BE 3600 BIOMEDICAL INSTRUMENTATION Spring 2003

http://www.biomed.mtu.edu/osoykan/classes/be3600/be3600.htm

3 Semester Credits

Prerequisite: EE-3010

Will meet on Tuesdays and Thursdays, 8:05 - 8:55

Classroom: ME-EM 303

Instructors:

Michael R. Neuman and (MNeuman @ Memphis.Edu)

Orhan Soykan (OSoykan @ MTU.Edu)

Teaching Assistants:

Heidi M. Niska (HMNiska @ MTU.Edu), Office Hours: to be announced

Ming Ling (MLing @ MTU.Edu), Office Hours: to be announced

Amy Latimer (ANLatime @ MTU.Edu), Office Hours: to be announced

Grading:

Midterm Exam 1= 17.5 pointsMidterm Exam 2= 17.5 pointsComprehensive Final= 22 pointsLab Grade= 33 pointsGraded Homework= 10 pointsTOTAL= 100 points

Α 90-100 85-89 AB В 80-84 BC 75-79 С 70-74 CD 65-69 D 60-64 F 0-59

Tentative Syllabus is as follows:

14 January 2003, Tuesday, Introducti	on to the course by Michael R. Neuman
	Generalized medical instrumentation system
Lecture 1	Characterizing medical instruments
	Terminology
	ASSIGNED READING: Notes handed out in class
16 January 2003, Thursday, Measure	ment systems by Heidi M. Niska
	Signals and noise
Lecture 2	Electric circuits review
	ASSIGNED READING: Chapter 1, pp. 1-26

21 January 2003, Tuesday, Measurem	ent Devices
	Displacement transducers,
Lecture 3	Ohmmeters and bridge circuits.
	ASSIGNED READING: Chapter 2, pp.44-72
23 January 2003 Thursday Measurem	nent Devices
	Measurement of temperature.
Lecture 4	Potentiometer circuits.
	ASSIGNED READING: Chapter 2, pp.44-72; Class Notes
29 January 2002 Tuesday, Liss of Sta	tiatiaal Mathada far Maaauramanta
26 January 2003, Tuesday, Ose of Sta	Statistics and Instruments
Lecture 5	Statistical processing of signals.
	ASSIGNED READING: Chapter 1, pp. 26-35; Class Notes
30 January 2003, Thursday, Principles	of Signals,
Locturo 6	Fundamentals of time and frequency domain analysis,
Lecture o	ASSIGNED READING: Chanter 1, np. 26-35
4 February 2003, Tuesday, Data proce	ssing systems
	Data acquisition and storage systems,
Lecture 7	Recording and display systems.
	ASSIGNED READING: Chapter 7, pp. 287-308
6 February 2003. Thursday. Mechanica	al measurements
	Measurement of force,
Lecture 8	Pressure transducers
	Direct measurement of blood pressure.
	ASSIGNED READING: Chapter 7, pp. 308-328
11 February 2003 Tuesday Mechanic	al measurements, continued
	Indirect measurement of blood pressure
Lecture 9	Sensing heart sounds
	Measurement of flow
	Thermal flow measurement
	ASSIGNED READING: Chapter 8, pp.332-355
12-14 February 2003, Winter Carnival	
18 February 2003 Tuesday Measure	ment of volume and flow
	Electromagnetic flow sensors
Lecture 10	Doppler flow measurement
	Plethysmography
	ASSIGNED READING: Chapter 8, pp.355-368

