

**Course Title:** Designing mechatronic systems for rehabilitation

**Course description**

Course components	40h CM; 20h TP
European credits	6 ECTS
Master specialization	Ingénierie pour la santé / Mechatronic Systems for Rehabilitation
Semester	S3

**a) Objective**

The objective of this course is to apply mechatronic design to the specific area of physical rehabilitation. The point of view of physical medicine and rehabilitation is first presented. The first part of this course considers the presentation of the nervous system and its main pathologies that alter the motor functions and performances of the patient. The second part considers how to measure these motor performances for, in one hand diagnostic quantification and in the other hand for the design of mechatronic systems for rehabilitation. The last part of the course is devoted to the design of these specific systems that can physically assist the movement of a patient and eventually apply corrective forces. This part is based on examples and case studies.

In addition, visit and practical works will be held in Garches Hospital in Paris, which is the largest hospital dedicated to the rehabilitation and uses a lot of high technology systems in rehabilitation protocols.

**b) Content**

Presentation of the nervous system: Organization of the NS, Brain, Spinal cord, Tracts and Circuits, Neuron and synapse  
Pathologies study: Stroke, Spinal cord injury, Myopathy  
Introduction to Biomechanics aspects  
Sensors for human motion & interaction estimation  
Signal processing  
Review in rehabilitation robotics  
Aspects of the interactive robot design (cases study)  
Sensors fusion for the control of robots that are in physical interaction  
Practical works in Garches Hospital

**c) Pre-requisites**

Bases in robot design, modeling (kinematics and dynamics) and control.  
Programming with Matlab

**d) Evaluation**

Final examination

**Teaching method**

In class work	Total time	Weekly hours	Enrollment
Lectures	40 h		
Tutorials			
Practical work	20 h		
Project			
Other			