Department of ECE

Details of Lesson Plan

S.No.	Particulars	Details
1.	Course Name	Computer Networks
2.	Course Code	ECE-603
3.	Academic Year	2024-25
4.	Semester	6th
5.	Number of Lesson plans	28
6.	Faculty Assigned	Ms. Gurpreet Raina

Faculty Signature

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Lesson Plan No. 0	Course Name: Computer Networks Introduction to Course	Course No.: COM-502

Objectives	At the end of the lesson the student shall be able to: 1. Understand the basic concepts of computer networks. 2. Recognize the importance of computer networks in modern society. 3. Identify various career opportunities in the field of computer networks. 4. Describe future trends in networking technology.
Teaching Aids (if any)	a. Presentation slides. b. Projector c. You Tube video

Teaching Development	1. **Introduction** (10 minutes)
	   d. Ask questions:
	    1. When you send an email to your friend in the USA, how does the email reach your friend's inbox?
	    2. Who manages the end-to-end delivery of this email?
	    3. Which path does email follow?
	    4. What is happening in the middle and how?
	
	   e. The invisible glue which ties data communications together and makes the magic happen is "Computer Networks" - a collection of network devices, protocols, techniques, mechanisms, frameworks and tools which enable computer systems to communicate with each other.
	
	   f. Hence, the study of computer networks is critical for the advancement of nations, society and the entire world.
	
	   g. Discuss course outcomes.
	
	2. **Development** (30 minutes)
	
	   Why Computer Networks?
	1. Discuss the importance of connectivity in today's digital age.
	2. Benefits such as resource sharing, communication, and data exchange
	
	3. Show a video on Introduction to Computer Networks:
	    YouTube Video: "Introduction to Computer Networks" by Techterms
	    (https://www.youtube.com/watch?v=aHJElrgj6UA)
	
	   Career & Job Perspective
	4. Network Administrator, Network Engineer, Cybersecurity Specialist
	5. Discussion on certifications:
	    1. Cisco Certified Network Associate (CCNA)
	    2. CompTIA Network+
	    3. Certified Information Systems Security Professional (CISSP)
	6. Introduction to networking courses available on platforms like Coursera and LinkedIn Learning
	
	   Future Trends in Networking (10 minutes)
	7. Real-time examples and emerging technologies
	    1. Internet of Things (IoT)

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	2.	5G and beyond
	3.	Software-Defined Networking (SDN)
	4.	Network Function Virtualization (NFV)
	8.	Discuss how these trends are shaping the future of networking and job opportunities
Closure	1.	Summarize the lesson, correlating with learning outcomes
	2.	Encourage students to explore further reading and online resources
	Suggested Reading: "Computer Networking: A Top-Down Approach" by James Kurose and Keith Ross, Chapter 1, pp 1-36. "Data Communications and Networking" by Behrouz A. Forouzan, Chapter 1, pp 1-26.	
Evaluation	Reflective Questions (What Why Who?). Allow students to answer and discuss. - What is a computer network, and why is it important in today's digital age? - Can you think of some everyday activities that rely on computer networks? - Which career roles in computer networking interest you the most, and why?	

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Lesson Plan No. 1	**Course Name:** Computer network **Topic**: Intro to Computer Networks	**Course No.: ECE-603**

Objectives	At the end of the lesson the student shall be able to: a. Understand the basic concepts of computer networks b. Able to learn uses of computer network. c. Able to understand the role of networking in communication.
Teaching Aids (if any)	A .ICT
Teaching Development	1. **Introduction** (5 minutes) Ask questions What is a network? Give example of any network in your surrounding? Introduce the formal definition of terminologies used in networking Highlight the important characteristics of the networks. 2. **Introduction to computer network** (30 minutes) Definition of a Computer Network. Define a computer network. Explain the basic concept of interconnected computers sharing resources. Discuss examples and applications of simplex communication (e.g.,keyboard to computer, television broadcast). 3. Uses of Computer Networks Discuss how networks enable communication through email, instant messaging, social media, and video conferencing. Explain how networks allow for sharing hardware (e.g., printers, scanners) and software resources (e.g., applications, data files). Explain how networks provide access to information through the internet, intranets, and extranets. Discuss how networks are used in streaming services, online gaming, and digital media sharing. Discuss how networks enable remote work, virtual offices, and telecommuting. 3.Benefits of Computer Networks Explain how networks improve efficiency and productivity by enabling quick access to information and resources. Discuss how networks can easily scale to accommodate growth in users and resources. Give examples to illustrate the present day networks in use from a user-perspective. 3. Exercise (5 minutes) – Ask basic questions based on the topic discussed
Closure	4. Summarize the Lesson Learning Outcomes and get affirmation

	from students on these. 5. Suggested Reading https://youtu.be/lnU-Zw3NEEQ?list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Reall the role of networking in today's communication. 3. Provide real-world examples of network applications in various fields (education, healthcare, business, government, and entertainment)

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Lesson Plan No. 1	Course Name: Computer Networks Topic: Introduction to Data Communication Systems	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: 1. Understand the basic concepts of data communication systems. 2. Identify different types of communication systems and their applications. 3. Explain the components of a communication system. 4. Recognize the importance of data communication in modern technology.
Teaching Aids (if any)	5. Presentation slides.

Teaching Development	6. **Introduction** (5 minutes)
	Ask students:
	  1. What do you understand by the term "data communication"?
	  2. How often do you use data communication in your daily life?
	  3. Explain the relevance of data communication in today's interconnected world.
	
	4. **Development** (30 minutes)
	
	  h. **What is Data Communication?**
	
	  1. **Definition:**
	  1. Explain data communication as the exchange of data between devices through a transmission medium.
	  2. Emphasize the role in various applications like the internet, emails, and mobile communication.
	  2. **Importance:**
	  1. Discuss how data communication enables the sharing of resources, information, and collaborative work.
	
	  i. **Basic Components of Data Communication**
	  j. **Message:** The data to be communicated.
	  k. **Sender:** The device that sends the data.
	  l. **Receiver:** The device that receives the data.
	  m. **Transmission Medium:** The physical path through which the data travels (e.g., cables, wireless).
	  n. **Protocol:** Rules that govern data communication (e.g., TCP/IP).
	  o. **Protocols in Data Communication**
	    p. **Common Protocols:**
	      a. Discuss protocols like HTTP, FTP, SMTP, and their roles in communication.
	    q. **Real-time example:** Sending an email using SMTP.
	  r. **Applications of Data Communication**
	    s. **Real-World Applications:**
	      a. Discuss examples like online banking, social media, and cloud services.
	    t. **Case Study:**
	      a. Walk through a scenario of a video call, identifying components and protocols involved.

