Course Description

Name of University:	Rangsit University
School/Faculty/Department:	Information and Communication Technology International College

1. General Information

1.	**Course ID and Course title** ICT209 Data Communication and Networking
2.	**Credit units (Number of hours per week for lecture, lab, and self-study)** 3 hours (3-0-6)
3.	**Programme and Categorization of course** This subject is a major course for Bachelor of Science Program in Information Communication Technology
4.	**Responsible faculty member and list of instructors** 1. Asst. Prof. Dr. Waiwit Chanwimelueng Section 130, 131
5.	**Semester/Year level** Semester 1, 2025
6.	**Pre-requisite course(s) (if any)** None
7.	**Co-requisite course(s) (if any)** None
8.	**Place of study** Rangsit University, Muang Ake Campus
9.	**Date of preparation or latest update** 13 Aug 2025

2. Learning Objectives and Development Objectives

1. Learning objectives

By the end of this course, students will be able to demonstrate a comprehensive understanding of data communication and networking concepts, protocols, and technologies, enabling them to design, implement, and troubleshoot network systems effectively by addressing three learning outcomes:

1. **CLO 1:** Develop a solid understanding of the foundations of networking and acquire in-depth knowledge of data communications and networking theory.
2. **CLO 2:** Demonstrate proficiency in designing, implementing, and maintaining computer networks, including understanding network structures, hardware, software, and network mechanisms.
3. **CLO 3:** Identify and implement security measures, network management practices, and protocols to ensure the security, reliability, and efficient operation of a Local Area Network (LAN).

2. Objectives for course development/improvement

This course aims to enhance practical skills by integrating interactive simulations and virtual labs for hands-on experience in configuring networking devices and troubleshooting issues. It includes updated content on emerging technologies like 5G and edge computing, industry case studies for applying theory to real situations, and guest lectures from experts. Hands-on projects, peer collaboration, diverse assessments, and scaffolding complex concepts foster critical thinking. The course emphasizes practical troubleshooting, ethical scenarios, and continuous professional development. It aligns with industry certifications to validate students' knowledge and skills. Regular feedback and interactive online resources support self-paced learning and course refinement.

3. Course Content and Activities

1. Course content

This course explores the principles and technologies that underpin modern communication systems and networks. From foundational concepts like the OSI model and TCP/IP protocols to advanced topics such as network security and emerging technologies like 5G and cloud computing. This course will equip students with the knowledge and skills needed to design, implement, and manage robust and secure network solutions. Through interactive simulations, hands-on labs, industry case studies, and expert insights, students will gain practical experience in configuring networking devices, troubleshooting issues, and navigating ethical challenges.

2. Number of hours per each semester

Lecture	Tutorial	Lab/Field Study/Workshop	Self-study
Lecture 45 hours	Upon requested	Quizzes	6 hours per week

3. Number of hours per week for advising and academic counseling for individual students

- Students can request academic advice prior/after classes or during class hours.
- Students can make appointment or stop by at the faculty members' offices during the
- specified office hours (16 hours per week).
- Students can request academic help through the College or emails of faculty members.
- Students can contact instructor by email, phone, Line, Facebook on emergency event

4. Learning Outcomes

1. Understanding

This comprehensive set of learning outcomes addresses the first CLO of the course: CLO 1: Develop a solid understanding of the foundations of networking and acquire in-depth knowledge of data communications and networking theory.

1.1 Understanding and ethics needed to develop

1.1.1. Demonstrate an understanding of the principles of responsible data handling, including consent, confidentiality, and transparency.

1.1.2. Justify the importance of upholding user privacy and data security in the design and implementation of networking systems.

1.1.3. Develop a sense of social responsibility by considering the potential impact of networking technologies on marginalized communities and advocating for equitable access.

1.2 Methodology

1.2.1. Describe the fundamental concepts of data communication and networking, including protocols, OSI model, and network topologies.

1.2.2. Apply critical thinking to compare and contrast different networking technologies and their implications for data transmission efficiency and reliability.

