

## COURSE CONTENT

<b>Academic Year</b>	2023/2024	<b>Semester</b>	2
<b>Course Coordinator</b>	Asst Prof. Dang Thuy Tram/ Assoc. Prof. Tan Thatt Yang Timothy		
<b>Course Code</b>	CB4216		
<b>Course Title</b>	Entrepreneurship in Medtech and Biotechnology		
<b>Pre-requisites</b>	Year 3		
<b>Grading</b>	Letter Graded		
<b>No of AUs</b>	3		
<b>Contact Hours</b>	39 hours		

### Course Aims

New medical technologies enable better, faster and/or cheaper diagnosis and treatment of health problems, facilitating timely intervention and improving health outcomes. Successful commercialization of innovative medical and health products is critical to translate significant medical research and breakthrough into social impact by improving patient care and generate economic value.

This course provides students with interest in medical innovation and entrepreneurship with a systematic scientific framework towards a commercialization pathway for biotechnology and medical devices. Entrepreneurship is not only a mindset, but can be taught as a skillset to significantly improve the odds of creating a successful and impactful ventures. The course is designed as an integrated toolbox by introducing key lean start-up fundamentals and presenting practical guides in customer discovery and market validation, MedTech product development and regulation, and business model design. These concepts will also be illustrated with selected case study of biotech and medtech start-ups.

Through lectures by instructors and interaction with industry mentors/stakeholders, student teams will learn and practice how to evaluate commercialization strategy for biomedical technologies. Each team under the guidance of an instructor and/or industry mentor will develop a pitch deck/presentation for a chosen technology, a business model canvas, and a short video clip about their project idea.

### Intended Learning Outcomes (ILO)

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

1. Understand key lean start-up concepts unique to biotechnology and medtech enterprising.
2. Understand and apply the concept of business model canvas to biotechnology and medtech innovations.
3. Validate product-market fit through the customer discovery and value proposition canvas.
4. Discover and understand significant of regulatory framework in the development of medical products.
5. Develop critical thinking and analysis through validated learning processes of learn-build-measure.
6. Communicate findings for a venture proposition individually and as a team.

## Course Content

This course is ideal for students interested in biotechnology entrepreneurship and commercialization, wishing to understand the strategy towards biotech innovation and start-up, through an experiential learning pedagogy which emphasizes on “learning by doing” and applying the findings through presentations and pitching.

Key topics taught include

1. Introduction to fundamentals of lean start-up concepts: business model canvas, patient care pathway, testing business hypotheses, customer discovery and development
2. Positioning of value propositions.
3. Perform competitive and market analysis.
4. Validation of product-market fit in value-proposition canvas.
5. Application of validated learning process
6. Introduction to human factor engineering and minimum viable business product.
7. Introduction to MedTech intellectual properties and regulation
8. Biotech and medtech start-up lifecycle and case study

## Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Related Programme LO or Graduate Attribute	Weighting (Total 100%)	Team/ Individual	Assessment rubrics
1. Individual pitching	1-6	a,b,c,f,l,j,k	30%	Individual	Refer to appendix 1a.
2. Group presentation	1-6	a,b,c,f,l,j,k	Team (40%); Individual (20%)	Group & Individual	Refer to appendix 1b & c
3. Class Participation	6	l,j	10%	Individual	Refer to appendix 1d

## Reading and References

*Suggested reading (not compulsory): **The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Author : Eric Ries 2011***

## Course Policies and Student Responsibilities

**CA:** Absentees must be supported by a medical certificate or other valid official documents. No make-up will be entertained.

**Group project:** No make-up.

## 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.

### Course Instructors

Instructor(s)	Office Location	Phone	Email
Dang Thuy Tram	N1.3-B3-09	67904257	ttdang@ntu.edu.sg
Timothy Tan	N1.2-B1-22	65921614	tytan@ntu.edu.sg

### Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities LN = Lecture Notes RW = Responseware	Lecturer
1	Course introduction (team/mentor logistic), intro to medtech/biotech business model	1,6	Group brainstorming on medical product idea	Dang Thuy Tram
2	MedTech business model canvass and patient care pathways	2,6	<b>Group presentation</b> of preliminary biotech/medtech product idea	Timothy Tan
3	Start-up life cycle and case study	1,2,4,6	Continued group brainstorming to refine product idea	Dang Thuy Tram
4	Customer Discovery	3,5,6	<b>Group presentation</b> of refined biotech/medtech product idea & draft patient care pathway	Timothy Tan
5	(no lecture)		<b>Group presentation</b> of finalized product idea and patient care pathway	Dang Thuy Tram, Timothy Tan

