A bioinstrumentation course for sophomore biomedical engineers

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Abstract

The curriculum for the BSBME degree at the University of Wisconsin-Madison has a series of lecture-laboratory courses: bioinstrumentation, biomechanics, biomaterials, physiology for engineers, modeling of physiological systems, one each semester. Bioinstrumentation is taken in the fourth semester, with prerequisites of calculus, physics, and chemistry. It builds on physics to provide learning of electric circuits, instrumentation, and strength of materials. Because this course also serves as an introduction to the different areas of biomedical engineering, students learn to make measurements in all these areas. For biomechanics, they learn to measure stress and strain of bone and to measure gait. For biomaterials, they learn to measure molecular size and protein adsorption. They learn the principles and practices of measurements in the hospital clinical chemistry laboratory as well as in cardiology, radiology, and other clinics. They learn biostatistics, as well as the newer techniques in biotechnology, such as gene sequencing and biosensors. Twelve laboratories complement the text chapters at www.engr.wisc.edu/coebin/courses98/get/bme/310/webster/.

Timetable listing

BME310 Bioinstrumentation (3 credits). Spring 1999, 11:00 TR + lab M, T 2:25. Prerequisites: Math 223, Physics 202 & Chem 103

Course description

This is a sophomore level first course in bioinstrumentation covering clinical and research measurements. Topics include: Measurement systems, signal processing, measurement of: molecules in clinical chemistry, biomaterials and tissue engineering; hematology; cells in biomaterials and tissue engineering; nervous system; heart and circulation; lungs; kidney; bone; skin; and the body. Twelve laboratory experiments complement the lectures.

This is the first required course in the new undergraduate curriculum in biomedical engineering.Most bioinstrumentation courses have emphasized measurements in the traditional biomedical engineering areas such as biomechanics, medical instrumentation, and medical imaging. I am developing a new text and course, that will build upon these traditional areas to include measurements in areas of growing importance, such as biosensors, cellular engineering, and tissue engineering. I would welcome suggestions for improvement.

Textbook table of contents

BIOINSTRUMENTATION, John G. Webster, editor

1 MEASUREMENT SYSTEMS, Kevin Hugo

- 1.1 Studying biomedical engineering
- 1.2 The need for bioinstrumentation
- 1.3 Instrumentation
- 1.4 Errors in measurements
- 1.5 Statistics
- 1.6 Lifelong learning
- 1.7 References
- 1.8 Problems
- 2 BASIC CONCEPTS OF ELECTRONICS, Hong Cao
- 2.1 Electronic components and circuit analysis
- 2.2 Amplifiers
- 2.3 Filters
- 2.4 Analog-to-digital (ADC) and digital-to-analog (DAC) converters
- 2.5 Digital signal processing
- 2.6 Microcomputer
- 2.7 Software and programming languages
- 2.8 Display devices
- 2.9 Recorder device
- 2.10 References
- 2.11 Problems

3 MOLECULES IN CLINICAL CHEMISTRY, Mat Klein

- 3.1 Spectrophotometry
- 3.2 Oxygen saturation
- 3.3 Bilirubin
- 3.4 Lactate
- 3.5 Creatinine
- 3.6 Urea
- 3.7 Glucose
- 3.8 Amperometric biosensors for oxygen and glucose
- 3.9 Ion-sensitive electrodes for pH and CO2
- 3.10 Flame photometry
- 3.11 Mass spectroscopy
- 3.12 Carbon dioxide concentration measurement by infrared transmission spectroscopy
- 3.13 Nitrogen by emission spectroscopy
- 3.14 Drugs by fluorometry and chromatography
- 3.15 Electrophoresis
- 3.16 DNA sequencing
- 3.17 References
- 3.18 Problems

4 MOLECULAR MEASUREMENTS IN BIOMATERIALS AND TISSUE ENGINEERING, Jorge Monzon

- 4.1 Molecules and biomaterials
- 4.2 Molecules and tissue engineering
- 4.3 Surface analysis
- 4.4 Protein adsorption

- 4.5 Molecular size
- 4.6 References
- 4.7 Problems
- 5 HEMATOLOGY, Susanne Clark
- 5.1 Blood components and processing
- 5.2 Red blood cells
- 5.3 White blood cells
- 5.4 Platelets
- 5.5 Complete blood count
- 5.6 References
- 5.7 Problems
- 6 CELLULAR MEASURMENTS IN BIOMATERIALS AND TISSUE ENGINEERING, Jeff Schowalter
- 6.1 Cell measurement overview
- 6.2 Light microscopy
- 6.3 Cell orientation
- 6.4 Cell rolling velocity
- 6.5 Cell pore size determination
- 6.6 Cell deformation
- 6.7 Cell shear stress
- 6.8 Cell adhesion
- 6.9 Cell migration
- 6.10 Cell uptake
- 6.11 Cell protein secretion
- 6.12 Cell proliferation
- 6.13 Cell differentiation
- 6.14 Cell signaling and regulation
- 6.15 References
- 6.16 Problems
- 7 NERVOUS SYSTEM, Jang-Zern Tsai
- 7.1 Action potential
- 7.2 Brain, EEG and evoked potentials
- 7.3 Brain imaging: X ray
- 7.4 Brain imaging: CT
- 7.5 Brain imaging: MRI
- 7.6 Brain imaging: nuclear imaging
- 7.7 Brain imaging: single-photon emission computed tomography (SPECT)
- 7.8 Brain imaging: positron emission tomography (PET)
- 7.9 Brain imaging: biomagnetism
- 7.10 Eye, ERG, EOG and visual field
- 7.11 Ear and audiometry
- 7.12 Muscles
- 7.13 References
- 7.14 Problems

