

# Course Package

## Neural & Motor Systems

Name module	Neural & Motor Systems
Educational programme	MSc Biomedical Engineering
Period	Second quartile of the second semester (Quarter 2B)
Study load	15 ECTS

Neural & Motor Systems			
Quarter 1A	Quarter 1B	Quarter 2A	Quarter 2B
			<b>Bioelectromagnetics</b> (5 EC)
			<b>Remote Monitoring and Coaching</b> (5 EC)
			<b>Topics in Human Anatomy</b> (5 EC)

Required preliminary knowledge: BSc in Biomedical Engineering, Health Sciences, Technical Medicine of Computer Science or another relevant technical BSc. Knowledge of MatLab is preferred. Basic Knowledge of Anatomy and Physiology.

### 201400282 **Bioelectromagnetics**

In this course a general introduction into the theory of volume conduction of ionic currents (bioelectric sources), based on the quasi-static expression of Maxwell's equations, is presented. This generalized, mathematical approach can be applied to the various electrophysiological and biophysical processes underlying the generation of bioelectrical activity (nervous system and muscles) which generate the electrical and magnetic signals that can be measured on the body surface, such as the electroencephalogram (EEG), the electrocardiogram (ECG), the electromyogram (EMG) and the electroneurogram (ENG). These signals are clinically relevant because they provide information on the (patho)physiological condition of the corresponding tissues.

### 201500132 **Remote Monitoring and Coaching**

In Telemedicine we study theories, approaches and systems that focus on treating and assisting people in managing chronic health conditions or lifestyle changes in their own daily environment thereby supported by health care professionals when needed (Remote monitoring and coaching). To understand these systems, analyse them and to design them, we need to understand the health issues and problems that have to be

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addressed by the telemedicine system and we need to understand what the suitable building blocks and architectures are to design these systems. Furthermore, we need to be able to evaluate the system and understand how they can be implemented in every day care practice. A telemedicine system can be decomposed into four main functional building blocks:

**Monitoring** – this part of the system takes care of sensing relevant health related parameters and whenever needed environmental parameters. It will often include some data processing so as to remove measurement artifacts or to extract basic features from the sensor data. Monitoring may also include the transfer of data to some local or remote data-store facility, and it may include presentation of the (raw) data.

**Analysis** – this part of the system takes care of analyzing and interpreting the with respect to biomedical or clinical metrics, or to estimate the state (either physical or mental) of the patient.

The two other functional building blocks are Decision Support and Feedback and coaching. In decision support the outcomes of the analysis are used to make decisions on whether or not action should be undertaken and which action. The question here is how we can derive and construct decision models and how should these be used. Once a decision has been made, proper feedback and coaching to the patient is needed in order to effectuate the action and/or move the patient into the desired direction.

This course is about the design and development of a remote monitoring and coaching system by addressing these four different building blocks.

Especially the rising age of the Dutch citizen as well as an increasing number of people with chronic diseases puts an extra pressure on our society as both elderly and people with chronic diseases are more viable to become victim of all kind of complaints and with the consequence of problems with their balance between work and private life. Supporting these people in deploying a healthier life style is considered important. Employers, communities and the taxpayer all bear the costs of working-age ill-health which is estimated to run to around several billion Euros every year. Since health, work and well-being are closely and powerfully linked, they need to be addressed together. Well-being applications at work and at home are expected to help people to continue contributing to society, the marketplace and the economy. Furthermore, these applications may help suppressing the rising costs of chronic disease and ill-health.

Two aspects related to deploying a healthier lifestyle are physical activity and stress. These two will be studied as cases in this course.

#### 200900040 **Topics in Human Anatomy**

This course will focus at different topics in the field of human anatomy and physiology with a focus on sport injuries and physiology. Lectures and practical courses will be used alternatively. In addition, guest speakers who are experts in the field of sport injuries and rehabilitation will provide one or more lectures. The course will be examined by a written exam and three assignments throughout the course. Some lectures/practicals will be held at Roessingh Research and Development.