Course unit title:	Automation and Robotics		
Course unit code:	AEEE414		
Type of course unit:	Compulsory		
Level of course unit:	BSc (1st Cycle)		
Year of study:	3		
Semester when the unit is delivered:	7 (Fall)		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr Christos Themistos		
Learning outcomes of the course unit:	1. Review matrix transformation techniques in terms of reference and body attached coordinate frames. Classify by coordinate system and by Control Method, Robotic Applications (Welding, spray, parts handing and transfer, assembly operations, parts sorting, parts inspection etc.) 2. Understand the kinematics and dynamics of a robot arm manipulator. Familiarise with coordinate matrix transformation, link-joint parameters and Lagrange Polynomial theory to estimate the kinematics and dynamics of a robot arm manipulator. Apply Coordinate transformations, Homogeneous Transformation Matrices, Link-Joint Parameters, DH Transformation Matrices to analyse Robot Arm kinematics of practical robot arm manipulators. Apply Lagrange Polynomial theory to estimate the dynamics of a robot arm manipulator. 3. Judge the different robot drivers, sensors and controllers for use in particular applications of robot arm manipulators. Classify robot drives and sensors and explain the operation of the various sensors and actuators together with various control techniques used in industrial robots. 4. Familiarise with Robot Programming languages and CAD simulations packages for Robotic Applications. Design a four link robot arm manipulator by utilizing the kinematics principles, develop its computer model and simulate it using CAD simulation packages for Robotics applications. 5. Appraise the integration of the robot arm manipulator in industrial automation systems		
Mode of delivery:	Face-to-face		
Prerequisites:	None	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	• **Robot classification**: Classification by coordinate system and by Control Method, Robotic Applications (Welding, spray painting, grinding, parts handing and transfer, assembly operations, parts sorting, parts inspection etc.) • **Kinematics and Dynamics:** Coordinate transformations, Homogeneous Transformation Matrices, Link-Joint Parameters, DH Transformation Matrices • **Programming:** AL programming language, Computer model and CAD simulation packages for Robotics applications. Programming and Simulation of RoboCIM 5150 Robot Arm Manipulator. • **Robot Drives:** Types of drive systems: Pneumatic, Hydraulic, Electric		

	(brushed and brushless DC motors, stepper motors),.Mechanical components (springs, gears, belts, chains, joints, clutches, brakes, bearings). • **Sensors:** Potentiometers, synchros, resolvers, linear variable differential transformers, opto-interrupters, optical encoders, velocity sensors, accelerometers, proximity sensors, force and torque sensors. • **Control of Robot Arm Manipulators**: Feedback control System of a robot arm manipulator joint, Industrial Automation Systems
Recommended and/or required reading:	
Textbooks:	J. J. Craig, ***Introduction to Robotics: Mechanics and Control***, Prentice Hall, 2003
References:	S. B. Niku, ***Introduction to Robotics: Analysis, Systems, Applications***, Prentice Hall, 2001 E. Wise, ***Applied Robotics***, Prompt Publications, 2000 Lab-Volt, RoboCIM 5150 Software manual, Lab-Volt Ltd, 2007
Planned learning activities and teaching methods:	Students are taught the course through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration. Auditory exercises, where examples regarding matter represented at the lectures, are solved and further, questions related to particular open-ended topic issues are compiled by the students and answered, during the lecture or assigned as homework. Topic notes are compiled by students, during the lecture which serve to cover the main issues under consideration and can also be downloaded from the lecturer's webpage. Students are also advised to use the subject's textbook or reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during lecturer's office hours. Further literature search is encouraged by assigning students to identify a specific problem related to some issue, gather relevant scientific information about how others have addressed the problem and report this information in written or orally. Students are assessed continuously and their knowledge is checked through tests with their assessment weight, date and time being set at the beginning of the semester via the course outline. Students are prepared for final exam, by revision on the matter taught, problem solving and concept testing and are also trained to be able to deal with time constraints and revision timetable. The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Assessment methods and criteria:	• Assignments 10% • Tests 50% • Final Exam 40%
Language of instruction:	English
Work placement(s):	No