# Course Specification
## (Bachelor)

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|---|---|
| **Course Title:** | Robotics |
| **Course Code:** | CS 1772 |
| **Program:** | Computer Science |
| **Department:** | Department of Computer Science |
| **College:** | Computing and Technology |
| **Institution:** | Albaha University |
| **Version:** | 1 |
| **Last Revision Date:** | Oct 13, 23 |

## Table of Contents

## A. General information about the course:

### 1. Course Identification

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|---|---|---|---|---|---|
| **1. Credit hours: ( 3 )** | | | | | |
| | | | | | |
| **2. Course type** | | | | | |
| **A.** | ☐University | ☐College | ☐Department | ☒ Track | ☐Others |
| **B.** | ☐Required | | ☒ Elective | | |
| **3. Level/year at which this course is offered: (12)** | | | | | |
| **4. Course general Description:** | | | | | |
| This course provides an overview of robotic systems. Topics to be covered include fundamentals of robotics, actuators and drive systems, sensors, Systems on chip microcontrollers, control programs, robotic actions and autonomous control algorithms, Object detection and classification, Neural network and machine learning. | | | | | |
| **5. Pre-requirements for this course** (if any)**:** | | | | | |
| Artificial Intelligence (CS 1505) | | | | | |
| **6. Pre-requirements for this course** (if any)**:** | | | | | |
| None | | | | | |
| **7. Course Main Objective(s):** | | | | | |
| The main purpose for this course is to teach students how to:<br>• Recognize fundamental principles of robotics<br>• Describe Actuators, drive systems and sensors<br>• Explain System on a chip microcontrollers<br>• Illustrate autonomous control algorithms<br>• Illustrate Object detection and classifications algorithms<br>• Explain Neural networks and machine learning<br>• Work both independently and collaboratively<br>• Communicate concepts and techniques in oral presentations | | | | | |

### 2. Teaching mode (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | Traditional classroom | 33 | 100% |
| 2 | E-learning | | |
| 3 | Hybrid<br>• Traditional classroom<br>• E-learning | | |
| 4 | Distance learning | | |

### 3. Contact Hours (based on the academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1. | **Lectures** | 33 |
| 2. | **Laboratory/Studio** | - |
| 3. | **Field** | - |
| 4. | **Tutorial** | - |
| 5. | **Others (specify)** | - |
| **Total** | | 44 |

## B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| **1.0** | **Knowledge and understanding** | | | |
| 1.1 | Recognize fundamental principles of robotics | K1 | • Lectures<br>• Multimedia presentation<br>• Discussions | • Home work (rubric)<br>• Midterm exam<br>Final Exam |
| 1.2 | Describe Actuators, drive systems and sensors | K2 | • Lectures<br>• Multimedia presentation<br>Discussions | • Home work (rubric)<br>• Midterm exam<br>Final Exam |
| **2.0** | **Skills** | | | |
| 2.1 | Explain System on a chip microcontrollers | S1 | • Demonstrations<br>• Group Discussion | • Home work (rubric)<br>• Final Exam |

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| | | | • Group Projects<br>• Case Studies | Project evaluation form (rubric) |
| 2.2 | Illustrate autonomous control algorithms | S2 | • Lectures<br>• Multimedia presentation<br>Discussions | • Home work (rubric)<br>• Quizes<br>• Final Exam<br>Project evaluation form (rubric) |
| 2.3 | Illustrate Object detection and classifications algorithms | S3 | • Lectures<br>• Multimedia presentation<br>Discussions | • Home work (rubric)<br>• Quizes<br>Final Exam |
| 2.4 | Explain Neural networks and machine learning | S4 | • Lectures<br>• Multimedia presentation<br>• Discussions | • Home work (rubric)<br>• Final Exam<br>• |
| 2.5 | Communicate concepts and techniques in oral presentations | S5 | • Slide Presentations<br>• Multimedia Presentations<br>• Demonstrations<br>• Debates/Discussions<br>• Group Projects | • Viva-voce (Rubric)<br>Presentation Assessment (Rubric) |
| **3.0** | **Values, autonomy, and responsibility** | | | |
| 3.1 | Work both independently and collaboratively | V1 | • Presentation<br>• Guest Lectures<br>• Debates/Discussions<br>• Group Projects<br>• Team-based Learning<br>• Case Studies<br>Seminars | • Rubrics<br>• Note Cards<br>Project evaluation form (rubric) |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1. | Introduction to Robotics | 2 |
| 2. | Actuators and drive systems | 3 |

