NATIONAL INSTITUTE OF EDUCATION
NANYANG TECHNOLOGICAL UNIVERSITY
PHYSICAL EDUCATION & SPORTS SCIENCE

MES814 Neuromuscular Biomechanics

Course Description

This course is designed for the understanding of the neuro-mechanics of muscles and ligaments, and the neural mechanisms for improved performance. The neuromuscular biomechanical responses to injury, rehabilitation and training will be introduced.
Laboratory work/projects will equip candidates with the skills to assess human motor performance using dynamometry, electromyography and eye tracking technology* (optional) (including all accompanying equipment).
Critical thinking will be required to interpret the data from these systems and subsequently applying the data to develop/enhance training programs targeted at improving human performance.

Learning Outcomes

At the completion of the course, the student should be able to understand:

- Muscle properties, characteristics and function during sporting performance and injury
- Change in muscle properties, characteristic and function from exercise and/or injury, and effect on performance.
- Afferent pathways and the use of these in proprioception and reflexes.
- Efferent pathways and the recruitment of motor units to generate force.
- Muscle activation patterns during sporting performance and/or injury, and how these change from exercise, training and injury.
- Reflex pathways in the generation of standard activation patterns and the role of these in exercise and/or injury
- Correct use and interpretation of electromyography
- Correct use and interpretation of dynamometry
- Integration of the information from the lectures/laboratories to assess the possible reasons for differences in sporting performance and musculoskeletal injuries

Course Content (*Subject to slight modifications*)

Week	Lecture/Laboratory Sessions
1	Introduction + Muscle Organization and Design
2	The Joint System + Handout of paper on Dynamometry for Individual Critique
3	Neuromuscular Training + Submission of Individual Critiques (10%)
4	Dynamometry 1: Individual Assignment 1: (Review on Hamstring/Rotator Cuff/ACL/Ankle/Elbow Injuries) Group assignment 1: Strength ratios, Torque-Velocity & Torque-Angle Relationships
5	Dynamometry 2: Individual Assignment 1: (Review on Hamstring/Rotator Cuff/ACL/Ankle/Elbow) Injuries Group assignment 1: Strength ratios, Torque-Velocity & Torque-Angle Relationships
6	PUBLIC HOLIDAY
7	Efferent + Afferent Systems Submission of Individual Review on Hamstring/Rotator Cuff/ACL/Ankle/Elbow Injuries (20%)
8	Submission of Group Project Written (20%) Group Presentations + Discussions (30 mins/group - 10%)
9	Reflexes
10	Movement and Muscle Activation Patterns

11	Electromyography practical (1) + individual research assignment: Torque-EMG Relationship & Proprioception
12	Electromyography practical (2) + individual research assignment: Torque-EMG Relationship & Proprioception
13	Electromyography practical (3) + individual research assignment: Torque-EMG Relationship & Proprioception
14	Submission of Individual Electromyography Assignments (25%) + Oral Presentations (15%)

Course Requirements

- Attend lectures and laboratory sessions
- Complete all required assignments/examinations

Student Assessment

Paper Critique (10%)
Individual Review on Hamstring/Rotator Cuff/ACL Injuries (20%)
Group Research Project (Dynamometry): (Written + Oral – 30%)
Individual Research Assignment (EMG): Written (25%) + Oral (15%)

Recommended Textbooks

Enoka, R.M. Neuromechanical Basis of Kinesiology, 4th Ed. Human Kinetics Books, Champaign, IL. 2008.

Vickers J.N. Perception, cognition and decision training: the quiet eye in action. Champaign, IL: Human Kinetics. 2007.

Recommended Readings & References

Selected research papers/readings/books will be recommended at the beginning of each topic and for laboratories.