



**SPORT SCIENCE & MANAGEMENT
SS3621 SPORT TECHNOLOGY, INNOVATION AND ENTREPRENEURSHIP**

Pre-requisites	-
No of AUs	3
Contact Hours	Total hours: 39

Course Aims

This course introduces fundamental topics related to sport technology, innovation and entrepreneurship. Contents related to sport engineering, making and coding culture, sport materials and wearable technologies, and data analytics are covered to provide you with broad-based knowledge regarding sport technology and innovation. You will also be guided to program and prototype a sport or movement related electronics gadgets. The last component of this course concerns the development of business plans. This course is important for both students in sport science and management strands as contents covered will help you understand the impact of Industrial 4.0 in the field.

Intended Learning Outcomes (ILO)

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

1. Describe the current developments pertaining to use of technology in sports, exercise and physical education.
2. Perform basic programming, and undertake hands-on prototyping sport or movement related gadgets.
3. Develop business plan for a sport product or innovative services.
4. Formulate in-depth discussions of topics and issues related to sport technology, innovation and entrepreneurship.

Course Content

The following topics will be covered:

1. The fourth industrial revolution
2. Maker movements
3. Existing technological innovations in sports, exercise and physical education
4. Basics of IoT, wearables, sport analytics, sport materials, and machine learning
5. Fundamentals of Sport Engineering
6. Programming of microcontroller and mobile applications
7. Understanding innovation and its relationship to sports science
8. New product design process
9. Crafting opportunity statement (based on sports tech need)
10. Developing purposeful solution to problem statement
11. Creating sustainable business model
12. Developing commercialization process
13. Understanding role of entrepreneurship
14. Working in a team

Assessment (includes both continuous and summative assessment)

Component	Course ILO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual	Assessment rubrics
1. Coding Task	2	A2, A3	15%	Individual	Appendix 1
2. Prototype poster and presentation	1,2	A1,A2,A3,B1,B2,B3,B4,B5,C1,D1,D2,E1	15%	Individual	Appendix 2
3. Learning resource curation and presentation	1,2	A1,A3,B1,B2,B3,B4,C1,D1	20%	Individual	Appendix 3
4. Business plan and presentation	1,2,3	A1,A2,A3,B1,B2,B3,B4,C1,C2,D1,D2,E1	25% 5%	Team Individual	Appendix 4.a Appendix 4.b
5. Individual written assignment	3,4	A1,A2,B1,B2,B3,B4,B5,C1,D1,E1	20%	Individual	Appendix 5
Total			100%		

Graduates of the SSM programme should show:

Competence	
A1: {Understanding}	process and interpret information, evidence and methodologies related to sport science or sport management
A2: {Self-discipline}	independently apply themselves to solve relevant problems
A3: {Modern Tool Usage}	use technology to communicate and provide feedback on sports activities, improve sports performance, monitor and increase physical activity, provide exercise prescription, solve problems for disadvantaged athletes/sportspeople, and commercialize and innovate sports products, events and services

Creativity	
B1: {Critical Thinking}	critically assess the applicability of sport science and sport management tools toward problems and in the workplace
B2: {Analytical Thinking}	critically analyse data from a multitude of sources
B3: {Interdisciplinary Thinking}	connect the subfields of sport science and sport management to tackle problems
B4: {Innovation}	be able to develop new applications or improve existing techniques
B5: {Entrepreneurship}	develop new ideas and plans for sport science, businesses and events
Communication	
C1: {Effective Communication}	present findings or ideas from sport science and sport management research logically and coherently at the appropriate level for the intended audience and in all forms of communication
C2: {Teamwork}	work in teams on projects that require sport science or sport management application, and communicate results via demonstration, verbally and in written form
Civic-Mindedness	
D1: {Professionalism}	act in a manner that respects the profession and meets the expectations of the sport science and sport management industry
D2: {Inclusiveness}	promote sport and physical activity in all individuals to bring people together and improve physical, social and psychological outcomes
Character	
E1: {Ethical behaviour}	act with integrity and in a socially responsible and ethical manner in line with societal and legal expectations in relation to collecting and analysing data of people and protecting personal data with appropriate computer security
E2: {Sportspersonship}	demonstrate appropriate safety, concern and good conduct in sport situations towards other individuals involved in the activity
Formative feedback	
<p>Formative feedback will be provided:</p> <ul style="list-style-type: none"> • On an ongoing basis during the course • At other times when you make appointments to consult on your work. 	

