



**German Jordanian University**  
**School of Applied Medical Sciences**  
**Department of Biomedical Engineering**

**BM344: Biomechanics and Rehabilitation Lab**

**Course Catalog**

1 Credit hour (3 hrs laboratory)

The aim is to the study of the movement of living things using the science of mechanics, also it is concerned with the description of motion and how forces create motion. Moreover, understanding how living things move and how kinesiology professionals might improve movement or make movement safer. In general, topics covered Anthropometry and Goniometry, Muscles Force, Gait Analysis and some Anatomical parts like Lungs Functions and Audiometry.

**Lab Instructor**

|                 |                          |
|-----------------|--------------------------|
| Lab Instructor  | Dr. Jumana Ma'touq       |
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**Lab Engineer**

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|------------------------|----------------------------|
| <b>Lab Engineer</b>    | Eng. Huda AlShami          |
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**Evaluation**

| Assessment Tool     | Weight | Expected Due Date   |
|---------------------|--------|---|
| <b>Lab Reports</b>  | 35 %   | Each report is due at the beginning of the next lab session |
| <b>Midterm Exam</b> | 25%    | Assigned at the beginning of each semester                  |
| <b>Final Exam</b>   | 40%    | Assigned at the beginning of each semester                  |
| <b>Total</b>        | 100%   | After completing final exam                                 |

| Topics Covered |                 |                |  |
|----------------|-----------------|----------------|--|
| Week           | Date            | Experiment No. | Topic  |
| 1              | 04.03.2020      | -----          | Lab Introduction   |
| 2              | 11.03.2020      | Experiment 1   | Anthropometry and Goniometry                                 |
| 3              | 18.03.2020      | Experiment 2   | Grip Force Measurement                                       |
| 4              | 25.03.2020      | Experiment 3   | Electromyogram (EMG) Activity in Antagonistic Muscles        |
| 5              | 01.04.2020      | Experiment 4   | Coefficient of Restitution (COR)+ Center of Percussion (COP) |
| 6              | 08.04.2020      |                | Free Lab   |
| 7              | 15.04.2020      | Exam           | Midterm Exam   |
| 8              | 22.04.2020      | Experiment 6   | Gait Analysis 1  |
| 9              | 29.04.2020      | Experiment 7   | Gait Analysis 2  |
| 10             | 06.05.2020      | Experiment 8   | Center of Gravity of the Total Body (Balance Board Methods)  |
| 11             | 13.05.2020      | Experiment 9   | Respiratory System+ Audiometry                               |
| 12             | 20.05.2020      |                | Free Lab   |
| 13             | 4 or 11.06.2020 | Exam           | Final Exam   |

| Objectives and Outcomes                                 |   |
|---|---|
| Objectives  | Outcomes  |
| 1. Understand the Language Anthropometry and Goniometry | 1.1 To provide quantifiable anthropometric measures to determine their relationship with measures of selected performances.<br>1.2 To provide exposure to various measurement techniques used in anthropometry including segmental circumferences, diameters, lengths and weights.<br>1.3 To determine the active and passive ranges of motion for selected body joints by means of orthopedic.   |
| 2. Get familiar with EMG Signal.                        | 2.1 To determine the relationship between the intensity of EMG activity and the force muscle contraction in the subject's dominant forearm and non-dominant forearm.<br>2.2 To observe the relationship between the length and strength of a muscle contraction and EMG activity in the dominant forearm and the non-dominant forearm.<br>2.3 To explore the electrical activity of skeletal muscle by recording an electromyogram (EMG)<br>2.4 To study the EMG activity in muscles that work in opposition to each other to flex or extend the hand . |

