

SPORT SCIENCE & MANAGEMENT
SS1025 INTRODUCTION TO SPORT BIOMECHANICS

Academic Year	2024-25	Semester	2
Course Coordinator			
Course Code	SS1025		
Course Title	Introduction to Sport Biomechanics		
Pre-requisites	-		
No of AUs	3		
Contact Hours	39		

Course Aims

Biomechanics is the study of a biological system by means of mechanics. This course will introduce basic mechanical concepts, biomechanics laboratory equipment and software to evaluate human movements. In this course, you will be able to relate the basic mechanical concepts introduced to the principles that govern human movements. This course will include laboratory activities and experimental work to link the theory and practice of biomechanical concepts.

Intended Learning Outcomes (ILO)

By the end of this course, you should be able to:

1. explain basic mechanical concepts in sport biomechanics.
2. relate human movements with the mechanical concepts.
3. use laboratory equipment and software to evaluate human movement.
4. conduct a project using biomechanical techniques.
5. apply course content in a practical setting to facilitate training, enhance performance and minimise the risk of injuries.

Course Content

The following topics will be covered:

1. Linear kinematics – basic concepts
2. Linear kinematics - projectile motion
3. Angular kinematics
4. Relating linear and angular kinematics
5. Kinematic video analysis
6. Linear kinetics – Newton's Laws
7. Linear kinetics – mechanical properties of bodies in contact
8. Principle of Equilibrium

- 9. Angular kinetics
- 10. Fluid mechanics

NTU Competencies & Graduate Attributes

NTU Competencies	
Character	√
Competence	√
Cognitive agility	

NTU Graduate Attributes	
Graduate Attributes	Level (i.e., basic, intermediate, advanced)
1. Problem Solving	Basic
2. Sense Making	Basic
3. Critical Thinking	Basic

Assessment (includes both continuous and summative assessment)

Component	ILO Tested	Weighting	Team/ Individual	Assessment Rubrics
1. Presentation	1-5	20%	Team (Team – 12%; Individual – 8%)	Appendix 1
2. Report	1,2,3,4	20%	(Team – 16%; Individual – 4%)	Appendix 2
3. Final Examination	1-5	60%	Individual	
Total		100%		

Formative Feedback

Feedback for learning will be verbally provided during each laboratory class session, where you have the opportunity to learn techniques and apply yourselves to problems related to sport biomechanics. In addition, you will receive verbal feedback on the techniques and mistakes in the experimental work, alongside suggestions for improvement.

Upon completion of the Group Project, you will receive verbal and/or written feedback as a group about your assessed performance.

Generic written feedback will be provided to the class for the Final Examination.

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	Lectures will provide information for key learning concepts and theories and support understanding of key concepts.

Laboratories	<p>Laboratories will:</p> <ul style="list-style-type: none"> • Give hands-on experiential learning to support key theories and information provided in lectures. • Provide tasks for you to apply theory to practice. • Allow you to discuss and assimilate the content to develop communication skills.
Independent Learning	<p>Time will be given for learning from online materials or practice in the laboratory as a part of the flip teaching approach. Online materials will support key concepts covered in lectures and laboratories. Laboratory practice will allow you to operate equipment and software effectively.</p>

Reading and References

NIE Research and Publications

1. Ang, C.L., & Kong, P.W.* (2023). Field-based biomechanical assessment of the snatch in Olympic Weightlifting using wearable in-shoe sensors and videos – A preliminary report. *Sensors*, 23: 1171. DOI: <https://doi.org/10.3390/s23031171>
2. Kong, P.W.*, Sim, A. and Chiam, M.J. (2022) Performing meaningful movement analysis from publicly available videos using free software – A case of acrobatic sports. *Frontiers in Education*, 7: 885853. doi: 10.3389/feduc.2022.885853
3. Tay, C.S. & Kong, P.W.* (2018). A video-based method to quantify stroke synchronisation in crew boat sprint kayaking. *Journal of Human Kinetics*, 65: 45-56.

Other Readings and References

Core text:

4. Hall, S.J. (2022). *Basic Biomechanics* (9th Ed.). McGraw-Hill Education.

Course Policies and Student Responsibilities

(1) General

You are expected to complete all assigned pre-class readings and activities, attend all classes – lecture and laboratory – punctually, submit all scheduled assignments and take tests by due dates. You are not allowed to swap laboratory groups without express permission from the course coordinator. You are expected to take responsibility to follow up with course notes, assignments and course related announcements for sessions they have missed. You are expected to participate in all discussions and class activities unless there is a valid medical reason not to do so.

(2) Absenteeism

Absence from class without a valid reason will affect your overall course grade. Valid reasons include falling sick, supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies.

If you miss a lecture, you must inform the course instructor via email prior to the start of the class.

(3) Absence Due to Medical or Other Reasons

If you are sick and not able to complete a test or submit an assignment, you have to submit the original Medical Certificate (or another relevant document) to the Sport Science & Management (or Home School) administration to obtain official leave. Without this, the missed assessment component will not be counted towards the final grade. There are no make-ups allowed.