6	Market sizing	3,5,6		Dang Thuy Tram
7	Competitive analysis	3,5,6	<b>Group presentation</b> on market sizing	Timothy Tan
8	(no lecture)	6	<b>Group presentation</b> of competitive analysis	Dang Thuy Tram
9	Crafting value proposition pitch	3,5,6	<b>Group presentation</b> of customer review outcome	Timothy Tan
10	Instructor feedback (no lecture)	1-6	Instructor meeting with team	Dang Thuy Tram, Timothy Tan
11	Industry mentor feedback (no lecture)	1-6	Industry mentor meeting with team	Industry mentor
12	Pitching of student team's cases for their proposed product idea. (no lecture)	6	<b>Individual pitching</b>	Dang Thuy Tram, Timothy Tan
13	Instructor feedback on final pitch	6	Instructor feedback to team	Dang Thuy Tram, Timothy Tan

## Appendix 1: Assessment Criteria for the Project

### a. Individual pitching (30%)

Marks	Criteria
> 85%	Excellent demonstration of understanding and application of topics discussed; business analysis; oral presentation with clear articulation and slides.
75% to 84%	Good demonstration of understanding and application of topics discussed; business analysis; oral presentation with clear articulation and slides.
65% to 74%	Fair demonstration of understanding and application of topics discussed; business analysis; oral presentation.
50% to 64%	Adequate demonstration of understanding and application of topics discussed; business analysis; oral presentation.
< 50%	Poor demonstration of understanding and application of topics discussed; business analysis; oral presentation.

### Individual Pitching and Pitch Deck Scoresheet

Name of Presenter: \_\_\_\_\_

Name of Product: \_\_\_\_

CRITERIA	Max Points	Points given
<b>Elevator Pitch</b> A one-liner summary that combines your vision/product or the mission of your company	5	
<b>The Problem</b> Define the current clinical burden and unmet needs	10	
<b>Market opportunity</b> Define Your Market: What business/space you are in, market Size. Targeted patients / customers: Clearly define exactly who you serve, possible macro trends & insights that define market.	10	
<b>The solution / product:</b> Value proposition, why now, how it works.	20	
<b>Business Model:</b> Clear business idea, key business activity & revenue streams (price and cost of product)	10	
<b>Market Approach &amp; Business Strategy:</b> Your plan and strategy to grow your business	5	
<b>Team &amp; Key Stakeholders</b> Is the team balanced? Have they managed to recruit advisers / key opinion leaders / partners?	5	
<b>Competitive advantage</b> How is the problem currently solved? Who are the ones solving it? What is your position to compete in the current market?	10	

<b>Investment and deliverable milestones:</b> Your 'Ask' (funding, mentoring, market access etc) & associated milestones.	5	
<b>Delivery</b> Able to articulate all ideas / concepts clearly, relatable, emotional engagement, passionate, simple language used, convincing	20	
<b>TOTAL</b>	<b>100</b>	

### Feedback on Pitch

#### **Positive feedback**

Provide at least 1 **POSITIVE** piece of feedback.

<input type="checkbox"/>	Solid business idea
<input type="checkbox"/>	Addressing a real, sizeable, and/or important problem / opportunity
<input type="checkbox"/>	Strong value proposition for the customers
<input type="checkbox"/>	Good Knowledgeable about the problem / opportunity
<input type="checkbox"/>	Understood the market
<input type="checkbox"/>	Understood the competition and competitive advantage
<input type="checkbox"/>	Solid team to take advantage of the business idea
<input type="checkbox"/>	Understood the financial aspects of the business idea (e.g. price, costs, funding needs)
<input type="checkbox"/>	Talked very clearly about the business idea/ technology
<input type="checkbox"/>	Told a good story
<input type="checkbox"/>	Used examples, backed up by data
<input type="checkbox"/>	Talked in language that anyone could understand, clear in delivery
<input type="checkbox"/>	Showed a lot of excitement and passion for his/her/their business idea / product
<input type="checkbox"/>	Had a killer one-liner elevator pitch that could easily be remembered
<input type="checkbox"/>	Other

#### **Negative feedback**

Provide at least 1 **NEGATIVE** piece of feedback (things he / she needs to work on)

<input type="checkbox"/>	Business idea is not well thought out
<input type="checkbox"/>	Addressing a small, non-existent, and/or unimportant problem / opportunity
<input type="checkbox"/>	Weak value proposition for the customers
<input type="checkbox"/>	Was not knowledgeable about the problem / opportunity
<input type="checkbox"/>	Didn't understand the market
<input type="checkbox"/>	Didn't understand the competition / competitive advantage
<input type="checkbox"/>	Need to improve on the skills that the founding team members have
<input type="checkbox"/>	Didn't understand the financial aspects of the business idea (e.g. price, costs, funding needs)
<input type="checkbox"/>	Didn't talk very clearly about the business idea
<input type="checkbox"/>	Didn't tell a good story
<input type="checkbox"/>	Could have used examples to explain the business idea better
<input type="checkbox"/>	Difficult to understand / lack clarity
<input type="checkbox"/>	Didn't show excitement and passion for his/her/their business idea / product

