Lingnan University

Course Syllabus

Course Title	:	Networking
Course Code	:	CDS2102
Recommended Study Year	:	Year 2
No. of Credits	:	3
Mode of Tuition	:	Sectional Approach
Class Contact Hours	:	3 hours per week
Category	:	Major Required
Discipline	:	Nil
Prerequisite(s)	:	CDS1001 Introduction to Programming for Data Science
Co-requisite(s)	:	Nil
Exclusion(s)	:	Nil
Exemption Requirement(s)	:	Nil

Brief Course Description:

As modern communication systems evolve to support high-speed connectivity and emerging technologies, understanding networking fundamentals has become essential for computing and engineering professionals. This course is designed to introduce the principles, architecture, and technologies behind networking. The course covers fundamental concepts such as network models, protocols, and standards, with a focus on the OSI and TCP/IP architectures. Students will learn about data transmission, addressing, routing, and switching, as well as the role of network devices such as routers, switches, and hubs. Topics include error detection and correction, flow control, congestion management, and the basics of network security. The course also examines physical and logical network structures, including wired and wireless technologies, and introduces advanced topics such as 5G networks and their role in enabling high-speed, low-latency communication for emerging applications. Students will explore Industrial Internet of Things (IIoT) concepts, focusing on how networking technologies support smart manufacturing, automation, and real-time data exchange in industrial environments. Common networking services such as DNS, DHCP, and HTTP are also covered. Practical exercises will involve configuring networks, analysing packet flows, and troubleshooting connectivity issues using industry-standard tools.

Aims:

This course aims to:

1. Develop students' foundational knowledge of networking concepts, architectures, and key protocols essential to modern digital communication.
2. Enable students to apply technical skills in the configuration, analysis, and troubleshooting of network environments.
3. Foster students' readiness for professional practice by cultivating abilities in teamwork, technical communication, and network project management.

Learning Outcomes (LOs)

Upon successful completion of this course, students will be able to:

1. Explain the fundamental concepts, architectures, and protocols underlying computer networks, including the OSI and TCP/IP models. (PILO1)
2. Configure, analyse, and troubleshoot basic wired and wireless networks using appropriate tools, applying core networking techniques and protocols. (PILO2)
3. Evaluate and compare network technologies, services, and security mechanisms in various contexts, including industrial applications such as IIoT. (PILO1, PILO2)
4. Demonstrate effective teamwork and technical communication through collaborative project work and network documentation. (PILO6)

Indicative Contents:

Introduction to Networking

Overview and evolution of computer networks; application domains; industry relevance

Network Models and Architectures

OSI and TCP/IP models; layering principles; protocol suites

Data Transmission and Encoding

Signals, bandwidth, analogue vs. digital, data rate, encoding methods

Network Devices and Components

Routers, switches, hubs, bridges, access points, repeaters

Addressing and Routing

MAC and IP addressing, subnetting, static and dynamic routing, ARP, ICMP

Switching Techniques

Circuit, packet, and message switching; VLAN concepts

Error Detection and Correction

Parity, CRC, checksums, error control strategies

Flow Control and Congestion Management

Sliding window, buffering, congestion avoidance protocols

Network Security Fundamentals

Basic security threats, firewalls, encryption, authentication

Wired and Wireless Technologies

Ethernet, Wi-Fi, Bluetooth, 4G/5G, physical vs. logical topologies

Network Services

DNS, DHCP, HTTP, FTP, SMTP, SNMP, remote access

Industrial Internet of Things (IIoT) and Advanced Topics

IIoT concepts, smart manufacturing, low-latency networking, emerging standards

Teaching Methods:

This course adopts a practice-oriented and sectional approach that integrates lectures, laboratory sessions, and group project-based learning. Lectures systematically introduce foundational concepts, architectural frameworks, and key technologies of computer networking, enabling students to develop a solid theoretical understanding. Laboratory sessions provide hands-on experience in network configuration, protocol analysis, and troubleshooting, guiding students to apply and reinforce lecture content in real-world scenarios. In-class assessments are embedded within both lectures and labs to monitor students' comprehension and technical proficiency in a timely manner. Collaborative group projects simulate industry practices, emphasizing teamwork, technical communication, and professional project management. Through presentation and documentation activities, students further strengthen their ability to communicate technical information and reflect critically on the networking solutions they develop. The final examination provides a comprehensive assessment of students' understanding of core networking concepts, problem-solving abilities, and readiness for professional engagement or further study.

