Course Specification
— (Bachelor)

Course Title: Data Communication & Computer Networks

Course Code: ITEC-251

Program: Bachelor in Information Technology (BIT)
Bachelor in Computer Science (BCS)

Department: Computer Science

College: Engineering and Computer Science

Institution: Jazan University

Version: 2

Last Revision Date: August 18, 2024

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A. General information about the course:

1. Course Identification

1. Credit hours: (3)

2. Course type

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

3. Level/year at which this course is offered: (4ᵗʰ Level & 2ⁿᵈ Year for both BIT & BCS)

4. Course general Description:

This is an entry-level course in data communication and networking. This course explains the students with the fundamentals of data communications and networking in detail. The topics include fundamentals of data communications: essential elements of data communications: simplex, half-duplex and full duplex transmission, basic concepts of networking: network criteria, network applications and benefits. Configurations, and categories of networks: line configuration, network topologies (mesh, star, tree, bus, ring, hybrid), internetwork or internet, types of network connection, intranet, and extranet. Introduction to OSI and TCP/IP network models: The OSI Model, The OSI layers, TCP/IP Protocol Suite in detail. Physical layer and media: analog and digital signals, periodic and non-periodic signals, signal parameters, time and frequency domains concepts, transmission impairment, transmission media: guided media, unguided media, circuit, and packet switching. Data link layer control: framing, error control and flow control, error detection and correction techniques: VRC, LRC, CRC, checksum, and hamming code techniques. Wired LAN (Ethernet), IP addressing, subnetting, supernetting. networking and internetworking devices, and VLANs. Students will be trained on the existing components and products related to Cisco such as wireless networking, switches, routers, bridges, gateways, repeaters, hubs, cellular communication, and satellite communication.

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

Nil

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

Nil

7. Course Main Objective(s):

- Understand the fundamental concepts of data communication and networking.
- Outline the layering concepts, network models e.g., Open System Interconnect (OSI) and the Internet Model (TCP/IP).
- Study the concepts of analog and digital transmission, flow control, and error control, error detection and correction techniques in detail.
- Identify various types of transmission media, network devices, and performance assessment parameters for each guided and unguided media and connecting device. Also, discuss Ethernet and wireless networks.
- Learn and apply the skills acquired concerning physical (MAC) and logical addressing (IP), subnetting and supernetting, network topologies, and VLANs.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	64	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**	30
2.	**Laboratory/Studio**	30
3.	**Field**	--
4.	**Tutorial**	--
5.	**Others (Revision + Final Lab Exam)**	04
Total		64

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	**Outline** the basic concepts concerning data communication, computer networking, guided, and unguided transmission media.	K1	Visual & Verbal [Lectures/ Presentations]	Exams, Assignment
1.2	**Summarize** the concepts of network topologies, layered architecture, OSI & TCP/IP network models, and analog & digital transmission.	K2	Visual & Verbal [Lectures/ Presentations]	Exams, Assignment
2.0	Skills			
2.1	**Analyze** and **Compare** different error detection & correction mechanisms, classful & classless IP addressing, and Ethernet generations.	S1, S3	Visual & Verbal [Lectures/ Presentations]	Exams, Assignment
2.2	**Create** subnets, supernets, and VLANs to meet the network requirements of an organization.	S2	Visual & Verbal [Lectures/ Presentations]	Exams, Assignment
3.0	Values, autonomy, and responsibility			
3.1	**Demonstrate** the ability to work in a group considering collaborative tasks, communication skills, and ethical aspects.	V1, V2, V3	Active class participation in group Activities.	Assignment/Lab Tasks

C. Course Content

No	List of Topics	Contact Hours
1.	**UNIT-1: Overview of Data Communication & Networking** • Introduction to Data Communication • Effectiveness of Data Communication • Components of Data Communication System • Simplex, Half-Duplex, Full-Duplex Data Flow Types • Introduction to Networks • Network Criteria, Types of Connection • Network Topologies (Star, Bus, Ring, Mesh) • Network Categories (LAN, MAN, WAN), Internet, Intranet, Extranet • Protocol, Key Elements of Protocols	6T + 6P

