

(course name: Data Communication) National Taiwan Normal University

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

2. **Course review submission record:**

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

It is an existing online course; the latest University's Course Committee approval was in the fall 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)	Chinese Course Title	資料通訊
(2)	English Course Title	Data Communication
(3)	Teaching Format	<input checked="" type="checkbox"/> Asynchronous Distance Teaching <input checked="" type="checkbox"/> Synchronous Distance Teaching Broadcast University Please fill-in the sign-off university and department for this course: (1) University: National Taiwan Normal University Department: Computer Science and Information Engineering
(4)	Instructor Name & Title	Chao Wang, Assistant Professor
(5)	Instructor Sources	<input checked="" type="checkbox"/> Appointed by Departments <input type="checkbox"/> Appointed by General Education Center <input type="checkbox"/> Both of Above <input type="checkbox"/> Others:
(6)	College/Department/Center	College of Science, Department of Computer Science and Information Engineering
(7)	School System	<input type="checkbox"/> Undergraduate Program <input type="checkbox"/> Master's Program <input checked="" type="checkbox"/> Undergraduate-master Program Joint Course <input type="checkbox"/> Undergraduate-postgraduate Joint Course <input 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"/> Others:

(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)	Required Courses	<input type="checkbox"/> University-required <input type="checkbox"/> College-required <input type="checkbox"/> Graduate Institute-required <input type="checkbox"/> Department-required <input checked="" type="checkbox"/> Others: Elective in the field, according to the department regulation 系上 規定之領域選修課
(11)	Course Duration	<input checked="" type="checkbox"/> One Semester (half year) <input type="checkbox"/> Two Semesters (one year) <input type="checkbox"/> Others:
(12)	Required/Elective Course	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/> Others:
(13)	Course Credits	3
(14)	Face-to-Face Teaching Hours Per Week	_ 1.4 _ hour(s)/week (For asynchronous distance teaching, fill-in the average of "face-to-face teaching" hours per week, which include the hours of face-to-face teaching and synchronous distance teaching. Divide the total "face-to-face teaching" hours by the total number of course weeks.)
(15)	Number of Classes	16 weeks in total, three classes per week
(16)	Estimated Total Number of Students	40
(17)	Fully English-Taught Course EMI Courses	<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 checked="" type="checkbox"/> Others: Not applicable
(19)	Course Platform Website (asynchronous teaching is required)	NTNU online learning platform: https://moodle.ntnu.edu.tw/
(20)	Syllabus Website	http://courseap.itc.ntnu.edu.tw/acadmOpenCourse/index.jsp

4. Course Teaching Design and Implementation Method

(1)	Course Goals	The objectives of this course are for students to learn design principles in data communication, to get some ideas of networking systems analysis, and to have some hands-on experience in systems development.																																										
(2)	Target Student Group	This course is designed for third-/fourth-year undergraduate students and graduate students.																																										
(3)	Prerequisite(s)	The students should have some working knowledge in both C and Linux.																																										
(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)																																											
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			Synchronous		Asynchronous																																							
	at least 2 weeks		at least 3 weeks		at least 8 weeks																																							
	<table border="1"> <thead> <tr> <th rowspan="3">Week</th> <th rowspan="3">Topics</th> <th rowspan="3">Learning Objectives (Brief Description)</th> <th rowspan="3">Teaching Interactive Design (topic discussion, peer review, etc.)</th> <th rowspan="3">Testing/Evaluation Activities (omit 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>Synchr onous</th> <th>Asynch ronous</th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Course Introduction</td> <td>To learn an overview of this course</td> <td>Topic discussion</td> <td></td> <td>2.5</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>Broker-Based Data Communication</td> <td>To have a first look at a contemporary data communication architecture</td> <td>Topic discussion; hands-on practice on the use of out-of-shelf MQTT services</td> <td>Homework 1</td> <td></td> <td></td> <td>2.5</td> </tr> <tr> <td>3</td> <td>Messaging Broker Design and Implementation</td> <td>To have an in-depth look on the design and implementation of the messaging broker architecture</td> <td>Topic discussion; code tracing for an open-source MQTT implementation</td> <td></td> <td></td> <td>2.5</td> <td></td> </tr> </tbody> </table>							Week	Topics	Learning Objectives (Brief Description)	Teaching Interactive Design (topic discussion, peer review, etc.)	Testing/Evaluation Activities (omit if not designed for the week)	Teaching Method and Hours (fill-in the number of hours, omit if none)			Face-to-Face Teaching	Distance learning		Synchr onous	Asynch ronous		1	Course Introduction	To learn an overview of this course	Topic discussion		2.5			2	Broker-Based Data Communication	To have a first look at a contemporary data communication architecture	Topic discussion; hands-on practice on the use of out-of-shelf MQTT services	Homework 1			2.5	3	Messaging Broker Design and Implementation	To have an in-depth look on the design and implementation of the messaging broker architecture	Topic discussion; code tracing for an open-source MQTT implementation			2.5
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4	The Queueing Model	To learn the basics of queueing theory	Topic discussion	Homework 2	2.5		
5	Poisson Process and Markov Chain	To understand the fundamental math tools for queueing analysis	Topic discussion; web visual widget illustration				2.5
6	Queueing Systems	To see how to apply the queueing analysis to examine data communication system performance	Topic discussion	Homework 3			2.5
7	Case Study: The Aloha System	To be able to evaluate a classic data communication system design	Topic discussion				2.5
8	Midterm Exam			In-class written exam	2.5		
9	Data Communication Bus	To learn industrial standard protocols for data communication	Topic discussion			2.5	
10	Data Routing and Flow Control	To learn the algorithmic perspective of data communication	Topic discussion	Homework 4			2.5
11	TDMA Data Communication	To gain insights into a typical design for wireless data communication	Topic discussion; problem-based learning				2.5
12	Time Synchronization	To see the standard approaches to synchronize computers over the	Topic discussion	Homework 5		2.5	

