

(Theory in Science and Mathematics) National Taiwan Normal University

Online Course Curriculum Plan

Guideline: Pursuant to **Article 6 of the Implementation Regulations Regarding Distance Learning by Universities**, Departments/Programs offering distance learning courses, shall present a course plan and submit it for approval by the university-level academic affairs committee. The course plan referred to in the preceding paragraph shall set forth learning objectives, the target student group, a course outline, teaching methods, interactive student-teacher discussion, grading and course requirements. The course plan shall be posted on the Internet.

1. **Course start date: Fall semester of 2022 (academic year):**

2. **Course review submission record:**

It is a new digital course or an existing face-to-face course switching to digital format in this semester

It is an existing digital course; the latest University's Course Committee approval was in the _spring_ semester of _2021_ (academic year)

Approved by the University's Course Committee and within the 5-year validity period.

The 5-year validity period has expired; a new application is required.

In case of a major change in the original approved course or if the revision ratio exceeds 30%, reapplication is required.

3. **Basic Course Information (check or if applicable)**

(1)	Course Chinese Name	科學與數學理論
(2)	Course English Name	Theory in Science & Mathematics
(3)	Teaching Format	<input checked="" type="checkbox"/> Asynchronous Distance Teaching <input type="checkbox"/> Synchronous Distance Teaching Broadcast University Please fill-in the sign-off university and department for this course: (1) University: _____ Department: _____
(4)	Instructor Name & Title	Associate Professor I-Wei Lai
(5)	Instructor Source	<input checked="" type="checkbox"/> Appointed by Departments <input type="checkbox"/> Appointed by General Education Center <input type="checkbox"/> Both of Above <input type="checkbox"/> Other: _____
(6)	The Name of the Course Unit (or the college and department name)	International Doctoral Program in Integrative STEM Education
(7)	Course Level	<input type="checkbox"/> Undergraduate Program <input type="checkbox"/> Master's Program <input type="checkbox"/> Undergraduate-master Program Joint Course <input type="checkbox"/> Undergraduate-postgraduate Joint Course <input checked="" type="checkbox"/> PhD Program <input type="checkbox"/> Continuing Education Master's Program
(8)	Program Type	<input checked="" type="checkbox"/> Full-time Program <input type="checkbox"/> Part-time Program <input type="checkbox"/> Other: _____

(9)	Course Type	<input type="checkbox"/> Common Courses <input type="checkbox"/> General Courses <input type="checkbox"/> School Required Courses <input checked="" type="checkbox"/> Professional Courses <input type="checkbox"/> Educational Courses <input type="checkbox"/> Other:
(10)	Which Unit Offered This Course?	<input type="checkbox"/> University <input type="checkbox"/> College <input type="checkbox"/> Graduate Institute <input checked="" type="checkbox"/> Department <input type="checkbox"/> Other:
(11)	Course Duration	<input checked="" type="checkbox"/> One Semester (half year) <input type="checkbox"/> Two Semesters (one year) <input type="checkbox"/> Other:
(12)	Course Attribute	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/> Other:
(13)	Number of Credits	2
(14)	Weekly Face-to-Face Class Hours	0.44 hour(s)/week (For asynchronous remote teaching, fill-in the average weekly "face-to-face" hours, which include classroom face-to-face and synchronized remote teaching hours. Divide the total "face-to-face" semester hours by the total number of course weeks.)
(15)	Number of Classes	1
(16)	Estimated Total Number of Students	10
(17)	Fully English-Taught Course	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
(18)	Cooperative Foreign University (Please fill-in the cooperative universities if applicable)	Names of foreign cooperative universities and departments/institutes: _____ <input type="checkbox"/> Domestic Broadcast <input type="checkbox"/> Domestic Sign-off <input type="checkbox"/> Overseas Special Program <input type="checkbox"/> Dual-Degree Program <input type="checkbox"/> Other:
(19)	Course Platform URL (must be filled-in for asynchronous teaching)	NTNU online learning platform: https://moodle.ntnu.edu.tw/
(20)	Curriculum Plan URL	http://courseap.itc.ntnu.edu.tw/acadmOpenCourse/index.jsp