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	u. Show a YouTube video on how the internet works:
	
	YouTube: (https://www.youtube.com/watch?v=Sfzo4xm5eX8)
	
	3. **Exercise (5 minutes)**
	
	     v. Ask students to summarize the components of data communication and their roles.
	     w. Discuss the answers with the class.

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. **Suggested Reading** "Data and Computer Communications" by William Stallings, Chapter 2, pp. 30-45. "Computer Networking: A Top-Down Approach" by James Kurose and Keith Ross, Chapter 1, pp. 1-35. **Homework:** Write a short essay on the importance of protocols in data communication and upload it on the Camu.

Evaluation	4. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	     x. How would you define data communication in your own words?
	     y. What are the basic components of data communication?
	     z. Why are protocols necessary?
	
	Spend 5 minutes to wrap up and consolidate the learnings.

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Lesson Plan No. 3	Course Name: Computer network Topic : Data Communication	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to:
	    aa. able to understand about data communications and networking.
	    bb. Understand the concepts of simplex, half-duplex,
	       and full-duplex communication.
	    cc. Identify the key characteristics and differences
	       between these modes of dataflow.

Teaching Aids (if any)	dd. ICT

Teaching Development	5. **Introduction** (5 minutes)
	     What do they understand by dataflow in communication
	     systems? Can they think of any examples where data is sent
	     in only one direction or in both directions?
	6.
	
	     What are different types of data?
	     What is difference between local communication and data
	     communication?
	     Can they identify any examples of serial and parallel systems?
	
	7. **Data Communication** (30 minutes)
	   ee. **Simplex Communication.**
	     a. Define simplex communication.
	     b. Explain how data is transmitted in only one
	    direction (unidirectional).
	     c. Discuss examples and applications of simplex communication
	    (e.g., keyboard to computer, television broadcast).
	   ff. **Half-Duplex Communication**
	     a. Define half-duplex communication.
	     b. Explain how data is transmitted in both directions, but
	    not simultaneously.
	     c. Discuss examples and applications of half-duplex
	    communication (e.g., walkie-talkies, CB radios).
	   gg. Full-Duplex Communication
	     a. Define full-duplex communication.
	     b. Explain how data is transmitted in both directions simultaneously.
	     c. Discuss examples and applications of full-duplex
	    communication (e.g., telephone systems, modern Ethernet
	    networks).
	   hh. Five components of data communication
	8. Fundamental characteristics
	9. Delivery
	10. Timeliness
	11. Jitter
	12. Accuracy
	13. Data Representation

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	14.	Exercise (5 minutes) –
	15.	Compare simplex, half-duplex, and full-duplex in terms of directionality, efficiency, and typical use cases.
Closure	16.	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	17.	Suggested Reading
		https://youtu.be/29Qdz0FmvmQ?list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up
		https://youtu.be/b6f9vh3cd6w?list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up
		Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	ii.	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
		Recall different types of data transmission modes. Give an example of each.

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Lesson Plan No. 4	Course Name: Computer network Topic : Data communication	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: 18. understand the basic of serial and parallel data communication 19. Understand the concept of Synchronous and asynchronous communication. 20. Identify the key characteristics and uses of serial and parallel communication systems.
Teaching Aids (if any)	jj. ICT
Teaching Development	kk. **Introduction** (5 minutes) ll. What is data communication mm. What kind of data can be transmitted? nn. What is serial & parallel communication. oo. What makes synchronous communication useful? pp. What is asynchronous communication **Data Communication** (30 minutes) a. Synchronous Communication Systems. - Define synchronous communication. - Explain how data is transmitted in a synchronized manner using a common clock signal - Discuss examples and applications of synchronous systems (e.g., real-time video conferencing). b. Asynchronous Communication Systems - Define asynchronous communication - Explain how data is transmitted without a common clock signal, using start and stop bits. - Discuss examples and applications of asynchronous systems (e.g., email, texting). c. Serial Communication Systems - Define serial communication. - Explain how data is transmitted one bit at a time over a single channel. - Discuss the advantages (e.g., simpler wiring, longer distances) and disadvantages (e.g., slower data rate) of serial communication. - Provide examples (e.g., USB, RS-232). d. Parallel Communication Systems - Parallel Communication Systems - Explain how data is transmitted multiple bits at a time over multiple channels. Discuss the advantages (e.g., higher data rate) and disadvantages (e.g., complex wiring, shorter distances) of parallel communication. - Provide examples (e.g., computer buses, parallel ports).

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	Exercise (5 minutes) – Give examples of synchronous communication & asynchronous communication
Closure	qq. Summarize the Lesson Learning Outcomes and get affirmation from students on these. rr. Suggested Reading https://www.techsmith.com/blog/synchronous-vs-asynchronous-communication/ ss. Video link https://youtu.be/swtH_okidQc?list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN https://youtu.be/swtH_okidQc?list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	21. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 22. Compare the serial and parallel communication. 23. Give one advantages and disadvantages of each system. Spend 5 minutes to evaluate student assimilation of the lesson contents

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Lesson Plan No. 5	Course Name: Computer network Topic : Network Devices	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to:
	  - able to understand communication between two devices and how data flow.
	  - Understand different types of switching techniques.

Teaching Aids (if any)	- ICT
Teaching Development	- Introduction (5 minutes) tt. Ask questions uu. What are the basic hardware used to connect nodes in a network vv. What is switching ? - Network Devices and Switching Techniques (30 minutes) ww. Types of Network Devices xx. NIC yy. Routers zz. Hub aaa. bridges bbb. switches ccc. Repeaters ddd. Switching in network eee. Data flow (simplex, half-duplex, and full-duplex) - Exercise (5 minutes) – Ask basic questions based on the topic discussed Use Nearpod to collect responses and discuss the answers.
Closure	fff. Summarize the Lesson Learning Outcomes and get affirmation from students on these. ggg. Suggested Reading/links https://youtu.be/teWamog0iuk Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	hhh. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

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Lesson Plan No. 6	Course Name: Computer network Topic: Topologies	Course No.: ECE-603

Objectives	iii. Understand TCP/IP model of computer network. jjj. Able to acquire fundamental knowledge of working of different layers of TCP/IP Model.
Teaching Aids (if any)	- PPTs