Measurement of Learning Outcomes:

Assessment / LOs	A1 (10%)	A2 (15%)	A3 (15%)	A4 (20%)	A5 (10%)	A6 (30%)
LO1	✓	✓	✓			✓
LO2			✓	✓		✓
LO3		✓		✓	✓	✓
LO4				✓	✓	

1. **Class Attendance and Participation** assess students' engagement in learning activities, ongoing understanding of core networking concepts, and collaborative skills (LO1).
2. **In-class Lecture Assessment** evaluates students' comprehension of theoretical content, network architectures, and protocols (LO1, LO3).
3. **In-class Lab Assessment** measures students' ability to configure, analyse, and troubleshoot networks, and apply protocols in practical contexts (LO1, LO2).
4. **Group Project Presentation** assesses students' technical communication, teamwork, and their ability to analyse, compare, and present networking solutions (LO2, LO3, LO4).
5. **Group Project Report** evaluates documentation quality, technical clarity, and teamwork reflection (LO3, LO4).
6. **Final Examination** comprehensively measures mastery of networking concepts and networking skills (LO1, LO2, LO3).

Assessment:

A1: Class Attendance and Participation	10%
A2: In-class Lecture Assessment	15%
A3: In-class Lab Assessment	15%
A4: Group Project Presentation	20%
A5: Group Project Report	10%
A6: Final Examination	30%
Total	100%

Required/Essential Readings:

1. Tanenbaum, A. S., Feamster, N., & Wetherall, D. J. (2021). Computer Networks (6th Edition). Pearson.
2. Kurose, J. F., & Ross, K. W. (2021). Computer Networking: A Top-Down Approach (8th Edition). Pearson.

Recommended/Supplementary Readings:

1. Forouzan, B. A. (2021). Data Communications and Networking (6th Edition). McGraw-Hill Education.
2. Stallings, W. (2021). Data and Computer Communications (10th Edition). Pearson.
3. Sanders, C. (2017). Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems (3rd Edition). No Starch Press.

Important Notes:

(1) Students are expected to spend a total of 9 hours (i.e. 3 hours of class contact and 6 hours of personal study) per week to achieve the course learning outcomes.
(2) Students shall be aware of the University regulations about dishonest practice in course work, tests and examinations, and the possible consequences as stipulated in the Regulations Governing University Examinations and Course Work. In particular, plagiarism, being a kind of dishonest practice, is "the presentation of another person's work without proper acknowledgement of the source, including exact phrases, or summarised ideas, or even footnotes/citations, whether protected by copyright or not, as the student's own work". Students are required to strictly follow university regulations governing academic integrity and honesty.
(3) Students are required to submit writing assignment(s) using Turnitin.
(4) To enhance students' understanding of plagiarism, a mini-course "Online Tutorial on Plagiarism Awareness" is available on http://pla.ln.edu.hk/.

Students must adhere to the University's guidelines and practices when using Generative Artificial Intelligence (GAI) tools. The official documents "Guidelines for Using GAI Tools at Lingnan University" and "Best Practices for Ethical and Responsible Use of GAI Tools in Course Assessments" can be found here: https://www.ln.edu.hk/tlc/generative-artificial-intelligence/gai-guidelines-best-practices.

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Course Rubrics

Rubric for Attendance and Participation (10%)

Criterion	Excellent (90-100)	Good (70-89)	Pass (50-69)	Fail (0-49)
Class Attendance (50%)	Attends over 90% of all scheduled classes, including lectures and other sessions.	Attends at least 70% but less than 90% of all scheduled classes.	Attends at least 50% but less than 70% of all scheduled classes.	Attends less than 50% of all scheduled classes.
Class Participation (50%)	Actively and consistently participates class activities, discussions, and in-class exercises; demonstrates strong engagement, preparedness, and constructive contribution.	Participates regularly in class activities and discussions; demonstrates adequate preparation and engagement.	Participates occasionally in class activities with limited engagement or preparation.	Rarely or never participates in class activities; shows minimal engagement or preparation.

Rubric for In-class Lecture Assessment (15%)

Criterion	Excellent (90-100)	Good (70-89)	Pass (50-69)	Fail (0-49)
Conceptual Understanding (60%)	Demonstrates comprehensive and accurate understanding of core networking principles (e.g., OSI/TCP-IP, protocols, devices); answers are precise and well-explained.	Good understanding with minor gaps.	Basic understanding with several inaccuracies.	Lacks basic understanding; answers largely incorrect.
Network Analysis & Evaluation (40%)	Correctly analyses and evaluates network technologies or scenarios (e.g., protocol selection, technology comparison, network topologies); arguments are well supported.	Analyses and evaluates most scenarios correctly; minor flaws.	Limited or partial analysis; answers sometimes unclear.	Fails to analyse/evaluate; answers missing or incorrect.