1.2.3. Engage in hands-on experiences with networking tools and simulation software to reinforce theoretical concepts and develop practical skills.

1.3 Assessment

1.3.1. Written Assignments: Craft essays or reports discussing the ethical considerations of specific networking technologies or instances of data breaches.

1.3.2. Examinations: Sit for exams evaluating understanding of both technical networking concepts and ethical considerations.

2. Knowledge

In this course, students will emphasize the acquisition of comprehensive knowledge and practical skills in the field of data communication and networking. By incorporating a combination of theoretical understanding, hands-on experience, and assessment methods, students are equipped to excel in both the theoretical and practical aspects of the subject by addressing second CLO of the course:

CLO 2: Demonstrate proficiency in designing, implementing, and maintaining computer networks, including understanding network structures, hardware, software, and network mechanisms.

2.1 Expected knowledge to be gained

2.1.1. Comprehend the process of data encapsulation and de-encapsulation in network communication.

2.1.2. Understand the role of IP addresses, subnetting, and routing in efficient data routing across networks.

2.1.3. Gain insights into network security measures, including firewalls, encryption, and intrusion detection systems.

2.1.4. Explore emerging technologies like virtualization, cloud computing, and Internet of Things (IoT) in the context of data communication.

2.2 Methodology

2.2.1. Engage in interactive lectures that present theoretical concepts with real-world examples and case studies.

2.2.2. Participate in hands-on lab sessions to configure networking devices, simulate network scenarios, and troubleshoot issues.

2.2.3. Access online resources, tutorials, and networking simulations to reinforce understanding and practice.

2.3 Assessment

2.3.1. Quizzes and Tests: Evaluate understanding of theoretical concepts, protocols, and network configurations.

2.3.2. Lab Reports: Document the practical application of networking principles through lab sessions.

2.3.3. Final Examination: Assess overall knowledge of the course, covering both theoretical and practical aspects of data communication and networking.

3. Intellectual Skills

Students will analyze communication protocols, evaluating strengths and weaknesses. They'll use critical thinking to troubleshoot and solve networking problems systematically. They'll synthesize intricate networking concepts to design scalable architectures and demonstrate informed decision-making regarding network security mechanisms for data protection. This part will assess the third CLO of the course:

CLO 3: Identify and implement security measures, network management practices, and protocols to ensure the security, reliability, and efficient operation of a Local Area Network (LAN).

3.1 Intellectual skills needed to develop

3.1.1. Utilize logical reasoning to understand the flow of data through different layers of the OSI model and their interactions.

3.1.2. Develop the ability to anticipate potential network performance bottlenecks and propose strategies for optimization.

3.1.3. Engage in creative thinking to design innovative networking solutions that address contemporary challenges.

3.1.4. Apply analytical skills to assess the impact of network design decisions on scalability, reliability, and security.

3.2 Methodology

3.2.1. Engage in theoretical lectures that present foundational concepts and theories in data communication and networking.

3.2.2. Participate in hands-on lab sessions to simulate real-world network scenarios and troubleshoot issues.

3.2.3. Collaborate in group projects that require the application of intellectual skills to design and implement network solutions.

3.2.4. Engage in discussions, debates, and case studies to enhance critical thinking and problem-solving abilities.

3.3 Assessment

3.3.1. Final Exam: Evaluate the comprehensive understanding of intellectual skills and theoretical knowledge acquired throughout the course.

3.3.2. Peer Evaluations: Engage in constructive peer assessments of project design choices and problem-solving strategies.

3.3.3. Class Participation: Engage actively in class discussions, contributing insights and asking thought-provoking questions that demonstrate analytical thinking.