Teaching Development	- **Introduction** (5 minutes)
	 o What do they think network topology means? Can they name any types of network topologies?
	 o Briefly introduce the topic and outline the objectives of the lesson
	
	- **Development** (30 minutes)
	 - **Definition of Network Topology**
	  o Define network topology as the arrangement of various elements (links, nodes, etc.) in a computer network.
	  o Explain the importance of choosing the right topology for network performance and efficiency.
	  o Explain the different types of topologies.
	 - **Bus Topology**
	  o Explain the structure: a single central cable to which all network devices are connected.
	  o Discuss its advantages (e.g., easy to install, inexpensive) and disadvantages (e.g., difficult to troubleshoot, limited cable length and number of stations).
	  o Provide examples of where bus topology might be used.
	 - **Star Topology**
	  o Explain the structure: all devices are connected to a central hub.
	  o Discuss its advantages (e.g., easy to manage, better performance) and disadvantages (e.g., if the central hub fails, the whole network is affected).
	  o Provide examples of where star topology might be used.
	 - **Ring Topology**
	  o Explain the structure: each device is connected to two other devices, forming a ring.
	  o Discuss its advantages (e.g., data packets travel in one direction, reduced chances of data collision) and disadvantages (e.g., a failure in any cable or device breaks the loop).
	  o Provide examples of where ring topology might be used.
	 - **Mesh Topology**
	  Explain the structure: every device is connected to every other device.
	 - Exercise (5 minutes) – share examples of different network topologies they have encountered or used. .

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading/linkhttps://www.youtube.com/watch?v=CvbZYZM23h4

	https://youtu.be/NSHj9BLnhj0?list=PL32DBC269EF768F7
Evaluation	- Reflective Questions (What, Why, Who?). Allow students to answer and discuss. - Quiz. - Discuss its advantages (e.g., high redundancy, reliable) and disadvantages (e.g., expensive, complex to set up and maintain).

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Lesson Plan No. 7	Course Name: Computer network Topic: Topologies	Course No.: ECE-603

Objectives	kkk. Identify different types of network topologies. lll. Discuss the advantages, disadvantages, and applications of each topology.
Teaching Aids (if any)	- PPTs

Teaching Development	- **Introduction** (5 minutes)
	   o What do they think network topology means? Can they name any types of network topologies?
	   o Briefly introduce the topic and outline the objectives of the lesson
	
	- **Development** (30 minutes)
	- **Tree Topology**
	   o Explain the structure: a combination of star and bus topologies.
	   o Discuss its advantages (e.g., scalable, easy to manage) and disadvantages (e.g., if the backbone line breaks, the entire network segment goes down).
	   o Provide examples of where tree topology might be used.
	- **Hybrid Topology**
	   o Explain the structure: a combination of two or more different types of topologies.
	   o Discuss its advantages (e.g., flexible, scalable) and disadvantages (e.g., complex design and maintenance).
	   o Provide examples of where hybrid topology might be used.
	- **Applications of Network Topologies**
	   o Discuss practical applications of different topologies in various environments such as homes, offices, data centers, and large enterprises.
	- Exercise (5 minutes) – Use diagrams and real-world examples to illustrate the differences between topologies..

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading/link https://www.youtube.com/watch?v=CvbZYZM23h4
Evaluation	- Reflective Questions (What, Why, Who?). Allow students to answer and discuss. - **Comparison of Network Topologies** o Compare different types of topologies in terms of cost, performance, reliability, and

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Lesson Plan No. 8	Course Name: Computer network Topic : Types of Networks	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to:
	    mmm. Identify the different categories of computer networks.
	    nnn. Explain the characteristics of each network category.

Teaching Aids (if any)	ooo. Chalk & Talk ppp. ICT

Teaching Development	**Introduction** (5 minutes)
	What is a client ?
	What are uses of computer networks networking
	Highlight the important merits /demerits of the networks.
	
	 Computer architecture (30 minutes)
	Types of Computer network used Computer network
	Peer-To-Peer network
	Client/Server network
	Uses Of Computer Network
	Features
	Personal Area Network (PAN)
	1. Define PAN.
	2. Explain its characteristics, including short range (typically within a few meters).
	3. Discuss applications and examples (e.g., Bluetooth connections between devices like smartphones, laptops, and wearables).
	
	Local Area Network (LAN)
	4. Define LAN.
	5. Explain its characteristics, including a limited geographic area (e.g., a single building or campus).
	6. Discuss applications and examples (e.g., home networks, office networks, school networks).
	Metropolitan Area Network (MAN)
	7. Define MAN.
	8. Explain its characteristics, including coverage of a city or large campus.
	9. Discuss applications and examples (e.g., city-wide Wi-Finetworks, large university networks).
	Wide Area Network (WAN)
	    Define WAN.
	    Explain its characteristics, including large geographic areas (e.g., countries, continents).
	    Discuss applications and examples (e.g., the Internet, corporate networks connecting multiple locations).

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	Exercise (5 minutes) – Definitions and characteristics of PAN, LAN, MAN & their comparisons.
Closure	qqq.　Summarize the Lesson Learning Outcomes and get affirmation from students on these. rrr. Suggested Reading/Links sss. Reading/links ttt.　https://youtu.be/NSHj9BLnhj0?list=PL32DBC269EF768F74 https://youtu.be/29Qdz0FmvmQ?list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up 　https://youtu.be/lnU-Zw3NEEQ?list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	uuu.　Reflective Questions (What, Why, Who?). Allow students to answer and discuss. vvv.　Summarise the key points. **www.**Compare the different types of networks in terms of range, speed, cost, and typical use cases.

