

## ENAE 692 – Syllabus Introduction to Space Robotics

CLASS	TOPIC	READING*
<b>KINEMATICS</b>		
L1	Introduction	1.1, 1.2, 1.3
L2	Cartesian Position Mappings	2.1, 2.2, 2.8 2.3
L3	Operators	2.4, 2.5, 2.6, 2.7
L4	Link Description (D-H Notation)	3.1, 3.2, 3.3
L5	Link Transformations	3.4, 3.5, 3.6, 3.7
L6	Cartesian Velocities	5.1, 5.2, 5.3, 5.4
L7	Link Velocity Propagation	5.5, 5.6
<b>JACOBIANS</b>		
L8	Velocity Transformation	5.7, Exer. 5.17, SS3.1, SS3.2
L9	Static Force Transformation	5.9, 5.10, 5.11
<b>INVERSE KINEMATICS</b>		
L10	Inverse Kinematics Approaches Planar Arm	4.1, 4.2, 4.3, SS3.7 4.4, 4.6
L11	Iterative Solution Method Singularities	SS3.5 5.8, SS3.3
L12	Kinematic Redundancy	SS3.4, SS3.7.1
<b>DYNAMICS</b>		
L13	Newton-Euler Dynamics	6.1-6.7
L14	Lagrangian Dynamics Properties of Dynamics	6.9, SS4.1 6.8, 6.12, 6.13, SS4.2
<b>CONTROL</b>		
L15	Single Joint Linear Control	9.1-9.4
L16	Control Law Partitioning Trajectory Following Control	9.5, 10.1, 10.2 9.6
L17	Independent Joint Control Decoupling Joint Control Cartesian-Based Control	10.3, 10.6 10.4, 10.5 10.8, SS6.6
L18	Force Control	11.1, 11.2, 11.5, SS7.4
L19	Hybrid Position/Force Control Stiffness Control	11.3, 11.4, 11.6, SS7.6 11.7
<b>MECHANISMS</b>		
L20	Kinematic Configuration/Workspace Parallel Mechanisms and Closed Chains	8.1-8.4 8.5
L21	Four-Bar Linkages	SS4.3.3
L22	Single Joint Modeling	9.9
L23	Reading Assignment: PHANToM Haptic	"The Phantom Haptic Interface"
L24	Actuators and Drive Systems	8.7
<b>HARDWARE</b>		
L25	Sensors and Actuators	8.6, 8.8, 8.9
L26	Force Feedback Devices	Slides/Handout

\*Introduction to Robotics: Mechanics and Control, 3rd Ed., John J. Craig, Pearson Prentice Hall ©2003