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|---|---|---|
| 3. | Sensors | 3 |
| 4. | System on a chip microcontrollers | 6 |
| 5. | Robotic actions and autonomous control algorithms | 4 |
| 6. | Introduction to Scientific programming | 4 |
| 7. | Object detection and classification | 6 |
| 8. | Neural networks and machine learning | 3 |
| 9. | Project presentation | 2 |
| | | |
| **Total** | | **33** |

## D. Students Assessment Activities

| No | Assessment Activities * | Assessment timing (in week no) | Percentage of Total Assessment Score |
|---|---|---|---|
| **1.** | Homework | Every two weeks | 10% |
| **2.** | Mid-term exam | 6 | 20% |
| **3.** | Quiz | 10 | 10% |
| **4.** | Project evaluation form (rubric) | 12 | 10% |
| **5.** | Final Exam | 13 | 50% |

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

## E. Learning Resources and Facilities

### 1. References and Learning Resources

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|---|---|
| **Essential References** | • "Introduction to Robotics: Analysis, Control, and Applications (2nd edition)," by Saeed B. Niku, Wiley, 2010.<br>• **Steven F. Barrett, "Arduino III : Internet of Things", [San Rafael, California] : Morgan & Claypool Publishers. 2021**<br>• **E. R. Davies, "Computer Vision : Principles, Algorithms, Applications, Learning", 5th edition. London : Academic Press. 2018** |
| **Supportive References** | • Computer Science Curriculum 2013 – http://cs2013.org<br>ACM (Association for Computer Machinery) Curricula Recommendations http://www.acm.org/education/curricula-recommendations |
| **Electronic Materials** | • ACM (Association for Computer Machinery) web site - http://www.acm.org/<br>• ACM SIGARCH (Special Interest Group on Computer Architecture) - http://www.sigarch.org/ |

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| | • IEEE Computer Society web site - http://www.computer.org/portal/web/guest/home<br>Open access course material online |
| **Other Learning Materials** | none |

## 2. Required Facilities and equipment

| Items | Resources |
|---|---|
| **facilities**<br>(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.) | An instructor computer station with:<br>• High speed Internet connection<br>• A desktop computer with a programming development tool<br>Power outlets for instructor's laptop plug-in Lecture rooms provide enough space for the students. |
| **Technology equipment**<br>(projector, smart board, software) | • A digital image projection system with connection to desktop computer and laptop computer.<br>• High speed Internet connection.<br>An instructor computer station |
| **Other equipment**<br>(depending on the nature of the specialty) | None |

## F. Assessment of Course Quality

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| Effectiveness of teaching | • Students<br>• Faculty<br>• Peer Reviewers<br>• Program Leader<br>Course Coordinator | • Surveys (indirect).<br>• Direct feedback from students (interview between Program leader and students).<br>• Course evaluation by Peer Reviewers (indirect).<br>• Class visit by Program Leader<br>Comprehensive Course report (where we can find information about teaching difficulties and action plan, …) |
| Effectiveness of Students assessment | • Students<br>• Faculty<br>• Peer Reviewers<br>• Course Coordinator<br>• Exam Evaluation Committee | • Surveys (indirect).<br>• Direct feedback from students (interview between Program leader and students). |

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| | Course Coordinator | • Assessment results (direct)<br>• Course evaluation by Peer Reviewers (indirect).<br>• Comprehensive Course report (where we can find information about assessment difficulties and action plan, …)<br><br>Exam evaluation by the Exam Evaluation Committee (indirect) |
| Quality of learning resources | • Students<br>• Faculty<br>• Peer Reviewers<br><br>Course Coordinator | • Surveys (indirect)<br>• Course evaluation by Peer Reviewers (indirect).<br>Comprehensive Course report (where we can find information about difficulties and challenges about learning resources as well as consequences and action plan, …) |
| The extent to which CLOs have been achieved | • Faculty<br>• Program Leader<br>• Course Coordinator | • Student Results (direct)<br>Comprehensive Course report (where we can find the CLO assessment results) |
| Other | None | None |

**Assessors** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

**Assessment Methods** (Direct, Indirect)

## G. Specification Approval

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| **COUNCIL /COMMITTEE** | |
| **REFERENCE NO.** | |
| **DATE** | |