

Course Title	Introduction to Information and Communication Networks	Instructor(s)	Baiko Sai (実務経験のある教員)
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Class Style	Lecture, seminar, etc.	Office Hours	Friday PM
Track		Mode of Instruction	Of-line
Credits	2	Allocated Year	Third or fourth year
Active Learning	Included	Compulsory or Elective	
Course Overview	<p>Acquire basic knowledge of information and communications network engineering and understand media handling theory, modulation methods, and the mechanisms of noise generation. Then, understand the configuration of familiar mobile communications networks.</p> <ol style="list-style-type: none"> <li>1. Understand the overall configuration of telecommunications systems.</li> <li>2. Understand various modulation methods.</li> <li>3. Understand various transmission media.</li> <li>4. Understand signals and noise.</li> <li>5. Synchronization, a journey into mobile communications networks.</li> </ol>		
Course Objectives	<p>Through lectures and exercises, this course will explain how to convert information into electrical signals and transmit them efficiently over wired or wireless transmission paths. It will also explain the outline of analog communication systems and the characteristics of transmission paths, as well as the methods and characteristics of carrier modulation. It will also teach digital communication methods.</p>		
Prerequisite			
Course Schedule	No	Contents	Homework
	1	Part 1: Introduction #1: Explanation of how the class will proceed. Introduction to the history of information and communication. Understand the difference between information as an intangible concept and signals as a physical entity. Understand the essential meaning of "communicating."	Yes
	2	Part 2: Information and communication network configuration #2: Types of information, coding of audio and video signals and bandwidth compression technology, data coding, and introduction to network configuration. Exercises.	Yes
	3	Part 3: Information handled through telecommunications #3: Amount of information, concept of entropy. Concept of redundancy. Exercises.	Yes
	4	Part 4: Basics of Electrical Signal Handling #4: Representation of signal waves in the time domain and frequency domain, Fourier transform and inverse Fourier transform, digital signal processing technology, digital television systems. Exercises.	Yes
	5	Part 5: Analog Modulation	Yes

		#5: Principles of AM modulation. Circuits and characteristics of AM modulation. Necessity of modulation, amplitude modulation, DSB, SSB, modulation circuits, frequency spectrum, practice problems.	
	6	Part 6: From Pulse Modulation to Digital Modulation #6: Principles of pulse modulation. Introduction to the digital modulation method of PCM modulation. Exercises.	Yes
	7	Part 7: Quantization of signals, sampling theorem #7: Quantization error, sampling theorem, theory of coding methods. Digital modulation of carrier wave, modulation rate and transmission rate. Exercises.	Yes
	8	Part 8: Summary of contents 1 to 7 #8: Quiz ① of contents 1 to 7, discussion.	No
	9	Part 9: Digital Modulation (1) #9: Multi-level modulation methods. Sampling theory, Pulse Code Modulation (PCM), predictive coding, digital modulation of carrier waves, modulation rate and transmission rate. Exercises.	Yes
	10	Part 10: Digital Modulation (2) #10: Signal multiplexing methods. Frequency division multiplexing (FDM), time division multiplexing (TDM), code division multiplexing (CDM), orthogonal frequency division multiplexing (OFDM), data signal multiplexing, packet multiplexing practice questions.	Yes
	11	Part 11: Digital Modulation (3) #11: Various disturbances in communications and noise reduction techniques. Internal noise, external noise, noise figure and equivalent noise temperature, disturbances due to distortion. Synchronization of digital communication systems, a journey to mobile networks. Exercises.	Yes
	12	Part 12: Telephone network, ISDN network #12: Understand the entire telephone network from telephone lines, dialed numbers, and exchanges (stations). Configure SDN networks. Understand assets to be left in historical museums. Exercises.	Yes
	13	Part 13: How the Internet Works #13: Network configuration elements and conditions. Introduction to wireless communications. Exercises.	Yes
	14	Part 14: Mobile network technology, satellite communication systems #14: Elements and conditions of network configuration. Introduction to wireless communications. Configuration, advantages, methods and application examples of satellite communication systems. Exercises.	Yes
	15	Part 15: Summary #15: Summary of contents from 8 to 14. Free discussion of information and communication networks. Active running.	No
Grading	Quiz 20 %		
	Assignments 30 %		
	Credit validation exam 50%		
	Perform a comprehensive evaluation.		

Textbooks	No
References	「計算機システム概論」―基礎から学ぶコンピュータの原理とOSの構造 大堀淳 図解でわかるソフトウェア開発のすべて」Mint著、日本実業出版社
NOTES	Before lecture: Preparation After the lecture: Exercises 無線通信専攻博士（工学）学位を持ち、20年間以上、産学官連携の次世代無線通信システムに関する研究経験、16年国立大学の研究プロジェクト指導を行った。関連特許3件、関連学術論文200件以上。