General feedback will be provided:

- At the end of the presentations
- At the end of the coding task
- For your individual assignment

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Coding tasks	Coding tasks will be assigned in class for you to utilize what you recently learned to solve specific problems. This targets L01.
Tutorial sessions	Tutorial sessions have been designed to incorporate multiple types of learning: <ul style="list-style-type: none">- Short lectures to support understanding of key concepts- Hands-on group learning setting for mastering assigned programming languages and prototyping their inventions- Small group activities like discussions allow space and time for you to assimilate the content and for sharing learning- Time will be given for learning from online materials as a part of flip teaching. This targets L01, LO2, LO3, and LO4.
Prototype poster and learning resource curation	These two assignments provide opportunities for you to take stock of what you have learned, and provides you with opportunity to deepen your learning. This targets L01, and LO2.
Group Project	This is an opportunity for you to work collaboratively in small groups to develop a business plan for a product or service in sports, exercise and/or physical education. This targets LO3.
Written assignment	This is an opportunity for you to reflect on the issues in sport technology, innovation and entrepreneurship that are of interest to you, which will in turn set you thinking about your future developments and future-use cases. This targets LO4.

Reading and References

Given the multi- and inter-disciplinary nature of the course, instead of specifying textbooks, it is more appropriate to provide you with a resource package which can be updated with relevant readings and references. Below is a list of potential readings and references that count as a starting point for the resource package and the list will be updated as and when appropriate.

Sports Engineering

Allen, T., & Goff, J. E. (2017). Resources for sports engineering education. *Sports Engineering*, 1-9. <https://link.springer.com/article/10.1007/s12283-017-0250-1>

MIT App Inventor

Wolber, D. (2011). *App Inventor: Create your own Android apps*. Sebastopol, Calif: O'Reilly. <http://www.appinventor.org/book2>

MIT App Inventor IoT website <http://iot.appinventor.mit.edu/>

Tiddlywiki

www.tiddlywiki.com

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 and 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. All of 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 recognize 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 [academic integrity](#)

[website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Collaboration is encouraged for your work in the class and laboratories because peer-to-peer learning helps you understand the subject better and working in a team trains you to better communicate with others. Working together and exchanging ideas and experiences will help improve the quality of your assessed presentation. It is important to credit others for their contribution to your work which promotes ethical practices and academic integrity.

Course Instructors

Instructor	Office Location	Phone	Email

Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Smart Nation Fourth industrial revolution Existing technological products and inventions in sports, exercise and physical education Fundamentals of Sport Engineering Making and coding culture	LO1,LO4	Short lecture, Internet searches, group learning and sharing Note-taking using Tiddlywiki Read: Allen and Goff (2017).
2	MIT App Inventor	LO1, LO2	E-learning via online videos Read: Wolber (2011).
3	In-class coding task for App Inventor (Assessment) Arduino and sensors	LO1, L02	Hands-on session
4	API and machine learning	LO1,LO2	Hands-on session
5	Prototyping exercise	LO1,LO2	Hands-on session
6	Preparation of presentation and poster	LO1, LO2	Optional face to face session
7	Presentation of Tiddlywiki (Assessment) Poster presentation of Prototype (Assessment)	L01,LO2,LO4	Assessment and feedback
8	<u>Purpose:</u> Craft Opportunity Statement (Based on Sports Tech Need) <u>Outcome:</u> 1) Understanding innovation and its relationship to sports science. Identify business segments & opportunities related to sports tech	L01,LO3,LO4	Short lecture, group experiential learning and peer sharing Work, present & gather feedback on business opportunity statement (1-hour)

