國立東華大學

教學計劃表　Syllabus

課程名稱(中文) Course Name in Chinese	分散式系統			學年/學期 Academic Year/Semester	113/2
課程名稱(英文) Course Name in English	Distributed Systems				
科目代碼 Course Code	CSIEM0140	系級 Department & Year	碩士	開課單位 Course-Offering Department	資訊工程學系
修別 Type	選修 Elective	學分數/時間 Credit(s)/Hour(s)	3.0/3.0		
授課教師 Instructor	/吳秀陽				
先修課程 Prerequisite					

課程描述　Course Description

A distributed system is a collection of independent computers and related software that appears to its users as a single coherent system. In the Internet/Web/Mobile/Cloud/IoT era, almost all our daily used net-related applications or services are provided by distributed systems. The latest AI LLMs such as ChapGPT and DeepSeek are trained on large scale distributed systems. It is one of the central knowledge that all computer science students must possess in order to be competitive in the fast changing world. The purpose of this course is to investigate the theory and practice underlying the design, construction and operation of distributed systems. We will discuss the fundamental principles such as distributed processes, addressing and naming, communication mechanisms, synchronization and coordination, replication and consistency, fault tolerance, distributed algorithms, transactions and concurrency control, security, mobile/pervasive computing, cloud services, big data processing, Internet of Things(IoT), etc.. If time permits, we will also discuss Distributed Quantum Computing (DQC) on a recent breakthrough that may have a profound impact on the entire world of computing.

In addition to the lecture part of the course, students are also required to conduct an independent study on selected topics and present papers in class. Students will also learn how to build distributed applications through assignments and term project. More details on the lecture notes.

課程目標　Course Objectives

A distributed system is a collection of independent computers and related software that appears to its users as a single coherent system. In the Internet/Web/Mobile/Cloud/IoT era, almost all popular network-based applications or services can be considered as provided by distributed systems. It is one of the central knowledge that all computer science students must possess in order to be competitive in the fast changing world. The purposes of this course are to investigate the theories and practices underlying the design, construction and operation of distributed systems. In the lecture part, we will discuss fundamental principles such as distributed processes, addressing and naming, communication mechanisms, synchronization and coordination, replication and consistency, fault tolerance, distributed algorithms, transactions and concurrency control, security, mobile/pervasive computing, cloud services, big data processing, Internet of Things(IoT), etc.. Students are also required to conduct an independent study on selected topics and present papers in class. To gain hands-on experience on the design and construction of distributed system, students will also learn how to use proper tools for building distributed applications through lab, assignments and term project.

	系專業能力 Basic Learning Outcomes	課程目標與系專業能力相關性 Correlation between Course Objectives and Dept.'s Education Objectives
A	統合資工知識技術之能力Ability to integrate knowledge and technologies of computer science and information engineering.	●

B	設計技術理論驗證實驗之能力Ability to design and conduct science experiments and to validate hypotheses.	●
C	資訊軟硬體設計開發之能力Ability to design and develop computer software and hardware.	●
D	團隊專案開發之能力Ability to design and develop team projects.	●
E	批判性思考與創新研發之能力。Ability of analytical thinking, creative research planning, and innovative development.	●

圖示說明Illustration ：● 高度相關 Highly correlated ○中度相關 Moderately correlated

授 課 進 度 表 Teaching Schedule & Content

週次Week	內容 Subject/Topics	備註Remarks
1	Course introduction, course information, requirement, syllabus	
2	Introduction: Introduction to distributed systems Networking and internetworking essentials Design goals Classification of distributed systems Examples of modern distributed systems Current and future trends	
3	Architectures and Middlewares: Architectural styles System models and architectures Middlewares Layered-system architectures Symmetrically distributed system architectures Hybrid system architectures Self-management	
4	Distributed Processes I: Processes and threads (Python threads) Clients and servers Operating system support	
5	Distributed Processes II: Virtualization Code mobility and agents Microservices	
6	Communication I: Interprocess communication models Remote invocation(RPC, RMI)	
7	Communication II: Message-oriented communication Multicast and group communication	
8	Addressing and Name Services: Fundamentals Flat vs. structured naming Attribute-based naming Directory services	
9	No Midterm Exam, study topics and schedule arrangement Time, Synchronization & Coordination I: Time and clock synchronization Logical clocks Global state and snapshot	
10	Time, Synchronization & Coordination II: Mutual exclusion Location systems Gossip-based coordination Swarm intelligence	