20 February 2003, Thursday, MIDTERM EXAM I (Lectures 1-9 through blood pressure)

25 February 2003, Tuesday, Electrical Lecture 11	impedance of biologic tissue Review of concept of electrical impedance Impedance bridge circuits Determining biological events by electrical impedance Detection of venous occlusion ASSIGNED READING: Review impedance in circuits book Chapter 4, pp. 121-125, 138-146, 164-171;	
27 February 2003, Thursday, Measure Lecture 12	ment of biopotentials Review of physics of electric fields Biological origin of electrical potentials, Electrochemical electrodes, ASSIGNED READING: Chapter 5, pp. 183-211	
3-7 March 2003 (Spring Break)		
11 March 2003, Tuesday, Measuremer Lecture 13	nt of biopotentials, continued Biopotential electrodes, Microelectrodes. ASSIGNED READING: Chapter 5, pp. 211-226	
13 March 2003, Thursday, Biopotential amplifiers		
Lecture 14	Examples of biopotential electrodes and signals, Review of operational amplifier circuits. ASSIGNED READING: Chapter 3, pp. 89-115	
18 March 2003, Tuesday, More biopote Lecture 15	ential amplifiers The instrumentation amplifier, The electrocardiograph, The electromyograph. ASSIGNED READING: Chapter 4, pp.146-151 Chapter 6, pp. 233-250	
20 March 2003, Thursday, Still more biopotential amplifiers		
Lecture 16	Cardiotachometers. ASSIGNED READING: Chapter 6, 250-266	
25 March 2003, Tuesday, Biomedical signal processing		
Lecture 17	Averaging. Integrating. ASSIGNED READING: Chapter 6, 267-281	
27 March 2003, Thursday, Optical sensing Review of physics of light		
Lecture 18	Light detecting devices, Elementary biomedical applications ASSIGNED READING: Chapter 2, pp. 72-85	

1 April 2003, Tuesday, Electrochemica	Isensors	
Lecture 19	Nernst equation, Potentiometric sensors, Measurement of pH Measurement of CO ₂	
	ASSIGNED READING: Chapter 10, pp. 440-450	
3 April 2003, Thursday, More electroch	emical sensors Amperometric sensors	
Lecture 20	Measurement of oxygen. ASSIGNED READING: Chapter 10, pp. 450-476	
8 April 2003, Tuesday, Clinical lab instrumentation		
Lecture 21	Blood gas measurement, Bioanalytical sensors. Glucose sensors	
	ASSIGNED READING: Chapter 10, pp 477-482, 486-502	
10 April 2003, Thursday, MIDTERM EXAM II (Lectures 10-20)		
15 April 2003, Tuesday, Chemical sens	sors	
Lecture 22	Colorimetric sensing, The pulse oximeter. ASSIGNED READING:Chapter 9, pp. 470-472, Chapter 10, pp. 507 515	
	Chapter 10, pp. 307-313	
17 April 2003, Thursday, Measurement of pulmonary variables		
Lecture 23	Measurement of lung volumes, Measurement of air flow	
	Breathing and apnea monitoring.	
	ASSIGNED READING: Chapter 9, pp. 390-406	
22 April 2003, Tuesday, Instrumentatio	n for biomaterials studies	
Lecture 24	viscoelastic properties.	
	Biocompatibility	
	ASSIGNED READING. To be assigned	
24 April 2003, Thursday, Instrumentati	on in molecular biology, by Dr. Orhan Soykan DNA sequencing technologies, Molecular Diagnostics,	
Locture 25	Polymerase chain reactors, Blotting techniques	
Lecture 25	ASSIGNED READING: To be assigned	
29 April 2003, Tuesday, Instrumentation in cellular biology, by Dr. Orhan Soykan		
	Fluorescence Assisted Cell Sorting, Recombination techniques, Bioreactors	
Lecture 26	ASSIGNED DEADING: To be assigned	
	ASSIGNED READING: TO be assigned	

1 May 2003, Thursday, Instrumentation in critical care medicine Cardiac monitoring, Lecture 27 Neonatal intensive care Fetal monitoring ASSIGNED READING: To be assigned

6 May 2003, Tuesday, General course review

Lecture 28

FINAL EXAM (Comprehensive): TBD

Required Background Knowledge: University Level Physics, Electric Circuits, Introductory Anatomy and Physiology

Required Textbook: Medical Instrumentation: Application and Design Edited by John G. Webster, John Wiley & Sons; ISBN: 0471153680; 3rd edition (August 1997) Price: US\$103.95 at Amazon.Com