

## ET5218 Innovation and Commercialisation of Technologies Course Outline

<b>Academic Year</b>	2022-23	<b>Semester</b>	2
<b>Course Coordinator</b>	Ngiam Tee Woh		
<b>Course Code</b>	ET5218		
<b>Course Title</b>	Innovation and Commercialization of Technologies		
<b>Pre-requisites</b>	Nil		
<b>No of AUs</b>	3		
<b>Contact Hours</b>	39 hours <ul style="list-style-type: none"><li>• Lectures : 26 hours</li><li>• Guest speakers : 3 hours</li><li>• Consultation: 4 hours</li><li>• Presentation: 6 hours</li></ul>		
<b>Proposal Date</b>	20 January 2022		

### Course Aims

The course aims to explore key issues of successes and failures in commercializing inventions and technological innovations of products and services. You will examine new challenges posed by the shortened life cycles of products and services and identify technology commercialization possibilities. You will also survey the challenges and opportunities posed by the emerging technologies seen in the Fourth Industrial Revolution. The course emphasizes on the successful transfer of technologies from a research environment for commercialization to the global market. You will understand values and skillsets needed as an entrepreneur or corporate entrepreneur in the development of new products and services in start-ups or corporate entities to remain competitive.

### Intended Learning Outcomes (ILO)

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

1. Explain the role of innovation in creating a competitive advantage that leads to entrepreneurial wealth creation.
2. Formulate the systematic entrepreneurial activities required by an entrepreneur in New Product Development and New Service Development for sustainable success.
3. Examine the corporate strategy and organizational knowledge of new products and services for a corporate entrepreneur.
4. Appraise the management of intellectual property and strategic alliances in R&D and technology transfer from R&D to the market.
5. Analyze the opportunities, issues and challenges posed by the shortened product and service life cycle and emerging technologies found in the Fourth Industrial Revolution.

### Course Content

1. Introduction to Innovation Management in Entrepreneurial Wealth Creation.
2. The Relationship of Technology Diffusion and Market Development.
3. The Management of New Product Development.

4. The Management of New Service Development.
5. The Role of Intellectual Property and Technology Innovation Business
6. The Management of R&D Teams and R&D Project.
7. The Importance of Organizational Knowledge in Sustained Innovation.
8. The Framework for Technology Transfer from R&D to the Commercial Market
9. The Future Challenges of new technology in Innovation and Commercialization in Contemporary Times.

**Assessment (includes both continuous and summative assessment)**

Component	ILO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual	Assessment Rubrics
Individual Assignment 1 (IA1): New Product Proposal	1, 2	*Explanation & Formulation	20%	Individual	Appendix 1
Continuous Assessment 1 (CA1): Cyclic Innovation Model	1, 2, 3	*Explanation, Formulate & Examination	25%	Team	Appendix 2 Appendix 6 (Peer evaluation)
CA2: New Service Development	1, 2, 3, 4, 5	*Competence	25%	Team	Appendix 3 Appendix 6 (Peer evaluation)
Individual Assignment 2 (IA2): Reflection Report	1, 2, 3, 4, 5	*Competence	20%	Individual	Appendix 4
Individual Class Participation	1, 2, 3, 4, 5	*Competence	10%	Individual	Appendix 5
Total			100%		

**Description of Assessment Components:**

Individual Assignment 1 (IA1) : Written Work 20%

You are required to be entrepreneurial and come up with a new product that will fulfil market needs. You will provide a sketch of the proposed product that can be used in an entrepreneurial elevator pitch together with your application of new product development processes

Continuous Assessment 1 (CA1): Group 20% ; Individual 5%

Your team will be tasked to conduct research on technological innovations and discover that the innovation is cyclical in nature using the Cyclic Innovation Model. Your essay will track the

Entrepreneurial Endeavors that brought Scientific Exploration, Technological Research, Product Development and Market Transitions together in the launch of a new technological product.

Continuous Assessment 2 (CA2): Group 20%; Individual 5%

Your team will come up with a proposed New Service that is highly entrepreneurial in nature and fulfil the market needs. You should also discuss the management of intellectual property (IP) and market collaboration of the venture. There should also be discussion the retention of organizational knowledge for e sustainable success of the start-up in the long run.

Individual Assignment 2 (IA2): 20%

You should reflect on the lessons learnt in this module and discuss on the potential of future entrepreneurial and/or corporate entrepreneurial application of theories and skillsets, pertaining to innovative Entrepreneurial Value Creation, IP Management, Organizational Knowledge in sustainable innovation as the society enters the Fourth Industrial Revolution.