11	Distributed Algorithms & Computation I: Election Consensus Distributed event processing	
12	Distributed Algorithms & Computation II: Distributed graph algorithms MapReduce BSP(Bulk Synchronous Parallel)	
13	Distributed Storage & Data Management: Distributed storage File service architecture Network File System Mobile File System Distributed database systems New storage technologies **	
14	Consistency and Replication: Consistency models Replica management Consistency protocols Fault Tolerance:** Failure Models and Process Resilience Reliable Communication Security:** Security Models Access Control Security Management	
15	Advanced Topics: (may be different on each offering)** Web services Mobile and pervasive computing Grid, cloud, fog and edge Computing P2P(Peer-to-peer) systems Wireless sensor networks(WSN) and Internet of Things(IoT) Crowd computing Mobile sensing Social networks and computing Distributed systems for AI and ML Distributed quantum computing	
16	Student presentation	
17	期末考試週 Final Exam	
18	Term Project Review & Demo	

教 學 策 略 Teaching Strategies

☑ 課堂講授 Lecture ☐ 分組討論Group Discussion ☐ 參觀實習 Field Trip

☑ 其他Miscellaneous: Independent study and presentation

教 學 創 新 自 評 Teaching Self-Evaluation

創新教學(Innovative Teaching)

☐ 問題導向學習(PBL) ☐ 團體合作學習(TBL) ☐ 解決導向學習(SBL)

☐ 翻轉教室 Flipped Classroom ☐ 磨課師 Moocs

社會責任(Social Responsibility)

☐ 在地實踐Community Practice ☐ 產學合作 Industy-Academia Cooperation

跨域合作(Transdisciplinary Projects)

☐ 跨界教學Transdisciplinary Teaching ☐ 跨院系教學Inter-collegiate Teaching

☐ 業師合授 Courses Co-taught with Industry Practitioners

其它 other:

學期成績計算及多元評量方式 Grading & Assessments									
配分項目 Items	配分比例 Percentage	多元評量方式 Assessments							
		測驗會考	實作觀察	口頭發表	專題研究	創作展演	卷宗評量	證照檢定	其他
平時成績 General Performance	20%				✓				Independent study and presentation
期中考成績 Midterm Exam	0%								
期末考成績 Final Exam	20%	✓							
作業成績 Homework and/or Assignments	40%		✓						
其他 Miscellaneous (Term Project)	20%		✓		✓	✓			

評量方式補充說明
Grading & Assessments Supplemental instructions

教科書與參考書目（書名、作者、書局、代理商、說明）
Textbook & Other References (Title, Author, Publisher, Agents, Remarks, etc.)

Textbook: (Recommended but not required)
Maarten Van Steen and Andrew S. Tanenbaum. Distributed Systems, 4.03th Edition. 2025.
(https://www.distributed-systems.net/index.php/books/ds4/)

References:
Unmesh Joshi. Patterns of Distributed Systems. Addison-Wesley, 2024.
Roberto Vitillo. Understanding Distributed Systems: What every developer should know about large distributed applications, 2nd Edition. 2022. (https://understandingdistributed.systems/)

課程教材網址(含線上教學資訊,教師個人網址請列位於本校內之網址)
Teaching Aids & Teacher's Website(Including online teaching information.
Personal website can be listed here.)

Web Page: on e-Learning

其他補充說明 (Supplemental instructions)

Must do the term project to pass the class!!