4. Course Teaching Design and Implementation Method

(1)	Learning Objectives	<p>Scientific rigor is the big challenge for a PhD student to link knowledge with action. This course provides a strategic framework for linking science and PhD research. The course provides on a focus from the latest cutting-edge finding of science and practices, leading an ideal text and science language to more logic ideas to apply personal reasonable and sound-science studies. Eight-week courses will be utilized all interdisciplinary systematic research and perspectives. All on-line courses will be provided all illustrations with brand-new concepts with a core set toward case studies regarding to sustainability throughout the courses.</p> <p>For Math Theory,</p> <ol style="list-style-type: none"> 1. To experience that Math is not only a computational tool but a viewpoint to explore science, technology, art, and engineering. 2. To learn the connections among various fields in STEM area. 3. To implement the STEM course that utilizes Math as a language to describe science, technology and engineering <p>For Science Theory</p> <ol style="list-style-type: none"> 1. To learn how to explain & how the world runs with an aspect of the natural world and universe that has been repeatedly tested and corroborated; 2. To learn how to use scientific method correctly, with accepted protocols of observation, measurement, and examination with scientific rigor; 3. To learn how this world became and how it could be worked with: such as Astronomy: Big Bang Theory; Biology: Cell Theory; Theory of Evolution; Germ Theory of Disease; Chemistry: Atomic Theory; Kinetic Theory of Gases; and Physics: General Relativity; Special Relativity; Theory of Relativity; Quantum Field Theory. 						
(2)	Target Student Group	First-year doctoral students of the International Doctoral Program in Integrative STEM Education						
(3)	Prerequisite(s)	Students should be able to manage the ability of academic literature reading and critical thinking.						
(4)	Course Content Outline: Please fill in the weekly teaching content and course outline (multiple teaching methods can be selected and filled in, for example: If the weekly face-to-face teaching is 2 hours and asynchronous teaching is 1 hour, write 2 in the "face-to-face" field, write 1 in the "asynchronous" field, and leave the "synchronous" field blank)							
						Teaching Method and Hours (fill-in the number of hours, omit if none)		
Week		Topics	Learning Goal (Brief Description)	Teaching Interactive Design (topic discussion, peer review, etc.)	Testing/Evaluation Activities (omit if not designed for the week)	Classroom Face-to-Face Teaching	Remote learning	
							Asynch-ronous	Synchr-onized
1		Introduction of Theory in	Understand the goal	Group discussion;		2		

	Mathematics	and the requirements of this lecture	peer review				
2	Mathematics Teaching	Understand the way of teaching Mathematics	Topic discussion; peer review	Take-home assignments		2	
3	Connections between Math and Engineering (Dr. Tze-Chang Liu)	Understand the connection between math and engineering	Topic discussion; peer review	Take-home assignments		2	
4	Connections between Math and Technology	Understand the connection between math and technology	Topic discussion; peer review	Take-home assignments	2		
5	Multimodal discourse and representations in STEM Education (Dr. Kok-Sing Tang)	Conduct the teaching practice with a math and engineering/technology topic	Topic discussion; peer review			2	
6	Connections between Math and Science	Understand the connection between math and science	Topic discussion; peer review	Take-home assignments		2	
7	Connections between Math and Art	Understand the connection between math and art	Topic discussion; peer review	Take-home assignments		2	
8	Teaching Practice	Conduct the teaching practice with a STEM topic	Individual presentation and peer review	Take-home assignments		2	
9	Science, What It Matters and What It Is	Obtain the knowledge of scientists and those who can be smart with connections to science	Topic discussion; peer review			2	

	10	Technology Beyond Borders – Exploring the nature of Technology (Dr. Wendy Fox-Turnbull)	Develop the ability to detect the basis for causes, beliefs, actions, events, and facts and know why.	Topic discussion; peer review	Take-home assignments			2
	11	Nature Science & Social Science	Science: Toward a science that deals with the natural world whereas toward social science to deal with human society and social relationships.	Topic discussion; peer review	Take-home assignments		2	
	12	Idea of Nature	Defining the essence of a thing to find fundamental metaphysical concepts	Topic discussion; peer review			2	
	13	STEM Education: Opportunities and Challenges (Dr. Lyn English)	Develop the ability to detect difference, transformation by the digital revolution and advances.	Topic discussion; peer review				2
	14	Sustainable Development Goals	To understand how science can detect Sustainable Development Goals, and the measures.	Topic discussion; peer review	Take-home assignments		2	
	15	Likelihood, Risk, and Signal Examination	To learn signal detection methods from surveillance to	Topic discussion; peer review	Take-home assignments		2	

