The University of Jordan
School of Engineering
Department of Mechatronics Engineering
1st Semester – A.Y. 2019/2020

Course:	Robotics Systems– 0908563 (3 Cr. – Core Course) Lecture Time (Sun, Tus, Thru: 11:00 – 12:00)
Instructor:	Dr. Mohammad Mashagbeh *Office:* Mechatronics Engineering Department, *Telephone:* 5355000 ext 23023, *Email*: m.mashagbeh@ju.edu.jo *Office Hours:* (Sun, Tus. 10.00-11.00)
Course Website:	http://elearning.ju.edu.jo
Catalog Data:	Introduction to Robotics, Spatial Description and Transformation, Kinematics of Robotic Manipulator, Velocity and Acceleration of Rigid Bodies, Dynamics of Rigid Bodies, Jacobian and singularity of Manipulators, Workspace of Robotics Manipulator, Force and torque transformation, MATLAB Programming
Prerequisites by Course:	Engineering Numerical Methods (0908311), Automatic Control (0908353)
Prerequisites By Topic:	Students are assumed to have sufficient knowledge pertaining to the following: 1. Numerical methods 2. Linear Algebra 3. Systems dynamics 4. Machinary 5. Matlab computer language.
Textbook:	**B. Siciliano et. al., Robotics – Modeling, Planning and Control, Springer, 2009.**
References:	Introduction to Robotics: Mechanics and Control by John J. Craig. 2th Edition. Prentice Hall. Robot Modeling and Control: 1st Edition by Mark W. Spong, Seth Andrew Hutchinson, M. Vidyasagar.
Schedule & Duration:	14 Weeks, 42 lectures (50 minutes each), plus exams.
Minimum Student Material:	Textbook, class handouts, scientific calculator, and an access to a personal computer with MATLAB
Minimum College Facilities:	Classroom with whiteboard and projection display facilities, computational facilities with MATLAB and Simulink.

Course Objectives:

1. Learn the fundamental concepts of robotics manipulation such as transformation mathematics in 3D space, forward kinematics, inverse kinematics, jacobians and singularities, manipulator dynamics, and motion planning.
2. Use computer languages such as MATLAB to solve course topics in a generalized procedure using symbolic manipulation and numerical techniques.

ABET SO:

6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Course Learning Outcomes:

Upon successful completion of this course, a student should:

1. Understand the Basic Principles, Description of Position and Orientation, Robots Geometry, Robot Dynamic, Robot Motion.
2. Understand the Rotational of a Point in Space, Translation of a Point in Space, Transformation of a Point in Space, Euler and Fixed Angles.
3. Determine Forward Kinematics, Standard Frame, Inverse Kinematics Wrist Configuration of manipulator
4. Find Trajectory path for Manipulator
5. Calculate Rotation Matrix, Linear Velocity and Acceleration of Rigid Body, Angular Velocity and cceleration of Rigid Body og manipulator
6. Understand the Kinetic Energy of a Rigid Body, Newton's and Euler's Equation, Newton-Euler Algrothim for Manipulator Dynamic Equations
7. Understand the Definition of Jacobian, Analytical Jacobian Gemoetric Jacobian and the definition of singularty
8. Use MATLAB to analyze the robotic manipulator.
9. Investigate the impact of Robotics in a global, economic, environmental, and societal context.

Course Topics:

Topic Description
Introduction to Robotics
Spatial Description and Transformation
Forward Kinematics of Industrial Manipulator
Inverse Kinematics of Industrial Manipulator
Differential Kinematics
Dynamics of Rigid Bodies
Motion Control
MATLAB Programming

Ground Rules:

- **Attendance:**
  Attendance is required and strictly enforced. To that end, attendance will be taken every lecture; Absence of more than 7 lectures will result in the expulsion of the student from the course.
- **Make up Examinations**

There will be no make up exams for any exam that will be taken during the course. exceptions to this rule is restricted only to the following cases:-

1. death of only first order relatives (father, mother, sister, or brother).
2. hospital entry (in-patient) during thr time of the examination.

Any other cases will be given zero mark in the corresponding exam.

- **Special Notes**
  1. Seating plan will be as given in the attendance sheet.

Student Questions:

- **Piazza:**

piazza.com/ju.edu.jo/fall2019/0908563/home

Assessments: Exams, Quizzes, Projects, and Assignments.

Grading policy:

Assessments	Mark
Participation and quizzes	10
Project (Deadline: Dec, 12)	10
Midterm Exam	30
Final Exam (MATLAB Programming)	10
Final Exam (written)	40
Total	**100**

Last Updated: Sep. 2019