9	<p><u>Purpose:</u> Develop Purposeful Solution to Problem Statement</p> <p><u>Outcome:</u> 1) Identify idea based on opportunity statements – incremental vs radical innovation 2) Definition and importance of patents & intellectual properties</p>	L01,LO3,LO4	<p>Short lecture, group experiential learning and peer sharing Read: What is Intellectual Property? Work, present & gather feedback on opportunity solutioning & idea (1-hour)</p>
10	<p><u>Purpose:</u> Create Sustainable Business Model</p> <p><u>Outcome:</u> 1) Review 4-types of business model 2) Introduction to Business Plan 3) New product design process</p>	L01,LO3,LO4	<p>Short lecture, group experiential learning and peer sharing Read: Handout – Marketing Your Product Work, present & gather feedback on Business model (1-hour)</p>
11	<p><u>Purpose:</u> Develop Commercialization Process</p> <p><u>Outcome:</u> 1) Innovative services 2) Key components of marketing actions (4P)</p>	L01,LO3,LO4	<p>Short lecture, group experiential learning and peer sharing Work on Business Plan (1-hours)</p>
12	<p><u>Purpose:</u> Role of Entrepreneurship Working in a team</p> <p><u>Outcome:</u> 1) Review steps to becoming an entrepreneur 2) Team dynamics</p>	L01,LO3	<p>Short lecture, group experiential learning and peer sharing Work on Business Plan (1-hours)</p>

Appendix 1: Coding task (15%)

You will be given a set of problems to solve using MIT App Inventor to be completed within a given time frame.

	Excellent/Very Good (4-5)	Good/Satisfactory (2-3)	Fair/Poor (0-1)
Workability (10 marks)	Program works well to solve the problem given. Clear-cut solution.	Program works, but has minor glitches.	Program did not work. Some effort in trying.
Time taken (5 marks)	Completed within the given time.	Within 5-10 minutes of the given time.	Exceed 10 minutes of the given time.

Appendix 2: Prototype poster and presentation (15%)

In this assignment, you will report on your prototype through a A2 size poster presentation.

	Excellent (5)	Good (3-4)	Satisfactory (2)	Fair/Poor (0-1)
Problem statement (2 marks)	Clear problem statement. The problem located is a substantial one.	The problem located is a substantial one, and stated somewhat clearly.	The problem located is a not substantial one, but stated somewhat clearly.	Unclear problem statement. The problem located is a not substantial one.
Clarity in solution (2 marks)	Clear description of solution. No mistakes.	Clear description of solution. 1 to 2 mistake or areas of concern.	Clear description of solution, but more than 3 mistake or areas of concern.	Poor description of solution
Solution workability (3 marks)	Convincing demonstration of workable solution.	Demonstration of workable solution.	Somewhat workable solution demonstrated.	Unworkable solution.
Innovation in solution (3 marks)	Solution is fundamentally distinctive from existing approaches and demonstrates proven ability to impact the problem in a new way.	Solution is somewhat distinctive from existing approaches and demonstrates potential to impact the problem in a new way.	Solution demonstrates some potential to impact the problem in a new way.	Solution is not fundamentally distinctive from existing approaches and does not demonstrates proven ability to impact the problem in a new way.
Design of poster (2 marks)	Overall visually very appealing and not cluttered. Excellent use of layout, colours, images and font to enhance readability.	Overall visually appealing and not cluttered. Good use of layout, colours, images and font to enhance readability.	Visual appeal is adequate but somewhat cluttered. Layout, colors, font and image detract from readability	Not very visually appealing; cluttered; Layout, colours, font and images hinder readability
Presentation and answering questions (3 marks)	Answers all questions directly and clearly.	Answers majority of questions directly and clearly.	Some answers were not directly addressing the question.	Some answers were incorrect.

Appendix 3: Learning resource curation and presentation (15%)

In this assignment, you will collate learning resources for technology in sports for the first seven weeks using Tiddlywiki (<http://tiddlywiki.com>).