Individual Class Participation (ICP): 10%

Classroom discussion is vital to the learning process in this course. You are expected to contribute to class discussions and appropriate marks will be awarded continuously throughout the course based on the quality of one’s contribution. Assessment criteria will include demonstration of analytical capability, integrative thinking, and interpersonal and communication skills. Merely showing up for class does not constitute a contribution.

**Formative feedback**

Feedback is central to this course. You will receive verbal feedback from me about your assignments and assessments during consultations. You will also receive both written and verbal feedback in response to your proposals when they are returned to you. The written feedback will be found using the “Track Changes” feature of Microsoft Word and PowerPoint or “Comments” feature for PDF files.

**Learning and Teaching approach**

Approach	How does this approach support you in achieving the learning outcomes?
Group Project Discovery	The course adopts the “Project Discovery” approach, which focuses on inculcating a culture of proactive individual and collaborative learning. There will be a series of mini lectures during the seminars followed by students research, class sharing and class discussions. . The roles of the instructors are to facilitate discussion and to guide you to acquire fundamental concepts and theories. You are expected to adopt, adapt and synthesize the acquired concepts and theories into practice.
Individual	The course will help to develop your individual learning abilities and

Assignment Discovery	attitudes toward active learning. You may attempt the two individual assignments – the first is to boldly create an entrepreneurial product that can woo a potential investor. The second Individual Assignment is for the student to reflect on the future application of the learnings from this course.
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## Reading and References

### Main Text

Trott, P. (2017). **Innovation Management and New Product Development**. 6th Edition. Pearson.

1. McKeown, M.. (2014). **The Innovation Book**. Pearson.
2. Lewrick, M., Link, P., Leifer, L. (2018). **The Design Thinking Playbook**. Wiley.
3. Martin, J.. (1989). **Technical Illustration: Materials, Methods and Techniques**. Child & Associates.
4. Ireland, R.D., Hoskisson, R.E., Hitt, M.A. (2013). **The Management of Strategy**. South-Western Cengage.

## Course Policies and Student Responsibilities

### (1) General

You are expected to complete all assigned pre-class readings and activities, attend all seminar classes punctually and take all scheduled assignments and tests by due dates. You are expected to take responsibility to follow up with course notes, assignments and course related announcements for seminar sessions they have missed. You are expected to participate in all seminar discussions and activities.

### (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.

## Academic Integrity

Good academic work depends on honesty and ethical behavior. 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	Office Location	Phone	Email
Ngiam Tee Woh	-	91271720	ngiamtw@gmail.com

### Planned Weekly Schedule

Week	Topic	ILO	Readings/ Activities
Week 1	Introduction to Innovation Management & Entrepreneurship	1	Maslow, A.H.. (1943). A theory of human motivation. Psychological Review. 50 (4): 370–396.
Week 2	Technology Diffusion & Markets	1	Rogers, E.M. (1962). Diffusion of Innovations. Simon & Schuster: 150
Week 3	New Product Development	1, 2	
Week 4	Technical Sketching & Consultation	1, 2	Piyasena, S., Philp, B. (2012). Just Draw It. Age Repro House Limited: 76-81 Guest speaker
Week 5	New Service Development	1, 2	Just In Mind (n.d.) <a href="https://www.justinmind.com/blog/mobile-app-wireframe">https://www.justinmind.com/blog/mobile-app-wireframe</a> on 12 Jan 2022
Week 6	Presentation	1, 2	
Week 7	Managing Intellectual Property and Technology Innovation Business	3, 4, 5	IPOS (n.d.) <a href="https://www.ipos.gov.sg/manage-ip/growing-with-resilience-through-intangibles">https://www.ipos.gov.sg/manage-ip/growing-with-resilience-through-intangibles</a> accessed on 3 Feb 2022
Week 8	Managing R&D Teams and R&D Project	3, 4, 5	
Week 9	Organizational Knowledge for Sustained Innovation	1,3, 4, 5	

Week 10	Innovation Strategy & Technology Transfer	1,3, 4, 5	Guest Speaker (Innovation, Tech Transfer sectors): Innovation Partner for Impact (IPI Singapore) or National Computer Board (NCB) or equivalent.
Week 11	Opportunities, Challenges & Sustainability in Contemporary Times	1, 5	United Nations Resolution adopted by the General Assembly on 25 September 2015. <b>Transforming our world: the 2030 Agenda for Sustainable Development.</b>
Week 12	Consultation	1, 2,3, 4, 5	
Week 13	Presentation	1,2, 3, 4, 5	

**Appendix 1: Assessment Criteria for Individual Assignment 1 [IA1] (20%)**

The objective of this IA1 is to for the student:

- Explain the Current Market Needs
- Formulate a New Product features to meet this Market Need
- Inclusion of a sketch(es) of the proposed New Product.