Rubric for In-class Lab Assessment (15%)

Criterion	Excellent (90-100)	Good (70-89)	Pass (50-69)	Fail (0-49)
Lab Task Completion and Network Skills (60%)	Correctly configures and analyses both wired and wireless networks; demonstrates proficiency in using relevant tools (e.g., ping, traceroute, Wireshark); all required tasks completed with accuracy.	Most tasks completed correctly; minor errors.	Some tasks completed; several errors or missing components.	Fails to complete tasks; major errors or tasks missing.
Understanding of Procedures (40%)	Shows clear understanding of lab procedures, protocol operations, and can explain steps and results accurately.	Understands most procedures with minor gaps or unclear explanations.	Understands only basic procedures; frequent confusion.	Lacks understanding of procedures or protocol operations.

Rubric for Group Project Presentation (20%)

Criterion	Excellent (90-100)	Good (70-89)	Pass (50-69)	Fail (0-49)
Network Project Implementation (40%)	Presents a working, well-designed network with appropriate configuration (e.g., addressing, routing, security); integrates relevant protocols and devices; demo runs smoothly.	Most requirements implemented; minor issues or incomplete features.	Basic implementation; major features missing or unstable demo.	Incomplete/incorrect implementation; fails to run or present.
Technology Integration and Evaluation (25%)	Effectively explains and justifies use of network technologies/services (e.g., VLAN, DNS, DHCP); compares alternatives and relates to project goals.	Appropriate technologies used; some justification or comparison.	Basic usage of required technologies; limited explanation.	Minimal or inappropriate use; no justification or evaluation.
Project Reflection & Analysis (20%)	Clearly reflects on design choices, challenges, lessons learned, and potential improvements; shows critical evaluation.	Reflection covers main aspects; some analysis.	Basic or superficial reflection; limited analysis.	No meaningful reflection; only descriptive or incomplete.
Presentation Clarity	Well-structured, clear presentation with accurate technical language and effective use of visuals.	Generally clear; minor issues with structure or clarity.	Covers basics but is difficult to follow or disorganized.	Unclear, disorganized, or major points omitted.

Rubric for Group Project Report (10%)

Criterion	Excellent (90-100)	Good (70-89)	Pass (50-69)	Fail (0-49)
Documentation and Diagrams (45%)	Report is thorough, clearly explains network design, configuration, protocol use, and includes accurate topology diagrams.	Generally clear documentation; diagrams included, minor omissions.	Basic documentation; diagrams incomplete or unclear.	Documentation/diagrams missing or insufficient.
Analysis & Troubleshooting (30%)	Provides detailed analysis of project testing, troubleshooting methods, performance, and reliability.	Adequate analysis and troubleshooting described.	Basic or superficial analysis/troubleshooting.	Lacks or omits analysis/troubleshooting.
Reflection and Improvement (15%)	Insightful reflection on process, decisions, and future improvements.	Satisfactory reflection; some improvement points mentioned.	Limited reflection; vague on improvement.	No meaningful reflection or improvement discussion.
Organization and Language (10%)	Well-organized, clear, free from language errors; properly cited sources.	Mostly organized; minor issues.	Some organizational/language problems.	Poorly organized or language impedes understanding.

Rubric for Final Examination (30%)

Criterion	Excellent (90-100)	Good (70-89)	Pass (50-69)	Fail (0-49)
Conceptual Understanding (40%)	Mastery of key networking concepts, models, protocols, and their application; answers precise and well-justified.	Good understanding; minor inaccuracies or missing detail.	Basic understanding; significant gaps.	Lacks understanding; incorrect or missing answers.
Applied Network Problem Solving (40%)	Correctly solves applied network problems (e.g., subnetting, protocol flows, device configuration); explanations are clear and technically sound.	Solves most problems correctly; explanations generally clear.	Partial solutions; explanations often unclear.	Fails to solve problems or explanations absent/incorrect.
Analysis & Evaluation (20%)	Critically analyses scenarios, evaluates alternative designs/technologies, and justifies choices effectively.	Satisfactory analysis/evaluation; justification generally sound.	Limited analysis; justification weak.	No meaningful analysis or evaluation.