**Module title:** Advanced Robotics

**Module Code:** 24-14-046-01

**Module Credit:** 3

**Term:** Second Term 1397-98

**Lecturer:** Assistant prof. H. Moeinkhah, [hmoein@eng.usb.ac.ir](mailto:hmoein@eng.usb.ac.ir)

**Module Objectives:**

This course is intended for graduate students in Mechanical Engineering. The overall goal of the course is to provide the students with sufficient exposure to advanced methods and tools that are relevant to Dynamics.

**References:**

1. Engineering dynamics, Jerry H. Ginsberg, ISBN: 978-0-511-47872-7, © 2008.
2. Advanced Engineering Dynamics, H. R. Harrison, ISBN: 0-340-64571-7, © 1997.
3. Dynamics: Theory and Applications, Thomas R. Kane, David A. Levinson, ISBN: 0-07-037846-0, © 1985.

**Assessments:**

Class activity, homework and Project: 20%

Mid-term exam: 30%

Final exam: 50%

**Module Subjects:**

**1st. week:** Basic Considerations, Particle Kinematics

**2nd .week:** Path Variables, Rectangular Cartesian Coordinates

**3rd .week:** Curvilinear Coordinates

**4th.week:** Relative Motion, CoordinateTransformations

**5th .week:** Angular Velocity and Acceleration, Velocity and Acceleration Analysis Using a Moving Reference Frame, Observations from a Moving Reference Frame

**6th .week:** Kinematics of Constrained Rigid Bodies, Eulerian Angles

**Mid-term exam**

**7th week:** Inertial Effects for a Rigid Body, Linear and Angular Momentum

**8th week:** Inertia Properties, Rate of Change of Angular Momentum

**9th week:** Newton–Euler Equations of Motion

**10th & 11th weeks:** Introduction to Analytical Mechanics, Generalized Coordinates and Kinematical Constraints

**12th .week:** Evaluation of Virtual Displacements, Generalized Forces

**13th .week:** Lagrange's Equations

**14th .week:** Lagrange's Equations–Constrained Case

**15th & 16th .weeks :** Hamilton's Principle

**Final exam**