Course Specification

(Bachelor)

Course Title:	Computer Networks 2
Course Code:	CS1257
Program:	Computer Science
Department:	Computer Science
College:	Computer Science and Information Technology
Institution:	Al-Baha University
Version:	1.0
Last Revision Date:	*Pick Revision Date.*

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A. General information about the course:

1. Course Identification

1. Credit hours					
4 Credit Hours					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (2nd Year – 6th Level)					
4. Course general Description:					

This course is an extension of CS1006 - Computer Networks 1, which covered the fundamentals of computer networking. In Computer Networks 2, students will focus on the lower layers of the TCP/IP model, specifically the Network Layer and the Link Layer.

Topics covered in the course include:

- **Network Layer**: Overview of the Network Layer, the Internet Protocol (IP), generalized forwarding and SDN, middleboxes, routing algorithms, intra-AS routing in the Internet, routing among ISPs, the SDN control plane, ICMP, and network management and SNMP, NETCONF/YANG.
- **Link Layer**: Introduction to the Link Layer, error detection and correction techniques, multiple access links and protocols, switched local area networks, link virtualization, data center networking, and the cycle of a web page request.

Upon completion of this course, students will be able to understand the architecture and operation of the Network Layer and the Link Layer, explain the various routing algorithms used in the Internet, configure and manage routers and switches, implement and troubleshoot network security measures, and analyze and optimize network performance.

5. Pre-requirements for this course (if any)**:**

CS1006 - Computer Networks 1

6. Pre-requirements for this course (if any)**:**

7. Course Main Objective(s):

- Describe the architecture and operation of the Network Layer and the Link Layer
- Explain the various routing algorithms used in the Internet.
- Configure and manage routers and switches.
- Implement and troubleshoot network security measures.
- Analyze and optimize network performance.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	33	60%
2	E-learning	22	40%
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	33
2.	**Laboratory/Studio**	22
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		55

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Describe the architecture and operation of the Network Layer and the Link Layer, including the different protocols used at each layer, the functions of each protocol, and how they interact with each other.	K1	Lectures / Lab	Assignments Midterm Exam Final Exam
1.2	Explain the different routing algorithms used in the Internet, how they work, and how they are used to route packets from source to destination.	K3	Lectures / Lab	Assignments Midterm Exam Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.3	Apply their knowledge of network architecture, protocols, routing, and security to analyze and optimize network performance.	K2	Lectures / Lab	Assignments Midterm Exam Final Exam
2.0	**Skills**			
2.1	Configure and manage complex networks using industry-standard protocols and tools, such as OSPF, BGP, and SNMP.	S1	Lectures / Lab	Assignments Midterm Exam Lab Exam Final Exam
2.2	Analyze and optimize network performance using a variety of tools and techniques, such as packet sniffers, network monitoring systems, and traffic shaping.	S2	Lectures / Lab	Assignments Lab Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Communicate effectively with other network administrators and users about network issues and solutions.	V1	Team-based learning	Assignments

C. Course Content

No	List of Topics	Contact Hours
1.	Networking principles: A quick recap	3
2.	**The Network Layer: Data Plane** • Overview of Network Layer • What's Inside a Router?	3
3.	• The Internet Protocol (IP): IPv4, Addressing, IPv6, and More	3
4.	• Generalized Forwarding and SDN • Middleboxes	3
5.	**The Network Layer: Control Plane** • Introduction • Routing Algorithms	4.5
6.	• Intra-AS Routing in the Internet: OSPF • Routing Among the ISPs: BGP	3
7.	• The SDN Control Plane	3

8.	• ICMP: The Internet Control Message Protocol • Network Management and SNMP, NETCONF/YANG	3
9.	**The Link Layer and LANs:** • Introduction to the Link Layer • Error Detection and Correction Techniques • Multiple Access Links and Protocols • Switched Local Area Networks	4.5
10.	• Link Virtualization: A Network as a Link Layer • Data Center Networking • Retrospective: A Day in the Life of a Web Page Request.	3
Total		**33**

b. Lab Topics

No	List of Topics	Contact Hours
1.	Wireshark Lab: A review	4
2.	Wireshark Lab: IP • Capturing packets from an execution of traceroute • Basic IPv4 • Fragmentation	4
3.	Wireshark Lab: NAT • NAT Measurement Scenario	2
4.	Wireshark Lab: ICMP • ICMP and Ping • ICMP and Traceroute	4
5.	Wireshark Lab: Ethernet and ARP • Capturing and analyzing Ethernet frames • The Address Resolution Protocol	4
6.	Wireshark Lab: 802.11 WiFi • Getting Started with 802.11 • Beacon Frames • Data Transfer • Association/Disassociation • Other Frame types	4
Total		**22**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	3, 5, 6, 9	20%
2.	Midterm Exam	6	20%
3.	Lab Exam	10	20%
4.	Final Exam	13	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	J. F. Kurose and K. W. Ross, *Computer Networking: A Top-down Approach*, 8th edition. Pearson Education, 2020.
Supportive References	
Electronic Materials	Access to the following resources: • Saudi Digital Library (SDL) • IEEE Xplore. • ACM Electronic Library Using the learning management system of the university - Rafid System.
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	A classroom or lecture hall with whiteboard for 25 students.
Technology equipment (projector, smart board, software)	• A digital image projection system with connection to desktop computer or laptop computer. • High-speed Internet connection. • An instructor computer station.
Other equipment (depending on the nature of the specialty)	A computer lab with 25 computers with Packet Tracer and Wireshark installed.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students Peer Reviewer Program Leader	Indirect: Survey Direct: Peer Review Direct: Class Visits
Effectiveness of Students' assessment	Exams Evaluation Committee Students	Direct: Exam Review Indirect: Survey
Quality of learning resources	Faculty Students	Indirect: Survey Indirect: Survey
The extent to which CLOs have been achieved	Faculty	Direct: Exams
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	