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|  | 2.5 To study the EMG activity in muscles that lift weight by flexion or by extension .   |
| 3. To be familiar with the nature of collision.        | 3.1 To determine the coefficient of restitution between balls and the ground using simple tools.<br>3.2 To determine the coefficient of restitution between balls and body parts (hands and feet) through simple activities.   |
| 4. Understand the Center of percussion.                | 4.1 To introduce students to the concept of center of percussion.<br>4.2 To locate the sweet spot of the racquet that will let the contact feels good and the ball seems to spring away with its greatest speed.<br>4.3 To be able to calculate and determine the centre of percussion of different structures and materials (Wood, Aluminum, Iron,...ect ).   |
| 5. Understand what is the Gait Analysis                | 5.1 To understand the change of human patterns due to walk constrains applied on the limbs.<br>5.2 To understand why the body changed the gait pattern and how it compensate to the presence of constraints.   |
| 6. Familiarize the students with some part of Anatomy. | 6.1 To introduce the student to spirometry as a technique for measuring respiratory variables.<br>6.2 To introduce the student to Audiometry as a technique for measuring the strength of Hearing (Hearing Loss).  |
| 7. Learning How to Calculate The Center of Gravity.    | 7.1 To calculate the total body center of gravity by the direct balance board method<br>7.2 To compute the CG location of an individual captured in a still photograph using the segmentation method.<br>7.3 To compare subjectively the results of these calculations with population norms.<br>7.4 To understand the underwater weighting by determining the change of water volume and using the segments' average densities. |

| <b>Lab Report Requirements</b> |  |
|--------------------------------|--|
| <b>Report section</b>          | <b>Description</b>   |
| <b>Introduction</b>            | This section should provide the context and motivation for the experiment, briefly explain relevant theory in sufficient detail, introduce any relevant laws, equations or theorems, and clearly state the aim or research question that the experiment is designed to address. You should try to write it in your own words, rather than paraphrasing the lab manual (but if you have to, be sure to include the appropriate references). It's always a good idea to read the entire experiment in the manual before you begin your introduction. |
| <b>Procedure</b>               | This section must include a description of the procedure followed. It should not simply be a re-statement of the procedure section of this manual. You should interpret the procedure section and develop your own step-by step method.  |
| <b>Results</b>                 | In this section, you present the main data collected during your experiment. Each key measurement needs to be reported appropriately. Data are often presented in graphs, figures or tables. These need to be labelled appropriately to clearly indicate what is shown. Tables should be labelled numerically above the table as Table 1, Table 2, etc. Everything else (graphs, images, diagrams etc.) is labelled numerically below the figure as Figure 1, Figure 2, etc.   |
| <b>Discussion</b>              | This section should demonstrate how will you understand what happened in the experiment. You should identify and comment on any trends you have observed, compare the experimental results with any predictions, identify how any sources of error might impact on the interpretation of your results, suggest explanations for unexpected results, and where appropriate, suggest how the experiment could have been improved.  |
| <b>Conclusion</b>              | This section should provide a message summing up what has been learned from the experiment such as: briefly restate the purpose of the experiment (the question it was seeking to answer), identify the main findings (answer to the research question), note the main limitations that are relevant to the interpretation of the results, summarize what the experiment has contributed to your understanding of the problem.   |
| <b>References</b>              | List all sources that you have referred to in the body of your report. These can include references to accepted literature values or equations you use in your calculations. You should use proper referencing techniques.   |
| <b>Appendix</b>                | It contains material that is too detailed to include in the main report, such as tables of raw data, software code or detailed calculations.   |
| <b>Formatting</b>              | Font type: Times New Roman.<br>Font size: 12 for the main paragraphs and 14 bold for the titles.<br>Justify the paragraphs.<br>Numbering.  |

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|  | <p>Figures should be inserted in the center of the page and they should be labeled below the figure with font size 10.</p> <p>Tables should be inserted in the center of the page and they should be labeled above the table with font size 10.</p> |
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| <b>Policy</b>          |   |
|------------------------|---|
| <b>Attendance</b>      | Attendance will be checked at the beginning of each lab session. University regulations will be strictly followed for students exceeding the maximum number of absences (20%).  |
| <b>Reports</b>         | Each student must hand his\her own separate report. Laboratory reports are due to <i><b>one week after</b></i> the experiment was carried out and it will be collected at the beginning of each laboratory. If any report is not submitted to the TA by the deadline, it will be judged as " <b>LATE</b> ".   |
| <b>Examinations</b>    | The midterm and the final exams are closed book tests. Students who are not able to attend an examination (medical or another emergency) must notify the instructor. Make up tests require a Valid University excuse.   |
| <b>Student Conduct</b> | It is the responsibility of each student to adhere to the principles of academic integrity. Academic integrity means that a student is honest with him/herself, fellow students, instructors, and the University in matters concerning his or her educational endeavors. Cheating will not be tolerated in at all. University regulations will be pursued and enforced on any cheating process. |