This submission is to be completed as an Infographic. Infographics is the creative method to provide an easy-to-understand overview through the clever combination of imagery, charts, text and colours use.

IA1 will be evaluated based on the following rubrics:

<b>Individual Assignment 1 (IA1) 20%</b>			
Criteria	Exceeds Expectations 4 % - 5%	Meets Expectations 2% - 3%	Below Expectations 0% - 1%
Introduction to the Current Market Needs (5%)	Detailed explanation of Market Needs using Maslow Hierarchy of Needs.	There is evidence of Market Needs using Maslow Hierarchy of Needs.	Lacking or no evidence of Market Needs using Maslow Hierarchy of Needs.
New Product Features (5%)	Detailed explanation of How the New Product features will fulfil the Market Needs.	There is some explanation of how the New Product features will fulfil the Market Needs.	Brief explanation of how the New Product features will fulfil the Market Needs.
New Product Sketches (5%)	Detailed sketches of 2 or more views with the key features of the New Product.	Sketch(es) of some of the key features of the New Product.	Sketch(es) of the New Product lacking in details of key features.
Clarity of Infographics (5%)	Clear, concise and well organized infographics with good balance of New Product Description, sketches and the excellent use of colours.	Contains organized infographics of the New Product description, sketches and good use of colours.	Infographics that are layout in a haphazard manner on the New Product description, sketch(es) and the lack of use of colours.

**Appendix 2: Assessment Criteria for Continuous Assignment 1 [CA1] (25%)**

The objective of this CA1 is to be completed by a group of students (min 4 – max 6 pax):

- Examine an existing and successful Technology-Based Innovation against the Cyclic Innovation Model
- Explain how Entrepreneurship brought Scientific Exploration, Technological Research, Product Development and Market Transitions together.

This submission is to be completed as an audio and video presentation embedded in Powerpoint (or equivalent) using an array of technological tools. The steps to make a video in a Powerpoint can be found here: <https://youtu.be/D8JV3w4TOVw>. The video length should not be more than 10 mins.

The submission will be evaluated on the following rubrics:

<b>Continuous Assignment 1 (CA1) 25% : 20% (Group); 5% (Individual)</b>			
<b>Group Component: 20%</b>			
<b>Criteria</b>	<b>Exceeded Expectations 4 % - 5%</b>	<b>Met Expectations 2% - 3%</b>	<b>Below Expectations 0% - 1%</b>
Introduction to the existing and successful Technology-Based Innovation and its commercial success. (5%)	Detailed explanation of an existing and successful Technology-Based Innovation and its commercial success.	There is explanation of an existing and successful Technology-Based Innovation and its commercial success.	There is explanation of an existing and successful Technology-Based Innovation and there is lack of discussion on its commercial success.
<b>Criteria</b>	<b>Exceeded Expectations 8% - 10%</b>	<b>Met Expectations 5% - 7%</b>	<b>Below Expectations 0% - 4%</b>
Application of the Cyclic Innovation Model. (10%)	There are clear and detailed findings of <ul style="list-style-type: none"> <li>• Scientific Exploration</li> <li>• Technological Research</li> <li>• Product Development</li> <li>• Market Transition</li> </ul> And strong demonstration on how Entrepreneurship links all these elements.	There are findings of <ul style="list-style-type: none"> <li>• Scientific Exploration</li> <li>• Technological Research</li> <li>• Product Development</li> <li>• Market Transition</li> </ul> And some demonstration on how Entrepreneurship links up these elements.	There is a lack of findings of <ul style="list-style-type: none"> <li>• Scientific Exploration</li> <li>• Technological Research</li> <li>• Product Development</li> <li>• Market Transition</li> </ul> And little or no demonstration on how Entrepreneurship links up these elements.
<b>Criteria</b>	<b>Exceeded Expectations 4 % - 5%</b>	<b>Met Expectations 2% - 3%</b>	<b>Below Expectations 0% - 1%</b>
Video presentation of the Powerpoint slides with Embedded Individual Presentation. (5%)	The video presentation (within 10 mins) has clear and concise Powerpoint slides (within 10 mins) that is	The video presentation (within or exceeded 10 mins) has Powerpoint slides that is accompanied by video	The video presentation may be incomplete and/or overly lengthy (beyond 12 mins) and/or not presented



	accompanied by video presentation by all team members that are consistent in tone and audibility.	presentation (with unclear audio) and all team members are present.	by all team members.
Individual Component: 5%			
Criteria	Exceeded Expectations 4% - 5%	Met Expectations 2% - 3%	Below Expectations 0% - 1%
Performance & Delivery (5%)	The individual video presentation in the embedded is clear & logical.	The individual video presentation is included in the submission.	The individual video presentation is not included.

