BIOMEDICAL TRANSDUCERS

1.1. Identification

University:	Alma Mater Studiorum – Università di Bologna						
School:	School of Engineering						
Course:	Biomedical Transducers						
ECTS:	6						
Semester:	*Winter*		X	*Summer*			
Category	*Fundamental course*			*Specialisation course*			X
Module	*MFI*	*MFII*	*MFIII*	*MSI*	*MSII*	*MSIII*	X
Teachers:	Angelo Cappello						
Language:	*English*	X	*Italian*	X	*Swedish*	*Spanish*	

1.2. Learning-outcomes

- Knowledge about the fundamentals of measurement in the biomedical field: accuracy, precision, static and dynamic properties
- Knowledge about the physical principles of the most common biomedical transducers
- Knowledge of basic transducer design
- Knowledge about biomedical data acquisition, processing and feature extraction

1.3. Competencies

▪ **General**
- To have critical understanding of technical and scientific tools
- To be able to select and apply analytical and numerical tools
- Communication skills
- To be able to work in an international context

▪ **Specific**
- To understand the methods for investigating advanced biomedical transducers
- To understand the physical and chemical interaction between the transducer and the physiological system
- To be able to design and test a transducer prototype

1.4. Contents

10. Fundamentals of physiology

11. Basic measurement principles: accuracy, precision, static and dynamic behavior of a biomedical instrument
12. Basic physical interaction: resistive, capacitive, inductive and semiconductor transducers, optical sensors, acoustical sensors, chemical sensors
13. Measurement of temperature
14. Measurement of chemical properties: pH
15. Measurement of electrophysiological signals: ECG, EEG, EMG
16. Measurement of biomechanical variables: position and orientation, velocity, acceleration, force, pressure, flow
17. Instrumentation preamplifiers, A/D conversion, analog and digital processing
18. Feature extraction for diagnosis and monitoring of physiological functions

1.5. Teaching Methodology

- Lecture sessions
- Laboratory sessions using software tools
- Practical laboratory sessions on prototypes

1.6. Evaluation

- Oral exams, including discussion of the laboratory work

1.7. Bibliography

J.D.Bronzino (Ed.), *Medical Devices and Systems*, Taylor and Francis, 2006
M.H.Bao, *Micro Mechanical Transducers*, (Handbook of Sensors and Actuators series, S. Middelhoek Editor) , Elsevier Science, 2000.