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Lesson Plan No. 9	Course Name: Computer network Topic: OSI Reference Model	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: xxx. Understand reference model of computer network. yyy. Identify and describe the seven layers of the OSI model zzz. Able to acquire fundamental knowledge of working of different layers. aaaa. Understand the functions and protocols associated with each layer.
Teaching Aids (if any)	- PPTs - Animated Video
Teaching Development	- **Introduction** (5 minutes) bbbb. How the data transmit across the globe? cccc. What do you think the network Models are used for? dddd. Have they heard of the OSI model? What do they know about it? eeee. - **Reference Models** (30 minutes) ffff. Overview of the OSI Reference Model gggg. Define the OSI (Open Systems Interconnection) model. hhhh. Explain its importance in standardizing network communications and ensuring interoperability between different systems. iiii. Explain the different layers of OSI model. **Application Layer** jjjj. Describe how it provides network services directly to end-users. kkkk. Mention common protocols like HTTP, FTP, SMTP. **Presentation Layer** llll. Explain its role in data translation, encryption, and compression. mmmm. Mention concepts like data encryption and formatting (e.g., ASCII, JPEG). **Session Layer** nnnn. Discuss its function in establishing, maintaining, and terminating sessions. oooo. Mention protocols like RPC. **Transport Layer** pppp. Explain how it ensures reliable data transfer and error recovery. qqqq. Mention protocols like TCP and UDP **Network Layer** rrrr. Describe how it handles logical addressing and routing. ssss. Mention protocols like IP, ICMP. **Data Link Layer** tttt. Explain its role in physical addressing and error detection/correction. uuuu. Mention protocols like Ethernet, PPP. **Physical Layer** vvvv. Discuss its function in transmitting raw bitstreams over a physical medium.

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	- Exercise (5 minutes) – Draw the model layout Name layers and give at least one function of each. Share examples of how they use different layers of the OSI model in their daily network interactions.
Closure	wwww. Summarize the Lesson Learning Outcomes and get affirmation from students on these. xxxx. Suggested Reading/link yyyy. Video link https://youtu.be/-6Uoku-M6oY
Evaluation	zzzz. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. aaaaa. Mcqs based test.

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Lesson Plan No. 10	Course Name: Computer network	Course No.: ECE-603
	Topic: OSI Reference Model	

Objectives	bbbbb. Understand reference model of computer network. ccccc. Able to acquire fundamental knowledge of working of different layers. ddddd. Identify and describe the seven layers of the OSI model. eeeee. Understand the functions and protocols associated with each layer.
Teaching Aids (if any)	- PPTs
Teaching Development	- **Introduction** (5 minutes) - Ask questions How many layers are here in OSI Model Data in physical layer is in which form? In which layer router is used? What is the need of the model in networking? - **Reference Models** (30 minutes) a. Functions and Protocols of Each Layer -Provide more detailed explanations of the functions and protocols associated with each layer. - Use examples and scenarios to illustrate how each layer operates and interacts with others. b. Importance of the OSI Model - Discuss how the OSI model helps in troubleshooting and designing network systems. - Explain its role in facilitating communication between different hardware and software systems. Software Layers of OSI Model **Session layer** **Presentation layer** **Application layer** Flow of data in OSI model Advantages of OSI Model - Exercise (5 minutes) – Ask basic questions based on the topic discussed. Explain OSI Model in nutshell. Reall responsibility of each layer.
Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading/link https://youtu.be/-6Uoku-M6oY

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	Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	- Reflective Questions (What, Why, Who?). Allow students to answer and discuss. - Discuss layered structure of OSI Model. - Name hardware layer& software layers.

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Lesson Plan No. 11	Course Name: Computer network Topic: TCP/IP Model	Course No.: ECE-603

Objectives	fffff. Understand TCP/IP model of computer network. ggggg. Able to acquire fundamental knowledge of working of different layers of TCP/IP Model.
Teaching Aids (if any)	- PPTs

Teaching Development	- **Introduction** (5 minutes)
	- Explain what the TCP/IP Reference Model is and its significance in networking.
	- Identify and describe the layers of the TCP/IP model.
	- Understand the functions and protocols associated with each layer.
	    What is full form of IP?
	    Data in physical layer is in which form?
	    In which layer router is used?
	
	- **TCP/IP Models** (30 minutes)
	a. **Overview of the TCP/IP Reference Model**
	- Define the TCP/IP (Transmission Control Protocol/Internet Protocol) model.
	- Explain its importance in standardizing internet communications and ensuring interoperability between different systems.
	- Present a diagram of the TCP/IP model with its four layers.
	b. **Application Layer**
	- Describe how it provides network services directly to end-users.
	- Mention common protocols like HTTP, FTP, SMTP, DNS.
	c. **Transport Layer**
	- Explain how it ensures reliable data transfer and error recovery.
	- Mention protocols like TCP and UDP.
	d. **Internet Layer**
	- Describe how it handles logical addressing and routing.
	- Mention protocols like IP, ICMP, ARP.
	e. Network Interface Layer (Link Layer)
	- Explain its role in physical addressing and framing.
	- Mention technologies like Ethernet, Wi-Fi, and point-to-point
	
	    Exercise (5 minutes) –
	    What is the need of the model in networking? Explain

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading/link https://youtu.be/a-zYm2KzqHQ
Evaluation	- Reflective Questions (What, Why, Who?). Allow students to answer

	and discuss.
	- Define basic protocols of layered structure of TCP/IP Model.

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Lesson Plan No. 12	Course Name: Computer network Topic: TCP/IP Model	Course No.: ECE-603

Objectives	hhhhh. Understand TCP/IP model of computer network. iiiii. Able to acquire fundamental knowledge of working of different layers of TCP/IP Model. c. Identify and describe the layers of the TCP/IP model. d. Understand the functions and protocols associated with each layer.
Teaching Aids (if any)	- PPTs

Teaching Development	- **Introduction** (5 minutes)
	Highlight the applications of each of the layer of Model
	How does IP protect data?
	Give one difference between flow control & Error control?
	
	- **TCP/IP & OSI Models** (30 minutes)
	- **Functions and Protocols of Each Layer**
	  o Provide more detailed explanations of the functions and protocols associated with each layer.
	  o Use examples and scenarios to illustrate how each layer operates and interacts with others.
	- **Comparison with OSI Model**
	  o Compare the TCP/IP model with the OSI model, highlighting similarities and differences.
	  o Discuss the practical usage and widespread adoption of the TCP/IP model in real-world networking.
	- **Importance of the TCP/IP Model**
	  o Discuss how the TCP/IP model helps in the design, implementation, and management of networks, especially the Internet.
	  o Explain its role in facilitating communication between different hardware and software systems.
	
	- Exercise (5 minutes) –
	Ask basic questions based on the topic discussed.
	Diagrammatic comparison of the layered structure of both models.

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading/link https://youtu.be/a-zYm2KzqHQ
Evaluation	- Reflective Questions (What, Why, Who?). Allow students to answer and discuss. - Enlist features of Model.