**Appendix 3: Assessment Criteria for Continuous Assignment 2 [CA2] (25%)**

The objective of this CA2 is to be completed by a group of students (min 4 – max 6 pax):

- Formulate a New Service that is entrepreneurial and fulfilling market needs.
- Appraise the possible industry collaboration for market entry.
- Examine the long-term goal in terms of the management of intellectual property and organizational knowledge.

This submission is to be completed as an audio and video presentation embedded in Powerpoint (or equivalent) using an array of technological tools. The steps to make a video in a Powerpoint can be found here: <https://youtu.be/D8JV3w4TOVw>. The video length should not be more than 10 mins.

The submission will be evaluated on the following rubrics:

<b>Continuous Assignment 2 (CA2) 25% : 20% (Group); 5% (Individual)</b>			
<b>Group Component: 20%</b>			
<b>Criteria</b>	<b>Exceeded Expectations 4% - 5%</b>	<b>Met Expectations 2% - 3%</b>	<b>Below Expectations 0% - 1%</b>
Introduction to proposed New Service that is entrepreneurial and fulfils market needs. (5%)	Detailed explanation of a New Service that is both entrepreneurial and fulfils market needs.	There is explanation of a New Service that is both entrepreneurial and fulfils market needs.	There is explanation on the New Service but lacks the discussion on how it is entrepreneurial and/or how it fulfils market needs.
<b>Criteria</b>	<b>Exceeded Expectations 8% - 10%</b>	<b>Met Expectations 5% - 7%</b>	<b>Below Expectations 0% - 4%</b>
Analysis of the possible industry collaboration, intellectual property management and organization knowledge management. (10%)	There are clear and detailed discussions on the possible <ul style="list-style-type: none"> <li>• Industry Collaboration</li> <li>• Intellectual Property Management</li> <li>• Organization Knowledge Management</li> </ul> And strong demonstration on how it will lead to Entrepreneurial value-creation.	There are discussions on the possible <ul style="list-style-type: none"> <li>• Industry Collaboration</li> <li>• Intellectual Property Management</li> <li>• Organization Knowledge Management</li> </ul> And some demonstration on how it will lead to Entrepreneurial value-creation.	There is a lack of discussions on the possible <ul style="list-style-type: none"> <li>• Industry Collaboration</li> <li>• Intellectual Property Management</li> <li>• Organization Knowledge Management</li> </ul> And little/no demonstration on how it will lead to Entrepreneurial value-creation.
<b>Criteria</b>	<b>Exceeded Expectations 4% - 5%</b>	<b>Met Expectations 2% - 3%</b>	<b>Below Expectations 0% - 1%</b>
Video presentation of the Powerpoint slides	The video presentation (within 10 mins) has	The video presentation (within or exceeded 10	The video presentation may be incomplete a

with Embedded Individual Presentation. (5%)	clear and concise Powerpoint slides (within 10 mins) that is accompanied by video presentation by all team members that are consistent in tone and audibility.	mins) has Powerpoint slides that is accompanied by video presentation (with unclear audio) and all team members are present.	and/or overly lengthy (beyond 12 mins) and/or not presented by all team members.
Individual Component: 5%			
Criteria	Exceeded Expectations 4% - 5%	Met Expectations 2% - 3%	Below Expectations 0% - 1%
Performance & Delivery (5%)	The individual video presentation in the embedded is clear & logical.	The individual video presentation is included in the submission.	The individual video presentation is not included.

**Appendix 4: Assessment Criteria for Individual Assignment 2 [IA2] (20%)**

The objective of this IA1 is to for the student to reflect on this module at its conclusion. They are to:

- Provide the reasons for taking up the Module
- Analyze the concepts (Value Creation, IP Management, Organizational Knowledge), and skillset (Sketching, Teamwork in New Product/Service Development, etc.) learnt in this module that are relevant to the student’s future venture creation as an Entrepreneur and/or Corporate Entrepreneur.
- Conclude on how it will help the students in their future endeavors.