2.	**UNIT-2: Network Models & Networking Devices** • Layering Architecture Concepts • TCP/IP or Internet Model • Organization of Layers • Functions of TCP/IP Layers • Physical Layer & its Responsibilities • Datalink Layer and its Responsibilities • Network Layer and its Responsibilities • Transport Layer and its Responsibilities • Application Layer and its Responsibilities • Addressing (Physical, Logical, Port, & Specific) • Flow Control, Error Control, & Segmentation • OSI Model & its Layers • Session Layer and its Responsibilities • Presentation Layer and its Responsibilities • Comparison of TCP/IP & OSI Network Models • NIC, Passive Hubs, Active Hubs, Repeaters, & Bridges • Switches, Routers, and Gateways	6T + 6P
3.	**UNIT-3: Signals, Multiplexing, and Switching** • Analog, and Digital Data • Periodic and Aperiodic Signals • Period, Frequency, Amplitude, and Phase Shift • Time and Frequency Domain of a Sine Wave • Bandwidth of Periodic and Non-Periodic Composite Signals • Baseband and Broadband Transmission • Transmission Impairment, and its Causes • Attenuation, Distortion, and Noise • Types of Noise (Thermal, Induced, Crosstalk, and Impulse) • Signal to Noise Ratio (SNR) • Performance Parameters (Bandwidth, Throughput, Latency) • Propagation, Transmission, and Queuing Time • Switching, and Switching Networks • Circuit Switching, Packet Switching • Multiplexing, Frequency Division & Time Division Multiplexing • Datagram Networks, and Virtual Circuit Networks	6T + 6P
4.	**UNIT-4: Error Detection & Correction, Wired LAN, and IP Addressing** • Error and Types of Error • Single Bit Error, and Burst Error • Error Detection, its Methods • Parity Check, 2D Parity Check, CRC, Polynomials, & Checksum • Error Detection Mechanisms • Retransmission, Forward Error Correction, and Burst Error Correction • Hamming Codes	6T + 6P

	• Wired LAN (Ethernet-IEEE 802.3), Ethernet Evolution, Categories of Standard Ethernet • Fast Ethernet and its Implementation • Unicast, and Multicast Addresses • IPV4 Addresses, Notations, Classful (Classes & Blocks) IP Addressing • Subnetting, and Supernetting	
5.	**UNIT-5: Transmission Media, and VLANs** • Introduction to Transmission Medium • Classification of Transmission Media • Guided Media • Twisted-pair, Coaxial, and Optical Fiber Cables • STP Versus UTP, Categories of Coaxial Cable, BNC Connectors, Applications of Coaxial Cable • Fiber Optic Cable and its Construction, Connectors, and Applications, Advantages and Disadvantages • Unguided Media (Wireless), Propagation Methods of Wireless Transmission	6T + 6P
6.	• Types of Wireless Transmission Waves (Radio, Microwave, Infrared) • Bands of Wireless Transmission Propagation • Types of Antenna for Wireless Transmission • Cellular Telephony, Satellite Networks, Orbits • Categories of Satellites Networks (GEO, MEO, LEO) • Connecting Devices • Collision Domains, Backbone Networks • Virtual Local Networks (VLANs), VLANs Membership, VLANs Advantages	
7.	• Revision + Final Lab Exam	2T + 2P
Total		32T + 32P

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Exam	7-8th	15%
2.	Assignment-1	6th	10%
3.	Assignment-2	10th	15%
4.	Lab Tasks/Lab Assignment	Throughout semester	10%
5.	Final Lab Exam	16th	10%
6.	Final Theory Exam	17th	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	Behrouz A Forouzan, Data Communications and Networking, 6th Edition, 2022, ISBN-13: 978-1-26-436335-3.
Supportive References	❖ William Stallings," Data and Computer Communication", Pearson Education, 10th Edition, 2014, ISBN-13: 9781292014388. ❖ James Kurose, "Computer Networking: A Top-Down Approach", Pearson, 8th Edition, 2021, ISBN-13: 9780136681557. Larry Peterson, "Computer Networks: A Systems Approach", Morgan Kaufmann, 6th Edition, 2022, ISBN-13: 9780128182000 Andrew Tanenbaum, "Computer Networks", 6th Edition, 2021, ISBN 13: 9781292374062.
Electronic Materials	✓ http://highered.mheducation.com/sites/0073376221/information_center_view0/index.html ✓ http://williamstallings.com/DataComm/ ✓ https://book.systemsapproach.org/
Other Learning Materials	Cisco Packet Tracer, Networking Toolkit

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom / Labs
Technology equipment (projector, smart board, software)	Projector, Smart Board, Cisco Packet Tracer
Other equipment (depending on the nature of the specialty)	Networking Tool Kit, Cables, Network Devices

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	HOD/QAU/PL/Students	Indirect
Effectiveness of Students assessment	HOD/QAU/PL/CC	Indirect
Quality of learning resources	HOD/PL/Lab Unit/Students	Direct
The extent to which CLOs have been achieved	PL/QAU/Track Leaders	Direct
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	ENGCSCS2406
DATE	19/09/2024