	Excellent (5)	Good (3-4)	Satisfactory (2)	Fair/Poor (0-1)
Contents (5 marks)	Very high number of subjects/topics/issues covered. At least 40 distinctive subjects/topics/issues. Judged to be highly relevant for your learning.	High number of subjects/topics/issues covered. At least 30 distinctive subjects/topics/issues. Judged to be somewhat relevant for your learning.	At least 20 distinctive subjects/topics/issues. Judged to be somewhat relevant for your learning.	Very low number of subjects/topics/issues covered. Less than 10 distinctive subjects/topics/issues.
Organization (5 marks)	Very systematic organization of information with tabs and links. Demonstrates high competency in use of Tiddlywiki.	Systematic organization of information with tabs and links.	Display of information with tabs and links. Room for improving organization.	Messy presentation coverage.
Delivery (5 marks)	Eye contact with audience virtually all the time. Absence of distracting body gesture or vocalised pauses. Confident and loud enough voice projection. Does not rely on notes.	Occasional eye contact with audience. Some distracting body gesture or vocalised pauses. Confident and loud enough voice projection. Rely on notes occasionally.	No eye contact with audience. Frequent distracting body gesture or vocalised pauses. Moderate voice but not loud enough voice projection. Rely on notes.	No eye contact with audience. Distracting body gesture or vocalised pauses virtually all the time. Weak voice projection. Rely on notes.

Appendix 4.a: Business plan and presentation (25%)

In this team assignment, you will develop and present a business plan for a sport or physical education related technical product.

Business plan submission		Weightage
I	Executive Summary	
	Describe the need and the opportunity for the product. Include recent history or context related to the product. The summary should provide a quick summary of the whole report.	10/100
II	Company Description	
	Provide some company history, mission statement and overview of what is planned to sell and to whom	10/100
III	Market Analysis & Target Market	
	Determine the most relevant forces and environmental issues could have a real and dramatic impact on the business? <u>Target Market</u> – identify your primary target market using the four segmentation bases.	10/100
IV	Market Strategy	
	<u>Product Strategy</u> Describe the product features, benefits, branding etc. Apply the new product development process to new product.	10/100
	<u>Price Strategy</u> Identify your price position relative to competition and recommend what pricing tactics will be adopted.	7/100
	<u>Place Strategy</u> Describe your proposed distribution channel structure and strategy.	7/100
	<u>Promotion Strategy</u> Describe any three main promotional tools your company will adopt Give specific action plan and details of the promotion	7/100
V	Research Skills – Demonstrate skills in use of library resources and useful information in the market situation analysis (provide proper referencing)	7/100
VI	Good organizational structure and correct use of Language and Grammar	7/100
	TOTAL	75/100
Business plan presentation		Mark Allocation
I	Content	
	clear and concise delivery consistent analysis relevant information presented	6/100
II	Presentation slides	
	logical sequence, creative photos, animation, video, links, and other materials to best communicate content	6/100
III	Communication Skills	
	clear and audible voice	6/100

	good expression, tone and gesturing, eye contact engaging presentation	
IV	Q&A	
	ability to defend his ideas/report findings appear confident and convincing; exhibits teamwork	7/100
	TOTAL	25/100

Appendix 4.b: Outcome of peer evaluation of individual contribution (5%)

Every group to give a mark for each member.

Marking Criteria	Below Expectation	Meeting Expectation	Exceeding Expectation
Peer Evaluation (within team members)	Individual contributed very little to team project.(0-1 marks)	Individual contributed an expected level to team project.(2-3 marks)	Individual contributed more than expected level to team project. (4-5 marks)

Appendix 5: Individual written assignment (20%)

In this assignment, you will demonstrate your ability to discuss a topic of your choice on topics and issues related to sport technology, innovation and entrepreneurship through a 1500 word essay (word limit of plus/minus 10% as a guide).

	Excellent (5)	Good (3-4)	Satisfactory (2)	Fair/Poor (0-1)
Organization(5 marks)	Writing shows high degree of attention to logic and reasoning of points. Unity clearly leads the reader to the conclusion and stirs thought regarding the topic.	Writing is coherent and logically organized with transitions used between ideas and paragraphs to create coherence. Overall unity of ideas is present.	Writing is coherent and logically organized. Some points remain misplaced and stray from the topic. Transitions evident but not used throughout essay.	Writing lacks logical organization. It shows some coherence but ideas lack unity. Serious errors.
Level of Content (10 marks)	Content indicates synthesis of ideas, indepth analysis and evidences original thought and support for the topic.	Content indicates original thinking and develops ideas with sufficient and firm evidence.	Content indicates thinking and reasoning applied with original thought on a few ideas.	Shows some thinking and reasoning but most ideas are underdeveloped and unoriginal.
References (5 marks)	Excellent use of references.	Adequate use of references and no missing references.	Adequate use of references, but some are missing.	Non-use of references.