This submission is to be evaluated based on the following rubrics:

<b>Individual Assignment 2 (IA2)</b>			
Criteria	Exceeded Expectations 4% - 5%	Met Expectations 2% - 3%	Below Expectations 0% - 1%
Introduction to the Reason for taking up this Module. (5%)	Detailed explanation on the reasons for taking up this Module.	There is some explanation on the reasons for taking up this Module.	Lacking Introduction and/or no explanation on the reasons for taking up this Module.
Criteria	Exceeded Expectations 8% - 10%	Met Expectations 5% - 7%	Below Expectations 0% - 4%
Analyze the concepts, tools and skills learn in this module that are relevant to future venture creation. (10%)	There are clear and detailed analysis of <ul style="list-style-type: none"> <li>• Concepts (Value Creation, IP Management, Organizational Knowledge)</li> <li>• Skillset (Sketching, Team Work in New Product/Service Development, etc)</li> </ul> And strong demonstration on how these are relevant to their future venture creation.	There are some analysis of <ul style="list-style-type: none"> <li>• Concepts (Value Creation, IP Management, Organizational Knowledge)</li> <li>• Skillset (Sketching, Team Work in New Product/Service Development, etc)</li> </ul> And demonstration on how these are relevant to their future venture creation.	There is a lack of analysis of <ul style="list-style-type: none"> <li>• Concepts (Value Creation, IP Management, Organizational Knowledge)</li> <li>• Skillset (Sketching, Team Work in New Product/Service Development, etc)</li> </ul> And lacks demonstration on how these are relevant to their future venture creation.
Criteria	Exceeded Expectations 4% - 5%	Met Expectations 2% - 3%	Below Expectations 0% - 1%
Conclusion (5%)	Detailed conclusion on how the Module will help in the entrepreneurial journey.	There is some conclusion on how the Module will help in their entrepreneurial journey.	Lacking Conclusion and/or no explanation how the Module will help in their entrepreneurial journey.

**Appendix 5: Assessment Criteria for Individual Class Participation [ICP] (10%)**

Classroom discussion is vital to the learning process in this course. Each student is expected to contribute to class discussions and appropriate marks will be awarded continuously throughout the course based on the quality of one’s contribution. Assessment criteria will include demonstration of analytical capability, integrative thinking, and interpersonal and communication skills. Merely showing up for class does not constitute a contribution.

Excellent quality comments, remarks, and questions are those that move the discussion forward by:

- (1) revealing important issues;
- (2) making decisions and offering opinions that are well thought out and logical; and
- (3) debating or challenging your classmates without personal attack.

<b>Individual Class Participation (ICP): 10%</b>			
Criteria	Exceeded Expectations 8% - 10%	Met Expectations 5% - 7%	Below Expectations 0% - 4%
Level of Engagement & Contributions to Class (10%)	Proactively contributes to class by offering ideas and/or asks questions frequently and/or works consistently on group project the entire time.  Comments are highly relevant and reflect understanding in course materials; stimulating idea creations.	Contributes to class by offering ideas and asking questions at times.  Comments are sufficiently engaging when prompted.	Rarely or never contributes to class by offering ideas.  Seldom take part by asking questions.

**Appendix 6 : Assessment criteria for Peer Evaluation**

Peer evaluation will be conducted at the end of the module. Using the following evaluation form, you will be asked to evaluate each member of your team, including yourself.

1	2	3	4	5
Made no effort to contribute to teamwork.	Did not contribute much effort to teamwork.	Made some contributions but greater effort could have been made to teamwork.	Exhibited appropriate effort in contributions to teamwork.	Demonstrated outstanding contributions and effort to teamwork.

<b>Team Member being evaluated:</b>					
(i) Is well prepared and punctual for meetings, has completed required readings and research.	1	2	3	4	5
(ii) Active engagement during discussion, provides useful feedback to other team members while accepting constructive feedback from others, respectful of others, cooperative and remains task focused.	1	2	3	4	5
(iii) Timely response to questions outside of team meetings, engage in information sharing and exchange, continual active & constructive participation in the discussion process.	1	2	3	4	5
(iv) Quality and completeness of work allocated and timely completion by deadline.	1	2	3	4	5
<b>TOTAL POINTS</b>					
Provide constructive feedback for this team member (consisting of two to three sentences).					

Your TOTAL POINTS will be averaged based on the number of members in your team.

- If your average point is 70% and above, your marks for the team project will be the same as your team marks.
- If your average point is 50% and above but below 70%, your marks for the team project will be your team marks less between 5 to 10 marks, depending on the average point received.
- If your average point is less than 50%, your marks for the team project will be your team marks less between 11 to 20 marks, depending on the average point received.