5. Course Planning and Assessment

1. Course planning				
Week	**Topics/Details**	**Hours**	**Learning Activities/Media**	**Instructor**
1	**Introduction to Computer Networks and Data Communications** - The Language of Computer Networks - The Big Picture of Networks - Communications Networks—Basic Layouts - Local area network-to-local area network layouts - Wide area network-to-wide area network layouts - Sensor-to-local area network layouts - Network Architectures - The TCP/IP protocol suite - The OSI model	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
2	**Fundamentals of Data and Signals** - Data and Signals - Converting Data into Signals - Data Codes - Data and Signal Conversions in Action	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
3	**Conducted and Wireless Media** - Conducted Media - Wireless Media - Media Selection Criteria - Conducted Media in Action - Wireless Media in Action	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
4	**Making Connections** - Interfacing a Computer to Peripheral Devices - Data Link Connections - Making Computer Connections	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti

5	**Making Connections Efficient: Multiplexing and Compression** - Frequency Division Multiplexing - Time Division Multiplexing - Wavelength Division Multiplexing - Comparison of Multiplexing Techniques - Business Multiplexing in Action	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
6	**Errors, Error Detection, and Error Control** - Noise and Errors - Error Prevention - Error Detection - Error Control - Error Detection in Action	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
7	**Local Area Networks (1)** - Primary Function - Advantages and Disadvantages - The Bus/Tree LAN - A More Modern LAN - Switches - Wired Ethernet - Wired Ethernet Frame Format - LANs in Action	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
******* Midterm Break: *******				
9	**Local Area Networks (2)** - Wireless Ethernet - Network Operating Systems - Servers - Network Support Software - LAN Support Devices - LAN for Home	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
10	**Introduction to Metropolitan Area Networks and Wide Area Networks** - Metropolitan Area Network Basics - Wide Area Network Basics - Routing - Network Congestion - WANs in Action	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti

11	**The Internet** - Internet Protocols - The World Wide Web - Internet Services - The Internet in Action	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
12	**Voice and Data Delivery Networks** - The Basic Telephone System - Digital Subscriber Line - Cable Modems - Frame Relay - Asynchronous Transfer Mode - MPLS and VPN and Convergence	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
13	**Network Security** - Standard System Attacks - Physical Protection - Controlling Access - Securing Data and Communications - Security Policy Design Issues - Network Security in Action	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
14	**Network Design** - Systems Development Life Cycle - Network Modeling - Wide area connectivity map - Metropolitan area connectivity map - Local area connectivity map - Capacity Planning - Creating a Baseline	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
15	**Network Management** - Network Diagnostic Tools - Tools that test and debug network hardware - Network sniffers - Managing operations - Simple network management protocol - Capacity Planning and Network	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti

	Design in Action			

16	**Wrap-up Review**	3	Lecture Discussion / PowerPoint Examples	• Dr. Woratat Makhasiranont • Asst. Prof. Dr. Waiwit Chanwimelueng • Dr. Herison Surbakti
******* Final Examination *******				

2.	**Assessment**			
Activity	**Learning Out-come**	**Assessment Method**	**Assessment Week**	**Marks Allo-cation**
1	1.3.2, 2.3.3, 3.3.1	Examination (Final)	Week 17	40%
2	1.3.1, 2.3.2, 3.3.2	Assignments, Final Presentation	Week 5, 8, 10, 15, 16	50%
3	2.3.1, 3.3.3	Class Participations, Quizzes/Tests	All	10%

6. Course Resources

1. Required textbooks and readings

- White, C. M. (2021). *Data Communications & Computer Networks: A business user's approach*. Course Technology.

2. Supplementary reading list/references

- West, J., White, C. M., & White, C. M. (2023). *Data Communications & Computer Networks: A business user's approach*. Cengage.

3. Recommended reading list/references

Interesting readings and recommended sources will constantly be shared in the class or social media groups

7. Course Feedback and Improvement

1.	**Course evaluation by students** - End-semester questionnaire - Class evaluation/peer evaluation - Questioning and answering session in class
2.	**Other methods of course evaluation** - Discussion with experts - Industry survey - Check the attendance and examination
3.	**Course development and improvement** - Research - Seminars - Course workshop and meeting - Course mentor - Class observation - Knowledge sharing
4.	**Quality verification of the course** - Internal committees - External committees - Internal quality assurance - External quality assurance
5.	**Course revision and development plan** - Major revision every 5 years - Minor revision where appropriate