AM6516 Neuromechanics of Human Movement - Syllabus

Objectives:
To introduce the neural system responsible for generation of human movements.
To introduce neural control of movements (principles and theories)
Briefly introduce topics of motor disorders and rehabilitation approaches.

Course contents:
Features of movement production system: Muscles, Neurons, Neuronal pathways, Sensory receptors, Reflexes and its kinds, Spinal control mechanisms

Major brain structures responsible for movement generation: Motor Cortex (including a discussion of premotor and supplementary motor areas), Basal Ganglia, Cerebellum, Descending and ascending pathways

Control theory approaches to motor control: Force control, generalized motor programs, muscle activation control, Merton's servo hypothesis, optimal control (including Posture based movement control)

Physical approaches to motor control: Mass-Spring models, Threshold control, Equilibrium point hypothesis, Referent configurations

Coordination of human movement: Approaches to studying coordination: Optimization, Dynamical systems approach, Synergies, Action-Perception interactions and coupling.

Exemplary behaviors: Prehension, postural control, locomotion, Kinesthesia.

Changing and Evolving behaviors: Changes to movement control due to fatigue and aging.

Motor disorders (introduction only): Spinal cord injury and Spasticity, Cortical disorders (Examples: Stroke, Cerebral Palsy), Disorders of Basal Ganglia (Examples: Parkinson's disease, Huntington's disease), Cerebellar disorders (Ataxia, Tremor, Timing issues, problems with error correction). Approaches to rehabilitation (Example: Deep Brain Stimulation in Parkinson's patients)

Text Book:
1. Neurophysiological basis of movement (2 ed), Mark Latash, Human Kinetics, 2008
2. Fundamentals of Motor control Mark Latash, Academic Press (Elsevier) (2012)

Reference Books:
1. Progress in Motor Control: A Multidisciplinary Perspective (Advances in Experimental Medicine and Biology) (No. 5), Dagmar Sternad (ed), Springer (2007)
2. Neuroscience (5 ed), Dale Purves et al, Sinauer Associates (2011)
3. Human Motor Control (2 ed), David Rosenbaum, Academic Press (Elsevier) (2009)
4. Principles of neural science (5 ed), Eric Kandel, James Schwartz et al (2012)