

Plan of the course

Measurement and Analysis of Human Locomotion

Academic year **2016/2017**

prof. dr. sc. Vladimir Medved

I. COURSE AIMS

The importance of measurements to properly assess human locomotion is increasingly recognized. Already well established as an experimental scientific research tool, human locomotion measurements are frequently a routine clinical application. Fields of application encompass both healthy and pathological locomotion encountered in kinesiology and sports science, and also in several medical fields such as: rehabilitation medicine, orthopaedics, neurology, pediatrics and sports medicine, among other.

Theoretical background for biomechanical analysis of human locomotion is provided at the beginning. Macroscopic body modelling is explained, and inverse dynamic approach, being a central methodological paradigm, is introduced. Measurement methods including 3D kinematics, ground reaction kinetics and multichannel surface electromyography (sEMG) are then explained, as well as basics of spirometry. Gait, a principal locomotor pattern, is discussed. Basic clinically recognisable gait pathologies are identified. Other typical pathologies linked to the locomotor system function are identified; primarily those related to posture and equilibrium disturbances. Computerised motion analysis laboratory setting serves for a number of clinical measurement applications and case studies. Measurement findings are interpreted in the context of the underlying physiological system (mal)function. Expert knowledge of relevant medical specialist is relied upon, and biomechanical data are combined and integrated into the comprehensive diagnosis- and clinical decision-making picture. More objective differential diagnostics of various locomotor pathologies is sought, being applicable in rehabilitation follow-up, pre-surgery planning and post-surgery evaluation, prostheses of extremities' evaluation etc. Sportive movement examples are discussed as well.

The course is aimed at introducing to the medical student modern clinically oriented methods of biomechanical locomotion analysis. A multidisciplinary tailored faculty team, trained in the fields such as biomedical engineering, several medical specialties, and kinesiology demonstrates inter- and multidisciplinary nature of this rapidly developing field.

II. COURSE STRUCTURE

Course hours:

Lectures: 12

Seminar: 5

Practicum: 7

Total hours: 24

III. PLAN OF THE COURSE AND COURSE SCHEDULE

BLOCKS OF THE COURSE

Number of blocks: 1

Block number	Start	End
1.	26.6.2017	30.6.2017

BLOCKS OF THE COURSE SCHEME

Block 1

Date	Time	Group	Course hours type	Theme	Teaching staff
Monday 26.6.2017.	09:00-09:45; MEF \C\ - Šercer		Lectures	The study of human locomotion - an introduction	prof. dr. sc. Vladimir Medved
	10:00-10:45; MEF \C\ - Šercer		Lectures	On evolution and development of human gait	doc. dr. sc. Marija Rakovac
	11:00-11:45; MEF \C\ - Šercer		Lectures	Mechanics of human locomotion	prof. dr. sc. Zdravko Terze
Tuesday 27.6.2017.	09:00-09:45; MEF \C\ - Šercer		Lectures	Measurement systems for human locomotion: kinematics and kinetics	prof. dr. sc. Vladimir Medved
	10:00-10:45; MEF \C\ - Šercer		Lectures	On modern 3D motion capture methods	izv. prof. dr. sc. Tomislav Pribanić
	11:00-11:45; MEF \C\ - Šercer		Lectures	Clinical importance of measuring gait and balance	prof. dr. sc. Vladimir Medved
	13:00-15:15; Poliklinika Kinematika, Laginjina 16		Seminar	Pedobarography - clinical applications	Maja Mirković, dr. med., prof. dr. sc. Marko Pečina
Wednesday 28.6.2017.	09:00-09:45; Kineziološki fakultet		Lectures	Kinesiology of human gait	prof. dr. sc. Vesna Babić
	10:00-10:45; Kineziološki fakultet		Seminar	Introduction to the walking school	prof. dr. sc. Vesna Babić
	11:00-11:45; Kineziološki fakultet		Lectures	Human locomotion energy expenditure	doc. dr. sc. Davor Šentija
	12:00-12:45; Kineziološki fakultet		Seminar	Ergometry diagnostics issues	doc. dr. sc. Davor Šentija
	14:00-17:00; Kineziološki fakultet		Practicum	Automated measurement and evaluation of human locomotion	prof. dr. sc. Vladimir Medved, dr. sc. Igor Gruić
Thursday 29.6.2017.	09:00-10:30; Kineziološki fakultet		Lectures	Electromyography: origins and properties of myoelectrical signals	doc. dr. sc. Rajka Liščić
	11:00-13:15; Kineziološki fakultet		Practicum	Surface electromyography: measurement technique and signal interpretation	dr. sc. Igor Gruić, prof. dr. sc. Mario Cifrek
Friday 30.6.2017.	09:00-10:30; MEF Nova vijećnica		Lectures	Towards expert systems for human locomotion	prof. dr. sc. Vladimir Medved
	11:00-11:00; MEF Nova vijećnica	SVI	Exam	Exam	prof. dr. sc. Vladimir Medved

IV. EXAMINATIONS

Exam (final):

- conditions to take the exam: attendance to all lectures, seminars and practicals(only exempts with explanation allowed)
- the way of testing the knowledge: oral
- exam terms bellow

Regular terms	Date
Summer	30.6.2017
Additional terms	
1.	On request

V./I. LIST OF LECTURERS AND TEACHING STAFF

V./II EXTERNAL ASSOCIATES:

1. prof. dr. sc. Marko Pećina
2. prof. dr. sc. Mario Cifrek
3. prof. dr. sc. Zdravko Terze
4. prof. dr. sc. Vesna Babić
5. doc. dr. sc. Davor Šentija
6. izv. prof. dr. sc. Tomislav Pribanić
7. doc. dr. sc. Rajka Liščić
8. doc. dr. sc. Marija Rakovac
9. Maja Mirković, dr. med.
10. dr. sc. Igor Gruić
11. prof. dr. sc. Vladimir Medved

V./III UNTENURED LECTURERS:

VI. LITERATURE

A. Obligatory

A. Obligatory

1. V. Medved: *Measurement of Human Locomotion*; CRC Press Inc., Boca Raton, FL, 2001.
2. M.M. Pećina and D. Bojanić: *Overuse Injuries of the Musculoskeletal System, Second Edition*; CRC Press Inc.; Boca Raton, FL, 2003.
3. J. Rose and J.G. Gamble (Eds.): *Human Walking, Third Edition*; Lippincott Williams & Wilkins, Baltimore, Md, 2006.

B. Additional

1. P. Allard, A. Cappozzo, A. Lundberg and C.L. Vaughan (Editors): *Three-dimensional Analysis of Human Locomotion*; John Wiley & Sons, New York, 1997.
2. J.M. Winters and P.E. Crago (Eds.): *Biomechanics and Neural Control of Posture and Movement*; Springer-Verlag, New York, 2000.
3. R. Merletti and P.A. Parker (Eds.): *Electromyography. Physiology, Engineering, and Noninvasive Applications*; IEEE Press, John Wiley & Sons, Inc., Hoboken, New Jersey, 2004.

NOTE: Handouts material will be stored at student web portal prior to the beginning of the course.