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Lesson Plan No. 13	Course Name: Computer network Topic :intro to physical layer & data encoding	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: 24. Articulate the concept of the physical layer in the OSI Model. 25. Appreciate the function of the physical layer. 26. Understand basic concepts of data transmission. 27. Understand the concept of encoding. 28. able to learn different types of Encoding
Teaching Aids (if any)	1. Chalk & Talk 2. ICT
Teaching Development	3. **Introduction** (5 minutes) Concept of Physical Layer: Explain what the physical layer is and its role in the OSI model. Why encoding is required in data communications? 4. **Introduction to Physical Layer** (10 minutes): Illustrate the position of the physical layer within the OSI model and its interactions with other layers. Working/Functionality of Physical Layer: Explain how the physical layer transmits raw bitstreams over a physical medium. Discuss bit-level transmission, modulation, and signal processing using real-world examples (e.g., Ethernet cables, fiber optics). 5. **Encoding techniques** (30 minutes) 6. Types of Encoding (NRZ, RZ, Manchester etc) b. What is encoding and its types? c. What are the various encoding schemes? d. What are the basic signal encoding techniques for digital transmission? 7. Exercise (5 minutes) – Practice of Encoding of a given bit pattern.
Closure	8. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 9. Suggested Reading 10. https://youtu.be/ifgs0uypC78
Evaluation	11. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. What id digital encoding? Name the device present in physical layer

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Lesson Plan No. 14	**Course Name:** Computer network **Topic**: Types of encoding	**Course No.:** ECE-603

Objectives	At the end of the lesson the student shall be able to: - Appreciate the Concept of Digital-to-Digital Conversion - Identify Different Digital-to-Digital Conversion Techniques - Describe the Purpose and Importance of Line Coding
Teaching Aids (if any)	- ICT

Teaching Development	1. **Introduction** (5 minutes)
	2. Ask questions
	3. Why encoding is required in data communications?
	
	4. **Encoding techniques** (30 minutes)
	    a. Need of encoding
	   b. Properties
	
	    a. Digital to Digital Conversion:
	      i. Explain the concept of digital signals.
	      ii. Discuss the importance of digital-to-digital conversion.
	      iii. Visual Aid: Use PPTs to show examples of digital-to-digital conversion.
	    b. Line Coding Schemes:
	      i. Define line coding and its purpose.
	      ii. Discuss various line coding schemes: Unipolar, Polar, Bipolar, and Manchester coding.
	
	5. Exercise (5 minutes) –
	Practice of Encoding of a given bit pattern.

Closure	6. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 7. Suggested Reading 8. https://youtu.be/ifgs0uypC78 Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	- Reflective Questions (What, Why, Who?). Allow students to answer and discuss. What are the different line coding schemes? Why is line coding necessary in digital communication? Give example of these digital conversion techniques and coding schemes.

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Lesson Plan No. 15	Course Name: Computer network Topic: Transmission Media	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: 9. Identify and Describe Types of Transmission Media 10. Compare and Contrast Transmission Media 11. Select Appropriate Transmission Media 12. Identify and discuss recent advancements and future trends in transmission media technologies
Teaching Aids (if any)	13. ICT

Teaching Development	1. **Introduction** (5 minutes)
	14. Can you name different types of transmission media?
	15. Briefly introduce the types of transmission media.
	16. What is main functionality of the transmission media?
	
	2 Transmission media (30 minutes)
	
	17. Types of transmission Media
	
	18. Classes of Transmission Media, Guided or wired Media: Coaxial Cable, Twisted Pair, Optical Fiber.
	
	19. Some factors need to be considered for designing the transmission media:
	    Bandwidth
	    Interference
	2. Wired Media:
	a. Discuss different types of wired media: Twisted pair cables, Coaxial cables, and Fiber optics.
	b. **Visual Aid:** Use PPTs to show images and diagrams of each type.
	3. Wireless Media:
	a. Explain various wireless media: Radio waves, Microwaves, and Infrared.
	
	4. Exercise (5 minutes) –
	List two features of wired & wireless transmission media

Closure	20. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 21. Suggested Reading 22. https://youtu.be/y7v3EAJsWXA?list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN
Evaluation	23. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. List devices that use different transmission media. Spend 5 minutes to evaluate student assimilation of the lesson contents

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Lesson Plan No. 16	Course Name: Computer network Topic: Transmission Media	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: 5. Able to familiar to different types of transmission media.
Teaching Aids (if any)	6. Chalk & Talk 7. ICT

Teaching Development	8. **Introduction** (5 minutes)
	9. Ask questions
	10. What is main functionality of the transmission media?
	
	11. Types of transmission Impairments (30 minutes)
	     Attenuation
	     Noise
	     Distortion
	
	12. Unguided or wireless media: - Radio Waves, Infra-Red, Microwave, Satellite, Light wave, unguided media (Wireless)
	
	13. Some factors need to be considered for designing the transmission media:
	     Bandwidth
	     Interference
	14. Advantages & disadvantages
	
	15. Exercise (5 minutes) –
	    Encoding of a given bit pattern.

Closure	16. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 17. Suggested Reading 18. https://youtu.be/hKq1tYlVxdQ?list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	19. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 17	Course Name: Computer network Topic: Switching Mechanism	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: 20. understand the concept of switch and switching mechanism 21. able to know how to establish connections 22. Identify and differentiate Switching Techniques 23. Understand Switching in Modern Networks
Teaching Aids (if any)	a. Chalk & Talk b. ICT

Teaching Development	c. **Introduction** (5 minutes)
	What do you mean by switching in general?
	To which level of OSI model switch is used?
	Can we call a switch an intelligent Hub. Give reason if yes.
	
	d. **Switching Mechanism** (30 minutes)
	Circuit Switching:
	Explain the concept of circuit switching.
	Use PPTs to show examples of circuit switching.
	Packet Switching:
	Define packet switching and its importance in modern networks.
	    a. Data is divided into packets that are routed independently.
	    b. More efficient use of network resources compared to circuit switching
	e. **Example Demonstration:** Illustrate packet switching on the whiteboard,
	   showing how packets travel through the network and are reassembled at the destination.
	
	f. **Message Switching:**
	Discuss the concept of message switching:
	    a. Entire messages are routed and stored at intermediate nodes until the path to the destination is available.
	
	g. Exercise (5 minutes) –
	 Compare the three types of switching with an example

Closure	h. Summarize the Lesson Learning Outcomes and get affirmation from students on these. i. Suggested Reading https://www.youtube.com/watch?v=f4rsJ0e72NY&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=19 https://www.youtube.com/watch?v=K8IsEbgoPTA&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=20

	Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	24. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. **Class Discussion:** Why packet switching is preferred ?