(4) Attire and safety

You are expected to participate in practical laboratory activities. Some of these activities involve exercise. You are expected to wear appropriate attire for participation, obey laboratory safety rules, and take appropriate care of and return all equipment after use.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognise your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion, and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [NTU Student Academic Integrity Policy and Procedures link](#) in the Student Portal for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Special note: Generative AI tools will be allowed to the extent stipulated for each assignment in the assignment instructions, and any such use must be duly referenced or disclosed.

Course Instructors

Instructor	Office Location	Phone	Email
TBA			

Planned Weekly Schedule

Week	Topic	ILO	Readings/ Activities
1	Introduction to Biomechanics	1,2	Hall (2022), Chapters 1,2 &3
2	Linear kinematics - terminology	1,2,3,5	Chapter 10
3	Linear kinematics - projectile motion	1,2,3,5	Chapter 10

4	Angular kinematics	1,2,3,5	Chapter 11
5	Relationship between linear and angular kinematics	1,2,3,5	Chapter 11
6	Video analysis Kinematics	3,4	Chapter 2
7	Linear kinetics – Newton's Laws	1,2,3	Chapter 12
Recess Week			
8	Linear kinetics – mechanical properties of bodies in contact	1,2,3,5	Chapter 12
9	Principle of Equilibrium	1,2,3,5	Chapter 13
10	Angular kinetics	1,2,3,5	Chapter 14
11	Fluid mechanics	1,2,3,5	Chapter 15
12	Project – team presentation	1-4	
13	Project – report submission	1-4	

Appendix 1: Assessment Criteria for Group Presentation (20% Final Grade – marked out of 100)

	A+, A, A-	B+, B	B-, C+, C	D+, D	F
Team Assessment (60 marks)					
Quality of presentation (max 20)	Information provided clearly answers the question set out. Presentation is clear and the flow is coherent and logical. Pace is appropriate.	Information mostly answers the question set. Presentation is mostly clear and the flow generally coherent and logical.	There are weaknesses or absences in the information provided, and the flow of presentation is unclear at times.	Much of the information provided does not answer the question, and the flow is difficult to understand.	Little relevant information and unclear flow.
Demonstration of material (max 30)	Able to clearly demonstrate and thoroughly explain mechanical concepts associated with sport and exercise. Able to answer questions in a poised and articulate manner with a high level of confidence.	Good demonstration and explanation of mechanical concepts associated with sport and exercise. Able to answer most of the questions clearly and with confidence.	Clear but basic demonstration and explanation of mechanical concepts associated with sport and exercise. Able to answer some of the questions clearly but lacks confidence at times.	Poor demonstration and weak explanation of mechanical concepts associated with sport and exercise. Has difficulty answering questions and lacks confidence.	Unable to demonstrate or explain mechanical concepts associated with sport and exercise. Unable to answer questions.
Use of technology (max 10)	Uses relevant technology very well to supplement and enhance the quality of presentation.	Good use of technology to improve the presentation.	Some use of technology to help improve the presentation.	Little use of relevant technology in the presentation.	No clear use of technology in the presentation.
Individual Assessment (40 marks)					
Communication (max 20)	Presentation is well-	Presentation is well-	Presentation is rushed or	Presentation is unclear	Did not present

	paced, very clear and easy to understand.	paced, clear and easy to understand most of the time.	dull and unclear at times.	and difficult to understand.	
Peer Assessment (max 20)	Strong and worthwhile contribution to the team	Good and consistent contribution to the team.	Fair contribution to the team.	Poor contribution to the team.	No contribution to the team.
<p>*All individuals within the group are expected to contribute to work involved in the planning, data collection and output. Therefore, an individual's score may vary from that of the team based on feedback and observations in this area.</p>					

Appendix 2: Assessment Criteria for Laboratory Report (20% Final Grade – marked out of 100)

	A+, A, A-	B+, B	B-, C+, C	D+, D	F
Team Assessment (80 marks)					
Quality of report (max 30)	Report is very clear and easy to understand. The flow of writing is coherent and logical.	Report is clear and easy to understand most of the time. The flow of writing is generally coherent and logical.	Report is unclear at times. There is some weakness in the presentation flow.	Report is unclear, and there is some difficulty in understanding the writing.	Report is unclear, and it is not possible to understand the writing.
Understanding of study (max 50)	Demonstrates a very good understanding of the background of the study, the study design, the analysis of the findings and the implications of the study's results.	Demonstrates a good understanding of the background of the study, the study design, the analysis of the findings and the implications of the study's results.	Demonstrates a basic understanding of the background of the study, the study design, the analysis of the findings and the implications of the study's results.	Demonstrates a weak understanding of the background of the study, the study design, the analysis of the findings and the implications of the study's results.	Does not demonstrate any understanding of the background of the study, the study design, the analysis of the findings and the implications of the study's results.
Individual Assessment (20 marks)					
Peer Assessment (max 20)	Strong and worthwhile contribution to the team	Good and consistent contribution to the team.	Fair contribution to the team.	Poor contribution to the team.	No contribution to the team.
*All individuals within the group are expected to contribute to work involved in the planning, data collection and output. Therefore, an individual's score may vary from that of the team based on feedback and observations in this area.					