	A forgettable one-liner elevator pitch
	Other

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**b. Group presentation (40%)**

<b>Marks</b>	<b>Criteria</b>
> 85%	Excellent demonstration of understanding and application of topics discussed; business analysis; oral presentation with clear articulation and slides.
75% to 84%	Good demonstration of understanding and application of topics discussed; business analysis; oral presentation with clear articulation and slides.
65% to 74%	Fair demonstration of understanding and application of topics discussed; business analysis; oral presentation.
50% to 64%	Adequate demonstration of understanding and application of topics discussed; business analysis; oral presentation.
< 50%	Poor demonstration of understanding and application of topics discussed; business analysis; oral presentation.

Assessment Form for Group Presentation

<b>Category</b>	<b>Grading Criteria</b>	<b>Total Points</b>	<b>Score</b>
<b>Organization (10 points)</b>	Information is presented in a logical sequence, easy for audience to follow	10	
<b>Content (50 points)</b>	Appropriate amount of material is prepared, Material included is relevant to the topic required and overall message	15	
	Presentation contains accurate information from reliable sources which are appropriately cited.	10	
	Critical evaluation of the materials presented, demonstrated that the group has sufficiently reflected on the information acquired from sources	15	
	Applying concepts/knowledge from class lectures in acquiring and analyzing the materials presented.	10	
<b>Presentation (20 points)</b>	Speaker maintains good eye contact with the audience and good body languages. Good language skills and pronunciation.	10	
	Visual aids are well prepared, informative, effective, and not distracting.	5	
	Length of presentation is within the assigned time limits.	5	

<b>Q&amp;A (20 points)</b>	Answers demonstrate a strong understanding of topic	10	
	Concise and relevant answers. Professionalism in delivering the answers	10	
<b>Score</b>	<b>Total Points</b>	<b>100</b>	

**c. Peer Evaluation (20%)**

Marks	Criteria
> 80%	Excellent demonstration of team work and effort.
65% to 79%	Good demonstration of team work and effort.
50% to 64%	Adequate demonstration of team work and effort.
< 50%	Poor demonstration of team work and effort.

**Conversion of peer assessment score into grade components**

- Peer evaluation score S out of 10 will be converted into peer evaluation score by the formula :  $S/10 \times 20\%$
- Furthermore, students who receive an average peer assessment score S of 8 or more will be awarded the full 40% of the group presentation component (b). In contrast, students who receive an average peer assessment score of less than 8 ( $S < 8$ ) will be awarded a pro-rated partial amount of the 40% group presentation component calculated as: Pro-rated group presentation grade =  $S/10 \times 40\%$

**Assessment Form for Peer Evaluation**

Please indicate an (x) next to the score that reflect your perceptions of other team member's contribution during the project development. Please fill in **one form for each of your team member**; copy and paste this evaluation form for the next team members in the same file and convert all evaluation forms **into one PDF file** to be uploaded to the NTU learn assignment "Peer Review Assessment".

Use the scale below for assessing each team member.

10-9	8-7	6-4	3-1	0
Demonstrate outstanding contributions and efforts during teamwork.	Exhibited appropriate effort in contributions during teamwork.	Made some contributions but greater effort could have been exhibited during teamwork.	Did not contribute much effort during teamwork.	Made no effort to contribute during teamwork.

**Name of evaluator:**

**Name of Team member to be evaluated:**

**Group number:**

<b>Preparation for work accomplishment:</b> completed readings.	10	9	8	7	6	5	4	3	2	1	0
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<b>Task-related collaborative behavior:</b> task-focused, respectful of others, and cooperative.	10	9	8	7	6	5	4	3	2	1	0
<b>Team adjustment behaviors:</b> intra-team coaching, problem solving	10	9	8	7	6	5	4	3	2	1	0
<b>Work behaviors:</b> involved and participatory	10	9	8	7	6	5	4	3	2	1	0
<b>Communication:</b> information shared and exchanged, engaged in process, and made verbal contributions.	10	9	8	7	6	5	4	3	2	1	0
<b>Provide constructive feedback for this team member.</b> (Consisting of two to three sentences):											

**d. Class Participation (10%)**

<b>Marks</b>	<b>Criteria</b>
> 80%	Class participation > 10 times per week
65% to 79%	Class participation 7 to 10 times per week
50% to 64%	Class participation 4 to 6 times per week
< 50%	Class participation < 4 times per week

## Appendix 2: The EAB (Engineering Accreditation Board) Accreditation SLOs (Student Learning Outcomes)

- a) **Engineering knowledge:** Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems
- b) **Problem Analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c) **Design/development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- d) **Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- e) **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
- f) **The engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- g) **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.
- h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- i) **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
- j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- k) **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- l) **Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change