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Lesson Plan No. 18	Course Name: Computer network Topic: Switching Mechanism	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: 25. understand the concept of switch and switching mechanism 26. able to know how to establish connections 27. Identify and differentiate Switching Techniques 28. Understand Switching in Modern Networks
Teaching Aids (if any)	j. Chalk & Talk k. ICT

Teaching Development	l. **Introduction** (5 minutes)
	What do you mean by switching in general?
	To which level of OSI model switch is used?
	Can we call a switch an intelligent Hub. Give reason if yes.
	
	m. **Switching Mechanism** (30 minutes)
	Circuit Switching:
	Explain the concept of circuit switching.
	Use PPTs to show examples of circuit switching.
	Packet Switching:
	Define packet switching and its importance in modern networks.
	   a. Data is divided into packets that are routed independently.
	   b. More efficient use of network resources compared to circuit switching
	n. **Example Demonstration:** Illustrate packet switching on the whiteboard,
	   showing how packets travel through the network and are reassembled at the destination.
	
	o. **Message Switching:**
	Discuss the concept of message switching:
	   a. Entire messages are routed and stored at intermediate nodes until the path to the destination is available.
	
	p. Exercise (5 minutes) –
	Compare the three types of switching with an example

Closure	q. Summarize the Lesson Learning Outcomes and get affirmation from students on these. r. Suggested Reading https://www.youtube.com/watch?v=f4rsJ0e72NY&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=19 https://www.youtube.com/watch?v=K8IsEbgoPTA&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=20

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	Spend 5 minutes to wrap up and consolidate the learnings

Evaluation	29. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	Class Discussion:
	
	30. Ask students to compare the pros and cons of each switching mechanism.
	    a. **Circuit Switching:** Reliable and predictable, but inefficient use of resources.
	    b. **Packet Switching:** Efficient and scalable, but potential for delays and packet loss
	    c. **Message Switching:** Flexible and stores complete messages, but can introduce significant delays.

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Lesson Plan No. 19	**Course Name:** Computer network **Topic**: Modem	**Course No.:** ECE-603

Objectives	At the end of the lesson the student shall be able to:
	    a. Describe and Classify Modem Types
	    b. Compare Modem Technologies
	    c. Discuss the Evolution of Modems

Teaching Aids (if any)	d. Presentation slides.

Teaching Development	e. **Introduction** (5 minutes)
	        a. Brainstorming Session:
	    s. Ask students: What do you know about modems?
	    t. Gather responses to gauge their prior knowledge and set the stage for the lesson.
	        a. Brief Introduction:
	    u. Introduce the concept of modems and their significance in data communication.
	    v. **Development** (30 minutes)
	        Modems:
	    a. Define modems and their role in data communication.
	    b. Discuss the basic working principle of modems.
	    c. **Visual Aid:** Use PPTs to show images of modems
	        Types of Modems:
	    w. Explain different types of modems: Dial-up, DSL, Cable, and Fiber optic modems.
	    x. **Example Demonstration:** Illustrate the working of each type of modem on the green board.
	
	    3. Exercise (5 minutes) –
	    - **Class Discussion:**
	    y. Ask students to list the types of modems they have used or encountered.

Closure	🎬 Recap**:** Summarize the key points about modems and their types. https://www.geeksforgeeks.org/what-is-modem/

Evaluation	z. Assess student comprehension through informal checks during the lesson, such as questioning and observation.
	  aa. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	        a. What are the different types of modems?
	        b. Why have modem technologies evolved over time?

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Lesson Plan No. 20	Course Name: Computer network Topic: RS cable	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: f. Understand RS-232 Basics g. Identify RS-232 Pinout and Signals h. Compare RS-232 with Other Serial Interfaces
Teaching Aids (if any)	i. ICT

Teaching Development	j. **Introduction** (5 minutes)
	    a. Have you encountered the RS-232 interface in any devices?
	    b. Set the Scene: Briefly introduce the RS-232 interface and its applications.
	
	k. **Development** (35 minutes)
	    l. RS-232 Interface:
	        a. Define RS-232 and its role in data communication.
	        b. Discuss the pin configuration and signal description.
	        c. Visual Aid: Use PPTs to show the RS-232 connector and its pin configuration.
	    m. Applications:
	        a. Explain where RS-232 is used in real life.
	        b. Example Demonstration: Show examples of devices that use RS-232.
	        c. Discuss different types of media: wired (e.g., twisted pair, coaxial cable, fiber optics) and wireless (e.g., radio waves, microwaves, infrared).
	    n. **Exercise** (5 minutes) –
	Class Discussion: - Ask students to identify devices they know that use RS-232.
	
	Activity:
	
	    a. Quick quiz on Nearpod to label the RS-232 pin configuration.

Closure	o. Recap:
	    Summarize the key points of the RS-232 interface.
	    Links
	    https://www.technologyuk.net/telecommunications/communication-technologies/rs-232-interface.shtml
	    https://www.geeksforgeeks.org/rs232c-for-data-transfer/

Evaluation	bb. Assess student comprehension through informal checks during the lesson, such as questioning and observation. What are the key features of the RS-232 interface?

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Objectives	At the end of the lesson the student shall be able to: 31. Understand the basis of RS 232 cable
Teaching Aids (if any)	cc. ICT

dd. **Introduction** (5 minutes)

Have you seen cables used in the set top box or in computers, weight machines and in expensive machines ?

Do you know any cable used as USB cable to communicate with other peripheral devices.

   RS Interface (30 minutes)
ee. Interface
ff. Rs 232 & Rs 232C

gg. Electrical specifications
hh. Pins & working
ii. Applications

jj. Exercise (5 minutes) –
Reall Pin configurations and abbreviations

kk. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
ll. Suggested Reading
https://www.technologyuk.net/telecommunications/communication-technologies/rs-232-interface.shtml
https://www.geeksforgeeks.org/rs232c-for-data-transfer/
Spend 5 minutes to wrap up and consolidate the learnings

mm.   Reflective Questions (What, Why, Who?). Allow students to answer and discuss.

Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 21	Course Name: Computer Networks Topic: Data Link Layer	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to:
	    a. Understand the basic concepts of the Data Link Layer.
	    b. Identify the functions and services provided by the Data Link Layer.
	    c. Explain the importance of error detection and correction.
	    d. Recognize various protocols used at the Data Link Layer.

Teaching Aids (if any)	a. Presentation slides.

