



**Jordan University of Science and Technology**  
**Faculty of Engineering**  
**Biomedical Engineering Department**

**BME 412: Biomedical Instrumentation Lab**

**Course Catalog**

1 Credit hour (3 h lab) Measurements errors and noise; sensor interface circuit calibration; signal conditioning, amplification, filtration, processing, Physiological principle and principle of circuit design of some biomedical measurement devices: ECG, Oscillometric blood pressure measurement, Photoplethysmogram measurement, Respiratory ventilation detection, Pulse meter and Body impedance detection.

**Text Book(s)**

Title	
	Biomedical Measurements System KL-720 Experiment manual

**Instructor**

Instructor	Eng. Razan Shatnawi
Office Location	C5L1
E-mail	Razan.shatnawi@outlook.com

**Class Schedule & Room**

Lab Time: TUE 2:15 -5:15pm  
Room: Biomedical Instrumentation Lab, E1:L2

**Engineers**

Engineer		
Office Location	E1L2	
Office Phone	22567	
E-mail	realomarie@just.edu.jo	

**Pre-requisites**

Prerequisites by topic	Biomedical Instrumentation, BME 411
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<b>Objectives and Outcomes</b>	
<b>Objectives</b>	<b>Outcomes</b>
<b>Detect ECG signals from six different leads of human body. [1, 6, 8, 9]</b>	<ul style="list-style-type: none"> <li>☞ Measuring the characteristics of ECG filters circuit.</li> <li>☞ Measuring the characteristics of ECG amplifier circuit</li> <li>☞ Recognize the isolation circuit used in ECG.</li> </ul>
<b>Realize the piezoelectric property of pressure sensor in addition to direct and indirect calibration methods for blood pressure registration. [2, 4, 6]</b>	<ul style="list-style-type: none"> <li>☞ Calibrating the pressure sensor driver</li> <li>☞ Measuring the characteristics of the filters circuit</li> <li>☞ Measuring the characteristics of rectifier circuit</li> </ul>
<b>Learn the non-invasive measurement of vessel volume [6, 8]</b>	<ul style="list-style-type: none"> <li>☞ Calibrating infrared photo-coupler sensor.</li> <li>☞ Measuring the characteristics of filters circuit</li> <li>☞ Measuring the characteristics gain amplifier</li> <li>☞ Evaluate the operating characteristics of mono-stable multi-vibrator and comparator.</li> </ul>
<b>Measurements of respiratory activities , including breath holding ability, excessive ventilation and frequency of respiratory. [1,6,8,9]</b>	<ul style="list-style-type: none"> <li>☞ Calibrating the differential amplifier.</li> <li>☞ Measuring the characteristics of filters and amplifier circuit</li> <li>☞ Evaluate the operating characteristics of mono-stable multi-vibrator and hysteresis comparator</li> </ul>
<b>Realize the alteration of pulse waveform in arteries under different external pressures. In addition, learn how to estimate the arterial static compliance. [1, 6, 8,9]</b>	<ul style="list-style-type: none"> <li>☞ Calibrating the strain gage amplifier.</li> <li>☞ Measuring the characteristics of filters and amplifier circuit</li> <li>☞ Evaluate the operating characteristics of mono-stable multi-vibrator and hysteresis comparator</li> </ul>
<b>Measure body impedance variations during heart cycle. [1, 6, 8, 9]</b>	<ul style="list-style-type: none"> <li>☞ Calibrating the pre-amplifier</li> <li>☞ Measuring the characteristics of filters and amplifier circuit.</li> <li>☞ Evaluate the operating characteristics of wien-bridge oscillator and demodulator.</li> </ul>

<b>Topics Covered</b>		
<b>Week</b>	<b>Topics</b>	<b>Lab handout</b>
1	<b>Introduction to the Lab</b>	.....
2	<b>Electrocardiogram (ECG) measurement</b> 1. Measuring the characteristics of high-pass filter. 2. Measuring the characteristics of amplifier.	1
3	<b>Electrocardiogram (ECG) measurement</b> 1. Measuring the characteristics of low-pass filter and band-reject filter. 2. Human ECG measurement using Scope.	2
4	<b>Oscillometric Blood Pressure measurement.</b> 1. Calibrating the pressure sensor driver. 2. measuring the characteristics of high –pass, low –pass filter and amplifier.	3
5	<b>Oscillometric Blood Pressure measurement.</b> 1. Measuring the characteristics of rectifier. 2. Blood Pressure measurement using stethoscope, Oscillometric sensor and scope.	4
6	<b>Vessel volume measurement.</b> 1. Calibrating infrared photo-coupler sensor. 2. Measuring the characteristics of high-pass filter, low-pass filter and amplifier.	5
7	<b>Vessel volume measurement.</b> 1. Measuring the characteristics differentiator, comparator and mono-stable multi-vibrator 2. Human vessel volume measuring using scope.	6
8	<b>Respiratory frequency measurement</b> 1. Calibrating the differential amplifier. 2. Measuring the characteristics of band-reject filter, amplifier and differentiator.	7
9	<b>Respiratory frequency measurement</b> 1. Measuring the characteristics of hysteresis comparator and mono-stable Multi-vibrator. 2. Respiratory frequency measurement using scope.	8
10	Pulse measurement	9
11	Body impedance Measurement.	10

Evaluation		
Assessment Tool	Expected Due Date	Weight
Lab Reports	All lab reports are due one week after the lab, and must be turned in at the beginning of the lab session. Partners may discuss the lab with each other, but lab reports should be done individually. There should be a few sections common to all lab reports. These are a brief introduction, theoretical background, procedures and methods, results and a short conclusion. For all figures, axes must be titled and labeled properly. Processed data should be included in the results section along with a short discussion on how they were obtained. The quality of writing and manner of presentation is important, and grading will reflect this. Write concisely without round-about wordiness and repetitive repetition, and repetition. Please be sure to answer all of the questions in the lab handouts.	20%
Quizzes & Performance	Quizzes are given at the beginning of each lab.	10 %
Med Term	According to the department schedule, Practical and Theoretical	30 %
Final Exam	On the Last week of Lectures	40 %

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Policy	
<b>Attendance</b>	Class attendance is required and applied according to the university regulations ( <b>student's guide page 43</b> ). Data support the idea that class attendance improves learning. It is very difficult as well as uninspiring for me to help a student who does not attend lectures. What is created in the classroom cannot be reenacted. Make-up tests will be done according to the university regulations. Please see student's guide pages <u>44-45</u> .
<b>Student Conduct</b>	All University regulations apply to this course. In particular, the policies concerning academic dishonesty and withdrawal from a course apply.

### Contribution of Course to Meeting the Professional Component

The course contributes to building the fundamental basic concepts, applications, and design of statistics in Biomedical Engineering.

#### Relationship to Program Outcomes (%)

1	2	3	4	5	6	7	8	9
7	11	18	5	18	13	3	14	11

#### Relationship to Biomedical Engineering Program Objectives

PEO1	PEO2	PEO3	PEO 4
√	√	√	√

Prepared by:  
Last Modified:

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