- 8 HEART AND CIRCULATION, Supan Tungjitkusolmun
- 8.1 Cardiac anatomy and physiology
- 8.2 Cardiac biopotentials
- 8.3 Cardiac pressures
- 8.4 Cardiac output
- 8.5 Cardiac sounds
- 8.6 Myocardial viability
- 8.7 Circulation
- 8.8 Blood flow
- 8.9 Blood pressure
- 8.10 Vessel distension
- 8.11 Vessel volume
- 8.12 References
- 8.13 Problems

9 LUNGS, KIDNEY, BONE AND SKIN, Shilpa Sawale

- 9.1 Lung
- 9.2 Pulmonary volume
- 9.3 Pulmonary flow
- 9.4 Pulmonary diffusion
- 9.5 Pulmonary resistance
- 9.6 Kidney
- 9.7 Kidney clearance
- 9.8 Kidney imaging
- 9.9 Hemodialysis
- 9.10 Kidney function
- 9.11 Bone
- 9.12 Skin
- 9.13 References
- 9.14 Problems
- 10 BODY, Chao-Min Wu
- 10.1 Regulation of body temperature
- 10.2 Clinical considerations
- 10.3 Measurement of surface temperature
- 10.4 Core temperature measurement
- 10.5 Measurement of body heat: calorimetry
- 10.6 Direct calorimetry
- 10.7 Indirect calorimetry
- 10.8 Measurement of body fat
- 10.9 Direct measurement of body fat
- 10.10 Indirect measurement of body fat
- 10.11 Measurement of body movement
- 10.12 Direct measurement of body movement
- 10.13 Image-based measurement of body movement
- 10.14 Safety measures
- 10.15 References
- 10.16 Problems

11 APPENDICES

- 11.1 Constants
- 11.2 Units

11.5

- 11.3 Acronyms and abbreviations
- 11.4 Web sites
 - Laboratory experiments:
 ECG
 electrophoresis
 blood pressure
 pulse oximeter
 temperature
 digital signal processing
 dynamic light scattering
 pacemaker
 spectrophotometer
 pressure sensor
 pH measurement
 stress and strain

JOHN G. WEBSTER

John G. Webster received the B.E.E. degree from Cornell University, Ithaca, NY, in 1953, and the M.S.E.E. and Ph.D. degrees from the University of Rochester, Rochester, NY, in 1965 and 1967, respectively.

He is Professor of Electrical and Computer Engineering at the University of Wisconsin-Madison. In the field of medical instrumentation he teaches undergraduate and graduate courses, and does research on RF cardiac ablation and measurement of vigilance.

He is author of Transducers and sensors, An IEEE/EAB Individual Learning Program (Piscataway, NJ: IEEE, 1989). He is coauthor, with B. Jacobson, of Medicine and clinical engineering (Englewood Cliffs, NJ: Prentice-Hall, 1977), and with R. Pallás-Areny, of Sensors and signal conditioning (New York: Wiley, 1991) and with R. Pallás-Areny, of Analog signal processing (New York: Wiley, 1999). He is editor of Encyclopedia of medical devices and instrumentation (New York: Wiley, 1988), Tactile sensors for robotics and medicine (New York: Wiley, 1988), Electrical impedance tomography (Bristol, UK: Adam Hilger, 1990), Teaching design in electrical engineering (Piscataway, NJ: Educational Activities Board, IEEE, 1990), Prevention of pressure sores: engineering and clinical aspects (Bristol, UK: Adam Hilger, 1991), Design of cardiac pacemakers (Piscataway, NJ: IEEE Press, 1995), Design of pulse oximeters (Bristol, UK: IOP Publishing, 1997), Medical instrumentation: application and design, Third Edition (New York: Wiley, 1998) Handbook of measurement, instrumentation, and sensors (CRC Press, Boca Raton, FL, 1999), and Encyclopedia of electrical and electronics engineering (New York: Wiley, 1999). He is coeditor, with A. M. Cook, of *Clinical engineering: principles and practices* (Englewood Cliffs, NJ: Prentice-Hall, 1979) and Therapeutic medical devices: application and design (Englewood Cliffs, NJ: Prentice-Hall, 1982), with W. J. Tompkins, of Design of microcomputer-based medical instrumentation (Englewood Cliffs, NJ: Prentice-Hall, 1981) and Interfacing sensors to the IBM PC (Englewood Cliffs, NJ: Prentice Hall, 1988), and with A. M. Cook, W. J. Tompkins, and G. C. Vanderheiden, of *Electronic devices for rehabilitation* (London: Chapman & Hall, 1985).

Dr. Webster has been a member of the IEEE-EMBS Administrative Committee and the NIH Surgery and Bioengineering Study Section. He is a fellow of the IEEE, Instrument Society of America and the American Institute of Medical and Biological Engineering. He is the recipient of the AAMI Foundation Laufman-Greatbatch Prize and the ASEE/Biomedical Engineering Division, Theo C. Pilkington Outstanding Educator Award.