



Course Specification

— (Bachelor)

Course Title: **Network Protocols and Algorithms**

Course Code: **CENX 445**

Program: **B.S. in Computer Engineering**

Department: **Department of Computer Engineering**

College: **College of Computer and Information Sciences**

Institution: **King Saud University**

Version: *Course Specification Version Number*

Last Revision Date: *Pick Revision Date.*

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A. General information about the course:

1. Course Identification

1. Credit hours: (3 hours)

2. Course type

A. ☐ University ☐ College ☒ Department ☐ Track ☐ Others
B. ☐ Required ☒ Elective

3. Level/year at which this course is offered: (Level 9)

4. Course general Description:

A broad range of advanced internetworking topics; Inter-domain Routing (BGP); IPv6, and Multicast Routing; Multiprotocol Label Switching (MPLS). Quality of Service; Congestion Control; Application layer protocols (Web, DNS, E-mail, Real-time Streaming, Video-on-Demand, Voice over IP and BitTorrent).

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

CENX 441, Computer Networks

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

7. Course Main Objective(s):

This course introduces students to advanced networking concepts and exposes them to the fundamental design elements of large-scale distributed computer networks. It covers inter-domain routing and label switching along with quality of service techniques. In addition, this course covers concepts, technologies, and protocols in the application layer.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4 hours per week	100%
2	E-learning		
3	Hybrid - Traditional classroom - E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	15
5.	Others (specify)	
Total		60

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	Recognize the Internetworking protocols of the Internet.	1	Lectures, Textbook, Course Notes, and Online Resources.	Assignments, Quizzes, Project, and Exams.
1.2	Explain the quality of service techniques.	1 and 4	Lectures, Textbook, Course Notes, and Online Resources.	Assignments, Quizzes, Project, and Exams.
1.3	Describe both client-server and peer-to-peer application architectures.	1	Lectures, Textbook, Course Notes, and Online Resources.	Assignments, Quizzes, Project, and Exams.
1.4	Recognize the principles of web and e-mail applications and their protocols.	1	Lectures, Textbook, Course Notes, and Online Resources.	Assignments, Quizzes, Project, and Exams.
2.0	Skills			
2.1	Apply the concept of label switching.	2	Lectures, Textbook, Course Notes, and Online Resources.	Assignments, Quizzes, Project, and Exams.
2.2	Recognize the requirements and	2	Lectures, Textbook, Course	Assignments, Quizzes,



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	protocols of well-known real-time applications.		Notes, and Online Resources.	Project, and Exams.
3.0	Values, autonomy, and responsibility			
3.1	Evaluate the Internet congestion control approaches	6	Lectures, Textbook, Course Notes, and Online Resources.	Assignments, Quizzes, Project, and Exams.

C. Course Content

No	List of Topics	Contact Hours
1.	Internetworking Protocols: Main Challenges and Definitions, Routing Area, Inter-domain Routing (BGP), IP Version 6, and Multicast Routing;	8
2.	Multiprotocol Label Switching (MPLS): Basics Concepts, Destination-based Forwarding, Explicit Routing, and Virtual Private Networks and Tunnels;	8
3.	Quality of Service: Application Requirements, Resource Overprovisioning and Reservation, Traffic Shaping, Admission Control, Resource Allocation, Integrated Services, and Differentiated Services;	8
4.	Congestion Control: Round-Trip Time Calculation, Slow Start, Additive Increase/Multiplicative Decrease, Fast Retransmission and Recovery, and Congestion Avoidance;	8
5.	Application Layer Architectures: Fundamental Principles, Client-Server and Peer-to-Peer Architectures, and Content Delivery Networks;	4
6.	Network Applications: HTTP, DNS, and E-mail;	8
7.	Application Performance: HTTP Optimization and Caching;	4
8.	Real-time Applications: Lossless Compression and Video Compression Techniques, Multimedia Streaming (using UDP, HTTP, and DASH), and Voice-over-IP;	8
9.	Review and Evaluation	4
Total		60

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Examination (1)	6	20%
2.	Midterm Examination (2)	12	20%
3.	Homework Assignments	Bi-weekly	5%





No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
4.	Written Quizzes	Bi-weekly	5%
5.	Group Project	15	10%
6.	Final Exam	End	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	- Computer networks: a systems approach, Larry Patterson and Bruce Davis, Morgan Kaufmann, 5th Edition, 2013. - Computer networking: a top-down approach, James Kurose and Keith W Ross, Pearson Education, 6th Edition, 2013.
Supportive References	Computer networks, Andrew Tanenbaum, Prentice Hall, 5th Edition, 2011.
Electronic Materials	All the teaching materials can be found at the Learning management system of King Saud University: https://lms.ksu.edu.sa
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	A classroom for both lectures and tutorials.
Technology equipment (projector, smart board, software)	Overhead projector with required software to facilitate presentations on smart board.
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Department Council	Course reports are evaluated by the Department Council.
Effectiveness of Students assessment	Faculty-Peer Review	Final examination is moderated.
Quality of learning resources	Students	Indirect – Edu-gate survey.
The extent to which CLOs have been achieved	Students	Attainment level of every CLO is measured directly.
Other		



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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

