 2 | Coordinate systems and transformation | 2 | a1,,a2,a3 | b1, | | |
| 3 | Robot kinematics& inverse kinematics | 3,4 | a5,a2 | b1,b2, | c1,c2, | |
| 4 | Robot dynamics | 5 | a5,a2 | b2,b3 | c1,c2, | d2 |
| 5 | motion pathplanning | 6,7 | a1,a3 | b1,b3 | c1,c3 | |
| 6 | Mid term exam | 8 | a1,,a2,a3 | b1,b2,b3 | | d2,d1 |
| 7 | robot motion control | 9,10 | a1,a3 | b1 ,b3 | c1, c3 | |
| 8 | Image processing in robotics | 11,12 | a1,a3 | b2,b3 | c2 | |
| 9 | Robot control and applications | 13,14 | a1,,a2,a3 | b1,b2, | c1,c2, | |
| 10 | Final exam | 15 | a1,,a2,a3 | b1,b2, | | d2,d1 |

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Matrix of course content and ILO's

Course Title: Robot Engineering

Code: ECE 447

Lecture: 4

Tutorial: 2

Practical: -

Total:6

Program on which the course is given: B.Sc. Electrical Engineering (Communications)

Major or minor element of program: Major

Department offering the program: Electrical Engineering Department

Department offering the course: Electrical Engineering Department

Academic year / level: **Fourth** Year / **second** Semester 2014-2015

Date of specifications approval: 20/6/2010

| Course content | a 1 | a2 | a3 | b 1 | b2 | b3 | c1 | c2 | c3 | d1 | d2 |
|---------------------------------------|--------|----|----|--------|----|----|----|----|----|----|----|
| Introduction | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | | |
| Coordinate systems and transformation | | ✓ | | ✓ | | | ✓ | | | | ✓ |
| Robot kinematics& inverse kinematics | ✓ | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | ✓ |
| Robot dynamics | ✓ | ✓ | | | | ✓ | | | ✓ | | |
| motion path planning | ✓ | | ✓ | | | ✓ | | | ✓ | | ✓ |
| robot motion control | | | | ✓ | | | ✓ | | ✓ | | |
| Image processing in robotics | | | ✓ | | ✓ | ✓ | | ✓ | | | ✓ |
| Robot control and applications | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | |

Matrix of course aims and ILO's

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| Course content | a 1 | a 2 | a3 | b1 | b 2 | b3 | c1 | c2 | c3 | d1 | d2 |
|--|--------|--------|----|----|--------|----|----|----|----|----|----|
| By the end of the course the students will be able to Analyze and design various robotic systems | | | | ✓ | ✓ | | ✓ | | | ✓ | |
| Gain advanced knowledge and understanding of s specialist topics in Industrial Electronics | | ✓ | | ✓ | | | | | ✓ | | |
| Provide a foundation for further postgraduate studies | | ✓ | ✓ | | ✓ | | ✓ | ✓ | | | ✓ |

Course coordinator: **Dr. Ashraf Mohammed Hafez Ghoneim**

Head of department: Prof. Dr. Sayed Ward