COURSE NUMBER: ME 5286, 4 credits	**COURSE TITLE:** Robotics
TERMS OFFERED: Spring	**PREREQUISITES:** ME 3281
TEXTBOOKS/REQUIRED MATERIAL: M. W. Spong / M. Vidyasagar, Robot Dynamics and Control, John Wiley, 1989.	**PREPARED BY:** Professor Donath DATE OF PREPARATION: May 15, 2007
COURSE LEADER(S): Professor Donath	**CLASS/LABORATORY SCHEDULE:** Two 115 minute lectures per week **CONTRIBUTION OF COURSE TO MEETING PROFESSIONAL OBJECTIVES:** 100 % Engineering Topics
CATALOG DESCRIPTION: Manipulator forward and inverse kinematics, homogeneous transformations and coordinate frames, the Jacobian and velocity control, task primitives and programming, computational issues; determining path trajectories; reaction forces; manipulator dynamics and control; vehicle kinematics, dynamics and guidance. Lab project demonstrates concepts. Sensors and introduction to computer vision and image processing.	**COURSE TOPICS:** (Topics 1-7: 10 weeks; Topic 8: 5 weeks) 1. Introduction to robots 2. Kinematics of manipulators 3. Path planning 4. Dynamics of manipulators 5. Control of manipulators 6. Sensors and role in robotics 7. Vehicle guidance (project) 8. Intro to computer vision and image processing - Image formation and camera models - Point and Mask processing Transformations - Image Histograms: Equalization & Matching - Edge Detection - Line Detection: Hough transform - Corner detection: Harris corner detector

COURSE OBJECTIVES	1. Teach the basics of robotic manipulator kinematics, dynamics and control, embedded computing and vehicle guidance. 2. Cover applications of robotics. 3. Teach the fundamentals of computer vision and image processing. Learn basic image processing techniques and implement them in a computing environment. 4. Provide practical experience with robotics, embedded computing and computer vision.
COURSE OUTCOMES	**(Letters shown in brackets are linked to program outcomes a-k)** 1. Students understand the basic theory of robot manipulators, including kinematics, dynamics and control, and image processing. [a] 2. Students learn to use modern computational tools relevant to real-time control and embedded computing (C/C++, QNX, Mathematica) [k] 3. Students gain experience in image processing through the completion of homework assignments and a take home quiz (or mini project). 4. Students gain practical experience in robotics through the completion of laboratory project (e.g. a robot vehicle guidance project). [b, c, g, k]
ASSESSMENT TOOLS:	1. Quizzes 2. Take Home Quiz (Computer Vision / Image Processing) (or Mini-project) 3. Major project

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Nature of Changes:

1. ***"Sensors and introduction to computer vision and image processing" has been added to the cataloged description.***
2. ***Topic #8 was added to the course topics list.***
3. ***"Teach the fundamentals of computer vision and image processing. Learn basic image processing techniques and implement them in a computing environment." Was inserted as course objective #3, course objective # 3 became topic #4***