Teaching Development	**1. Introduction (5 minutes)**
	  • What do you know about the Data Link Layer in networking?
	  • Can you name some functions that the Data Link Layer performs?
	Explain the relevance of the Data Link Layer in the OSI model and its role in network communication.
	
	2. Development (30 minutes)
	  a. **What is the Data Link Layer? Definition:**
	      • Explain the Data Link Layer as the second layer in the OSI model responsible for node-to-node data transfer.
	      • Emphasize its role in establishing, maintaining, and terminating a connection between two physically connected devices.
	Importance:
	      • Discuss how the Data Link Layer ensures error-free data transfer between devices.
	      • Mention its critical role in local area networks (LANs) and wide area networks (WANs).
	  2. Functions of the Data Link Layer
	-Framing:
	      • Explain the process of dividing the data stream into manageable frames.
	      • Error Control:
	      • Discuss techniques like Cyclic Redundancy Check (CRC) and Parity Check.
	      • Flow Control:
	      • Explain how flow control manages the pace of data transmission between sender and receiver.

	• MAC Addressing:
	• Describe how MAC addresses are used for hardware addressing in a network.
	3. **Protocols in the Data Link Layer**
	Common Protocols:
	• Discuss protocols like Ethernet, PPP (Point-to-Point Protocol), and HDLC (High-Level Data Link Control).
	Real-World Example:
	• Illustrate the use of Ethernet in a typical office LAN.
	4. **Applications of the Data Link Layer**
	Real-World Applications:
	• Discuss examples such as local area networks (LANs) and wireless communication.
	Exercise (5 minutes)
	Ask students to summarize the key functions of the Data Link Layer. Discuss the answers with the class.
	Write few lines on the importance of error detection and correction at the Data Link Layer and
Closure	Summarize the lesson learning outcomes and confirm understanding with the students.
	Suggested Reading:
	• 'Data and Computer Communications' by William Stallings Chapter 7 pp. 150-180.
	• 'Computer Networking: A Top-Down Approach' by James Kurose and Keith Ross Chapter 6 pp. 400-420.
	Link:https://www.youtube.com/watch?v=HNefQ1J4eFk
Evaluation	1. Reflective Questions (What, Why, Who?):
	2. How would you define the Data Link Layer in your own words?
	3. What are the basic functions of the Data Link Layer?

Lesson Plan No. 22	Course Name: Computer Networks Topic: Error Detection and Correction	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: a. Understand the basic concepts of error detection and correction. b. Identify different types of errors in data communication. c. Explain various error detection techniques. d. Understand and apply error correction methods.
Teaching Aids (if any)	a. Presentation slides.
Teaching Development	**1. Introduction (5 minutes)** What do you understand by the term "error detection and correction"? Have you ever experienced data errors in your communication devices? Explain the importance of error detection and correction in reliable communication. **2. Development (30 minutes)** **a. What is Error Detection and Correction?** - Explain error detection as identifying errors in the transmitted data and error correction as the process of correcting these errors to retrieve the original data. - Discuss the necessity of these processes to ensure reliable data transmission and communication integrity. **Types of Errors in Data Communication** - Single-Bit Errors: - Explain how single-bit errors affect only one bit of the data unit. - Burst Errors: - Describe burst errors as affecting multiple bits within a data unit. ● **Error Detection Techniques** *Parity Check:* - Explain how parity bits are used to detect errors. *Cyclic Redundancy Check (CRC):*

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	- Describe CRC and its use in detecting errors through polynomial division. *Checksum:* - Discuss the use of checksums in detecting errors by summing up data segments. ● **Error Correction Methods** *Automatic Repeat Request (ARQ):* - Explain ARQ as a method where the sender retransmits data upon detecting errors. *Forward Error Correction (FEC):* - Describe FEC as a method that adds redundant data to correct errors without retransmission. *Hamming Code:* - Explain the Hamming code and its ability to detect and correct single-bit errors. ● **Applications of Error Detection and Correction** - Discuss real-world applications such as in internet communication, satellite transmission, and data storage. **Exercise (5 minutes)** - Ask students to list and describe various error detection techniques. - Discuss the answers with the class.
Closure	Summarize the lesson learning outcomes and get affirmation from students on these. Suggested Reading: - "Data and Computer Communications" by William Stallings, Chapter 6, pp. 150-175. - "Computer Networking: A Top-Down Approach" by James Kurose and Keith Ross, Chapter 3, pp. 123-145. Link:https://www.youtube.com/watch?v=dLJL4rts5FQ

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Evaluation	Reflective Questions (What, Why, How). Allow students to answer and discuss.
	   - How would you define error detection in your own words?
	   - What are the basic error detection techniques?
	   - Why is error correction necessary?
	Spend 5 minutes to wrap up and consolidate the learnings.

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Lesson Plan No. 23	Course Name: Computer Networks Topic: Flow Control - Elements of Data Link Protocol	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of flow control in data link protocols. b. Identify different flow control mechanisms. c. Explain the importance of flow control in network communication. d. Recognize the practical applications of flow control in data communication.
Teaching Aids (if any)	a. Presentation slides.
Teaching Development	**Introduction (5 minutes)** ● Ask students: - What do you understand by the term "flow control" in the context of data communication? - Can you think of a situation where managing the flow of data is critical? - Explain the relevance of flow control in ensuring efficient and reliable communication in networks. **Development (30 minutes)** ● **What is Flow Control?** - Definition: - Explain flow control as the process of managing the rate of data transmission between two nodes to prevent a fast sender from overwhelming a slow receiver. - Importance: - Discuss how flow control ensures data integrity and prevents data loss by managing buffer capacities. ● **Basic Flow Control Mechanisms** ● **Stop-and-Wait Protocol:** - Describe the mechanism where the sender stops and waits for an acknowledgment for each data frame before sending the next one. - Advantages and Disadvantages: - Discuss simplicity and reliability vs. inefficiency and low utilization of bandwidth. ● **Sliding Window Protocol:** - Explain the mechanism allowing the sender to send multiple frames before needing an acknowledgment, with a sliding window controlling the flow. - Advantages and Disadvantages: - Discuss improved efficiency and better bandwidth utilization vs. increased complexity.

