National Taiwan Normal University Online Course Curriculum Plan

Instructions: According 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. **Chinese Course Name:** 科學與數學理論
2. **English Course Name:** Theory in Science & Mathematics
3. **Course start date: Fall semester of 2025**
4. **Course review submission record:** (■ if applicable)**:**

   □(1) **It is a new online course or an existing face-to-face course switching to online course in this semester**

   ■(2) **It is an existing online course; the latest University's Course Committee approval was in the _spring_ semester of _2021_**

   □(2.1) **The 5-year validity period has expired(109-1); a new application is required.**

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

5. **Basic Course Information** (■ if applicable)

(1)	Instructor Name & Title	Associate Professor I-Wei Lai
(2)	Instructor Source	■Appointed by Departments □Appointed by General Education Center □Both of Above □Other:
(3)	College/Department/Center	International Doctoral Program in Integrative STEM Education
(4)	School System	□Undergraduate Program □Master's Program □Undergraduate-master Program Joint Course □Undergraduate-postgraduate Joint Course ■PhD Program □Continuing Education Master's Program
(5)	Program Type	■Full-time Program □Part-time Program □Other:
(6)	Course Type	□Common Courses □General Courses □School Required Courses ■Professional Courses □Educational Courses □Other:
(7)	Required Courses	□University-required □College-required □Graduate Institute-required ■Department-required □Others:
(8)	Course Duration	■One Semester (half year) □Two Semesters (one year) □Other:
(9)	Required/Elective Course	□Required ■Elective □Other:
(10)	Course Credits	2

(11)	Average of Face-to-Face Teaching Hours Per Week	0.44 hour(s)/week (Divide the total "face-to-face teaching" hours, including the hours of face-to-face teaching and synchronous teaching, by the total number of course weeks.)
(12)	Number of Classes	1
(13)	Estimated Total Number of Students	10
(14)	EMI Courses	■Yes □No
(15)	Type of Cooperation with Domestic/Foreign Universities (omit if inapplicable)	1. Cooperative University:_____; Department/Institute: _____ Instructor Name:_____; Course Name: _____; Number of Students:_____ 2. □Partner University □Dual-Degree Program □Global Virtual Classroom Course □Others: _____
(16)	Course Platform Website (asynchronous teaching is required)	NTNU online learning platform: https://moodle.ntnu.edu.tw/
(17)	Syllabus Website	http://courseap.itc.ntnu.edu.tw/acadmOpenCourse/index.jsp

6. Course Teaching Design and Implementation Method

<table>
<tr><td>(1)</td><td>Course Goals</td><td>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.
For Math Theory,
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
For Science Theory
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.</td></tr>
<tr><td>(2)</td><td>Target Student Group</td><td>First-year doctoral students of the International Doctoral Program in Integrative STEM Education</td></tr>
<tr><td>(3)</td><td>Prerequisite(s)</td><td>Students should be able to manage the ability of academic literature reading and critical thinking.</td></tr>
<tr><td>(4)</td><td colspan="2">Course Content Outline:
<table>
<tr><th rowspan="3">Week</th><th rowspan="3">Topics
(If there are multiple instructors, please specify instructor names in each week)</th><th rowspan="3">Learning Objectives
(From the perspective of students)</th><th rowspan="3">Teaching Interactive Design
(Multiple choices allowed)</th><th rowspan="3">Testing/Evaluation Activities
(Multiple choices allowed. Choose “None” if not designed for the week.)</th><th colspan="3">Teaching Method and Hours
(fill-in the number of hours, omit if none)</th></tr>
<tr><th rowspan="2">Face-to-Face Teaching</th><th colspan="2">Distance learning</th></tr>
<tr><th>Synchronous</th><th>Asynchronous</th></tr>
<tr><td>1</td><td>Introduction of Theory in Mathematics</td><td>Understand the goal and the</td><td>Group discussion; peer review</td><td></td><td>2</td><td></td><td></td></tr>
</table></td></tr>
</table>

			requirements of this lecture					
	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	Nature Science & Social	Science: Toward a	Topic discussion;	Take-home			2

	Science	science that deals with the natural world whereas toward social science to deal with human society and social relationships.	peer review	assignments			
11	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	
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 identify elevated	Topic discussion; peer review	Take-home assignments			2

			risks in the world.					
	16	Self-directed Learning	Master the skills of academic writing	Report writing and reviewing				2

(5)	Teaching Method	(■ if included; multiple choices allowed) ■ 1. Provide primary and supplementary materials for online courses ■ 2. Provide face-to-face teaching, number: __2__ time(s), total hour(s): __4__ hour(s) ■ 3. Provide synchronous teaching, number: __3__ time(s), total hour(s): __6__ hour(s) ■ 4. Provide asynchronous teaching, number: __11__ time(s), total hour(s): __22__ hour(s) ■ 5. Provide topic discussion activities ■ 6. Provide cooperative learning activities between students ☐ 7. Mutual learning through students' works ☐ 8. Others: (please specify)
(6)	Learning Management System (moodle)	Which moodle functions are used in this course? (■ if included; multiple choices allowed) Note: For teachers and students from domestic or foreign universities who are participating in joint programs that require access to Moodle, please have the course instructor contact the platform manager at extensions 5673 or 5579. E-mail: elearn@ntnu.edu.tw ■ 1. Personal data ■ 2. Course information ■ 3. Latest News release & browse ■ 4. Course materials viewing & download ☐ 5. Grade system management & inquiry (omit if inapplicable) ■ 6. Perform online testing (omit if inapplicable) ■ 7. Learning information ■ 8. Interactive learning design (chat room or discussion area) ☐ 9. Other related functions: (please specify)
(7)	Public Information about Interactive Teaching	Instructor Profile and Published Works (webpage link instructions can be attached): Dr. I-Wei Lai https://optimizationanalysislab.github.io/lab-page/
		Instructor E-mail: Dr. I-Wei Lai: iweilai@ntnu.edu.tw

		Online Office Hours (at least 1 hour per week): Dr. I-Wei Lai: Monday 13:00-14:00 by appointments
		Teaching Assistant's Name/E-mail (omit if inapplicable):
		Other(omit if inapplicable):
(8)	Course Material Production	(■ if included; multiple choices allowed) ■ 1. Provide appropriate reminders of key points ■ 2. Provide teaching-related examples ■ 3. Provide teaching-related exercises and reflective activities ■ 4. Provide supplementary teaching materials or online resources ■ 5. Provide instructions for self-directed learning ■ 6. Learning objectives are consistent with course goals □ 7. Others:
(9)	Assignment Submission Method	(■ if included; multiple choices allowed) ■ 1. Provide online assignment content description ■ 2. Assignment file upload and download □ 3. Others:
(10)	Assessment	**※ To comply with the spirit of online course design, please understand and agree to the contents of the following 3 items, and provide detailed description:** ■ 1. The course can provide evaluation results and feedback for each learning evaluation ■ 2. The evaluation has taken the students online learning history and participation level into account ■ 3. The percentage of each score is explained in detail below: 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)	**<u>Observe intellectual property rights in the creation of course content.</u>** ※ 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.	