			identify elevated risks in the world.					
	16	Self-directed Learning	Master the skills of academic writing	Report writing and reviewing			2	
(5)	Teaching Method	<p>(if included, check ✓; multiple choices allowed)</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> 1. Provide primary and supplementary materials for online courses <input checked="" type="checkbox"/> 2. Provide online asynchronous teaching, number: <u>14</u> time(s), total hour(s): <u>28</u> hour(s) <input checked="" type="checkbox"/> 3. Have online teacher or online assistant <input type="checkbox"/> 4. Provide face-to-face teaching, number: ____ time(s), total hour(s): ____ hour(s) <input checked="" type="checkbox"/> 5. Provide online synchronous face-to-face teaching, number: <u>4</u> time(s), total hour(s): <u>8</u> hour(s) <input checked="" type="checkbox"/> 6. Provide topic discussion activities <input checked="" type="checkbox"/> 7. Provide cooperative learning activities between students <input type="checkbox"/> 8. Other: (please specify) 						
(6)	Learning Management System	<p>Does the content include the following roles and functions (if included, check ✓; multiple choices allowed)</p> <ol style="list-style-type: none"> 1. For learning management system database management by the system administrator <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Personal data <input checked="" type="checkbox"/> Course information <input type="checkbox"/> Other related information management functions 2. Provide the necessary learning management system functions for teachers (teaching assistants) and students <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Latest News release, browse <input checked="" type="checkbox"/> Textbook content design, viewing, download <input type="checkbox"/> Grade system management & inquiry <input checked="" type="checkbox"/> Perform online testing <input checked="" type="checkbox"/> Learning information releasing <input checked="" type="checkbox"/> Interactive learning design (chat room or discussion area) <input checked="" type="checkbox"/> Function presentation for various teaching activities <input type="checkbox"/> Other related functions: (please specify) 						
(7)	Public Information about	<p>Instructor Profile and Published Works (webpage link instructions can be attached): Dr. I-Wei Lai https://optimizationanalysislab.github.io/lab-page/</p>						

	Interactive Teaching	<p>Instructor E-mail: Dr. I-Wei Lai: iweilai@ntnu.edu.tw</p> <hr/> <p>Online Office Hours (at least 1 hour per week): Dr. I-Wei Lai: Monday 13:00-14:00 by appointments</p> <hr/> <p>Teaching Assistant's Name/E-mail (omit if inapplicable):</p> <hr/> <p>Other(omit if inapplicable):</p>
(8)	Course Material Production	<p>(if included, check ✓; multiple choices allowed)</p> <ul style="list-style-type: none"> <input type="checkbox"/> 1. Provides appropriate reminders of key points <input type="checkbox"/> 2. Provides teaching-related examples <input type="checkbox"/> 3. Provides teaching-related exercises and reflective activities <input type="checkbox"/> 4. Provides supplementary teaching materials or online resources <input type="checkbox"/> 5. Provides instructions for self-directed learning <input type="checkbox"/> 6. Unit goals are consistent with course goals <input type="checkbox"/> 7. Other:
(9)	Assignment Submission Method	<p>(if included, check ✓; multiple choices allowed)</p> <ul style="list-style-type: none"> <input type="checkbox"/> 1. Provides online assignment content description <input type="checkbox"/> 2. Online real-time assignment <input type="checkbox"/> 3. Assignment file upload and download <input type="checkbox"/> 4. Online testing <input type="checkbox"/> 5. Grade inquiry <input type="checkbox"/> 6. Other:
(10)	Grading Method	<p>※ To comply with the spirit of online course design, you must understand and agree to the contents of the following 3 items, and provide detailed description after checking ✓ the box for item 3)</p> <ul style="list-style-type: none"> <input type="checkbox"/> 1. The course can provide evaluation results and feedback for each learning evaluation <input type="checkbox"/> 2. The evaluation has taken the students online learning history and participation level into account <input type="checkbox"/> 3. The percentage of each score is explained in detail below: (testing method and items, and their total score

		percentage) Class discussion 10% Assignment 40% Attendance 10% Presentation 40 %
(11)	Precautions for Class:	1. Students should regularly check the course website for updates. 2. Students should complete and submit the online discussion, assignments, and exams on time.
(12)	<p><u>Observe intellectual property rights in the creation of course content.</u></p> <p>※ Pay attention to any infringement of copyright or other rights in the creation of relevant teaching content. ※ If the copyright for any part of the teaching content is owned by others and authorization has been obtained from the rights holder, please indicate the source of the material.</p>	