			network					
	13	Communication Error Handling	To learn some fault-tolerant data communication strategies and to see the trade-offs in the design	Problem-based learning		2.5		
	14	Case Study: LoRa and LoRaWAN	To learn a recent data communication specification in the era of Internet-of-Things	Topic discussion; real test-bed demonstration				2.5
	15	Research Topic: Real-Time Fault-Tolerant Communication	To have some initial look at academic research work in data communication	Topic discussion				2.5
	16	Final Exam			In-class written exam	2.5		
(5)	Teaching Method	<p>(if included, check ✓; multiple choices allowed)</p> <ul style="list-style-type: none"> ■ 1. Provide primary and supplementary materials for online courses ■ 2. Provide online asynchronous teaching, number: <u> 8 </u> time(s), total hour(s): <u> 20 </u> hour(s) ■ 3. Have online teacher or online assistant ■ 4. Provide face-to-face teaching, number: <u> 5 </u> time(s), total hour(s): <u> 12.5 </u> hour(s) ■ 5. Provide online synchronous teaching, number: <u> 3 </u> time(s), total hour(s): <u> 7.5 </u> hour(s) ■ 6. Provide topic discussion activities <input 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?</p> <p>(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"> ■ Personal data ■ Course information <input type="checkbox"/> Other related information management functions 						

		<p>2. Provide the necessary learning management system functions for teachers (teaching assistants) and students</p> <ul style="list-style-type: none"> ■ Latest News release, browse <input type="checkbox"/> Textbook content design, viewing, download ■ Grade system management & inquiry ■ Perform online testing ■ Learning information releasing ■ Interactive learning design (chat room or discussion area) ■ Function presentation for various teaching activities <input type="checkbox"/> Other related functions: (please specify)
(7)	Public Information about Interactive Teaching	Instructor Profile and Published Works (webpage link instructions can be attached): Instructor profile: https://web.ntnu.edu.tw/~cw/authors/cw/ Lab website: https://web.ntnu.edu.tw/~cw/
		Instructor E-mail: cw@ntnu.edu.tw
		Online Office Hours (at least 1 hour per week): Wednesdays and Thursdays 2–4 PM
		Teaching Assistant's Name/E-mail (omit if inapplicable): Yi-Hsuan Tseng 曾翊瑄 (email provided on Moodle)
		Other(omit if inapplicable):
(8)	Course Material Production	<p>(if included, check ✓; multiple choices allowed)</p> <ul style="list-style-type: none"> ■ 1. Provides appropriate reminders of key points ■ 2. Provides teaching-related examples ■ 3. Provides teaching-related exercises and reflective activities ■ 4. Provides supplementary teaching materials or online resources ■ 5. Provides instructions for self-directed learning ■ 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"> ■ 1. Provides online assignment content description ■ 2. Online real-time assignment ■ 3. Assignment file upload and download <input type="checkbox"/> 4. Online testing ■ 5. Grade inquiry <input type="checkbox"/> 6. Other:
(10)	Assessment Plan	<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"> ■ 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: (testing method and items, and their total score percentage) <p style="margin-left: 40px;">Homework Assignments 55% (five homework assignments, 11% each) Midterm Exam 20% (in-class written exam) Final Exam 20% (in-class written exam) Online/Offline Participation 5% (including Moodle platform interactions such as the forum discussion)</p>
(11)	Precautions for Class:	<p>This course is designed for third-/fourth-year undergraduate students and graduate students. Students taking this course are assumed to have learned what has been covered in the first two years of study in our department (data structures, algorithms, probability, etc.). We shall not repeat those materials in this course.</p>
(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>	