BCSCXXX: Introduction to Robotics

Office Hours: Thursdays from 1 to 3 PM. Office: Room xxx. Phone number: xxxx-xxx-xxx.

Course Summary

Course Title	**Introduction to Robotics**		
Course Code	**BCSCXXX**		
Credit Units	4		
Work load	Lectures 2h/week	Tutorial 2 h/week	Lab 2 h/week
Pre-requisite(s)	None		
Study Programme	BIT		
Level	XXX		
Semester	1		
Mode of Teaching	Lectures + Tutorial + Practical		
Course Description	This course will cover the introduction topics of robotics in practice and research including kinematics, inverse kinematics,vision, motion planning, mobile mechanisms and sensors. During the course lab hours students will construct robots which are driven by a microcontroller, with each project reinforcing the basic principles developed in lectures. Students usually work in teams. Puma and Scara robots will be also part of the projects. This course will also expose students to some of the contemporary happenings in robotics, including current robotics research, applications, robot contests and robot web surfing.		

Course Objectives

The main goal of the course is to learn the basic tools to implement Machine Learning algorithms and use them in Robotics applications.

Learning Outcomes

Upon completion of this course, the student will be able to:

- Understand the basic concepts and principles of Robotics.
- Understand the basic concepts and principles of Kinematics and inverse kinematics.
- Understand the basic principals of coordinate frames and conversions.
- Design, produce an industrial robot and program it.
- Able to find solutions to daily tasks by a robot design.
- Develop program competencies
- To be able to explain the principles, practices and scope of robotics.

Prerequisite(s)

A computer programming course preferably Java and/or Python

Co-requisite(s) and Concurrent Prerequisite(s)

None

Equivalent(s)

To be determined

Delivery Methods

- Lectures and Group Discussions
- Hands on training, design and implementation in Robotics Lab
- Technical Workshops, Conferences and seminars
- Videos

- Presentations of student developed applications
- Team works

Faculty of Science and Technology's Expectations

Students are required to participate fully and engage in lively, respectful debates and hands-on Java programming practicals. Much of the in-class work will involve critical thinking and cooperative learning that stress individual responsibility and collaborative approaches to Java programming. All lab work involve hands-on coding. Students are required to take part and make a meaningful contribution to their learning and to take part in technical workshops, conferences and seminars. Your teacher will be a facilitator to you as you go through the course content. Whether you go through all the course content or not with your teacher, it is your responsibility to ensure you go through all the content either alone or as a study group. This is important because test and exam questions will come from any of the content detailed in this course outline.

In this class, we believe that sometimes you can lead the group and we expect your best. We expect you to understand and implement robotics knowledge and implement what you learned, read the books, take notes and go back over your notes and code after each class. Arrive early to class, pay attention, ask questions, and work with others. We expect you to turn your cell phones off before class. Don't come in late or leave early unless absolutely necessary. We teach not only through lecture and discussion but with example. We use the readings, workshops, conferences, seminars and guest speakers as additional help. We love to teach and we want you to leave the class feeling special, ready to go and more aware of how to use your skills to make the world a better place.

Class Policies

- Late submission of assignments will not be accepted. All the assignments given must be completed on time. Penalties for any form of cheating or plagiarism are severe. Written work submitted must be a student's own. All sources of information used must be identified
- Students are responsible for both the information given in class and the readings from the text book or supplemental resources. If absent when materials are distributed, it is the responsibility of that student to get the information from another student
- All mobile phones must be turned off or put on silence mode during lectures
- Students must always be on time for classes, no habit of late coming will be entertained
- Students are required to stay for the entire duration of the lecture
- Attendance will always be monitored and students are required to have a class attendance record of at least (75%) attendance. Students with class attendance of less than 75% will be barred from writing examinations. Attendance is defined as coming to class on time and leaving after the class is over. Coming on time and leaving before the class is over or coming to class just before the class is over is NOT considered attendance
- Although occasional absence may be unavoidable, it in no way excuses you from meeting the requirements of the course
- If you have a prior commitment, it must be approved in advance with your professor and the work for that week will have to be made up
- If you have an emergency, the material can be made up within the next class period. It is your responsibility to notify the professor and the faculty administrator, and it is your responsibility to set up a strategy for completion
- The student is responsible for the material discussed and the assignments given on the day of his/her absence

Must do Assignments

1. Use course materials to design and implement a robot in the lab.
2. Use 3D solid modeling software to design the components of your robot
3. Use 3D printer to produce parts of your robot
4. Solve assigned problems to understand robotics calculations
5. Use a microcontroller to control your robot

NOTE

A Guest lecture on ML will be conducted plus a practical and project guidance.

Course Details

Week 1: Introduction to basic concepts

Understanding the concepts of the subject, expectations and the projects

Assignment
Search about the robotics, find case studies and present in the class

Week 2& 3: Forward Kinematics

Assignment
Assigned problems, work on robot design

Week 4: Inverse Kinematics

Assignment
Assigned problems, work on robot design

Week 5 : Break

Week 6 : Velocities

Assignment

Assigned problems, work on robot design

Week 7: Course work I + Test 1
Present your project preliminary work

Week 8: Static Forces

Assignment
Assigned problems,work on robot design

Week 9 : Dynamics

Assignment
Assigned problems,work on robot design

Week 10 : Trajectory Generation

Assignment
Assigned problems,work on robot design

Week 11: Manipulator Design

Manipulator Design, Sensors and actuators

Assignment

Assigned problems,work on robot design

Week 12: Course work II & Presentations

Week 13: Position & Force Control

Assignment

Assigned problems,work on robot design

Week 14: Robot vision

Assignment

Assigned problems,work on robot design

Week 15& 16: Programming Robots

Assignment

Write algorithms related to the tasks,work on robot design

Week 17: GUEST LECTURE

Assessment and Criteria

- **Course & Lab Work** **55%**
  - Class Presentation 05%
  - Attendance 05%
  - Assignment 15%
  - Implementations 30%
- **Exams** **45%**
  - Midterm 20
  - Final 25
- **Total** **100%**

——

Textbook

Introduction to Robotics, John J. Craig, Addison-Wesley Publishing, Inc., 1989.

Readings:

Machine Vision, D.H. Ballard and C.M. Brown, Prentice-Hall, 1982.

Robot Motion Planning, J.C. Latombe, Kluwer Academic Publishers, 1991.

Introduction to Robotics, P. J. McKerrow, ISBN: 0201182408