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	● **Flow Control in Action** ● **Real-world Examples:** - Discuss the use of flow control in protocols like TCP (Transmission Control Protocol) and its role in preventing network congestion. ● **Case Study:** - Walk through a scenario of file transfer between two devices, highlighting the role of flow control mechanisms. ● **YouTube Video:** **Exercise (5 minutes)** Ask students to summarize the main flow control mechanisms and their roles. Discuss the answers with the class.
Closure	Summarize the lesson learning outcomes and get affirmation from students on these. Suggested Reading: "Data and Computer Communications" by William Stallings, Chapter 7, pp. 230-260. "Computer Networking: A Top-Down Approach" by James Kurose and Keith Ross, Chapter 3, pp. 150-185. **Link:** https://www.scaler.com/topics/computer-network/sliding-window-protocol/ Video Link: https://www.youtube.com/watch?v=VUdfS70puWI
Evaluation	1. Reflective Questions (What, Why,Who?). Allow students to answer and discuss. 2. How would you define flow control in your own words? 3. What are the basic flow control mechanisms? 4. Why is flow control necessary in data communication?

Lesson Plan No. 24	Course Name: Computer Networks Topic: Channel Allocation Problems	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to:
	   a. Define channel allocation and its significance in communication networks.
	   b. Identify different types of channel allocation methods (Fixed, Dynamic, Hybrid).
	   c. Analyze the challenges of channel allocation in wireless and mobile networks.
	   d. Explore solutions to mitigate channel allocation problems in modern networks.

Teaching Aids (if any)	a. Presentation slides.

Teaching Development	**Introduction (5 minutes)**
	
	● **Ask students:**
	   ○ How does your phone or Wi-Fi connect to the internet without interference from other devices?
	   ○ Explain briefly what channel allocation is and its relevance in everyday communication (Wi-Fi, cellular networks).
	
	Development (40 minutes)
	
	A. Channel Allocation Methods (15 minutes)
	
	a. Fixed Allocation (7 minutes)
	
	● **Definition:** Explain how fixed allocation assigns specific channels to specific users or cells.
	● **Example:** Analog cellular systems, traditional FM radio stations.
	● **Discussion:** Ask, "What are the potential inefficiencies of fixed allocation?" (e.g., underutilized channels during low demand).
	● **Real-World Example:** Discuss the use of frequency division multiple access (FDMA) in early cell phone systems.
	
	b. Dynamic Allocation (8 minutes)
	
	● **Definition**: Explain how dynamic allocation allows channels to be assigned on-demand.
	● **Example**: GSM cellular networks dynamically allocate channels based on user demand.
	● **Discussion**: "How does this method adapt to varying traffic loads in mobile networks?"
	● **Real-World Example**: Explore how modern 4G/5G networks use dynamic allocation to improve spectrum efficiency.

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B. Challenges of Channel Allocation (10 minutes)

- **Interference**: Explain how multiple users can interfere with each other, leading to performance degradation.
- **Scarcity of Spectrum**: Discuss the limited availability of frequencies and the need for efficient allocation.
- **Real-World Problem**: "How do cities with high population densities (like New York) manage spectrum to support millions of cellular users?"

C. Solutions to Channel Allocation Problems (5 minutes)

- **Hybrid Systems**: Explain how hybrid systems combine fixed and dynamic allocation to balance efficiency and flexibility.
- **Techniques**: Briefly introduce frequency reuse and spectrum sharing in modern wireless networks.

Exercise (10 minutes)

- **Case Study**: "Imagine you are a network engineer tasked with allocating channels for a new 5G network in a dense urban area. What factors would you consider?"
- Break students into small groups (2-3) to brainstorm solutions.
- Allow each group to present their thoughts, then provide feedback.
- Discuss spectrum auctions as a real-world mechanism for managing limited spectrum resources.

Closure	Summarize the three main types of channel allocation methods (Fixed, Dynamic, Hybrid). Reiterate the importance of solving channel allocation problems to improve communication networks. Link: **Suggested Reading:** "Data and Computer Communications" by William Stallings, Chapter 6, pp. 180-210 (explains channel allocation techniques in-depth).
Evaluation	Reflective Questions (What Why Who?). Allow students to answer and discuss. • What are the advantages of dynamic channel allocation over fixed? • How does channel allocation affect user experience in crowded environments?

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Lesson Plan No. 25	Course Name: Computer Networks Topic: Multiple Access Protocol-ALOHA	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to:
	   a. Understand the concept of multiple access in communication networks.
	   b. Explain the ALOHA protocol and its variants (Pure ALOHA and Slotted ALOHA).
	   c. Identify real-world applications of the ALOHA protocol.
	   d. Analyze the efficiency and limitations of ALOHA.
	   e.

Teaching Aids (if any)	a. Presentation slides.

Teaching Development	**Introduction (5 minutes)**
	
	● **Ask students:**
	  ○ Have you ever experienced delays or slowdowns in your Wi-Fi connection when many devices are connected at once? Why do you think this happens?"
	  ○ Introduce the concept of multiple access: multiple devices trying to communicate over a shared channel.
	  ○ Briefly explain the historical context of ALOHA developed for wireless communication between remote stations in Hawaii.
	
	Development (30 minutes)
	
	A. Multiple Access & ALOHA Protocol (15 minutes)
	
	● **Definition of Multiple Access:** Explain how multiple devices use a shared communication channel, which can lead to collisions.
	● **Introduction to ALOHA:** Explain the basic idea of ALOHA, developed by Norman Abramson for wireless networks.
	  ○ **Pure ALOHA:**
	    ■ **How it works:** Devices transmit whenever they have data, leading to potential collisions.
	    ■ **Real-time example:** Imagine students raising their hands to answer questions in a class simultaneously, leading to confusion.
	    ■ **Formula:** Efficiency = 18.4%. (Discuss that about 18.4% of time is used successfully without collisions).
	  ○ **Slotted ALOHA:**
	    ■ **How it works:** Transmission is divided into time slots, reducing collisions.
	    ■ **Example:** Think of students being allowed to raise their hands only at the start of a teacher-determined time.
	    ■ **Efficiency:** 36.8%. Explain how time-slotted communication leads to fewer collisions.

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	B. Performance and Efficiency (10 minutes) ● Compare the efficiency of Pure ALOHA and Slotted ALOHA. Explain why Slotted ALOHA performs better. ● **Graphical Representation:** Show a graph comparing collision rates in Pure and Slotted ALOHA (this can be visualized in the PPT). ● Discuss how modern technologies like Ethernet and Wi-Fi have evolved based on these concepts. **C. Real-World Applications & Limitations (5 minutes)** ● **Application:** Explain that ALOHA is used in satellite communication, RFID tags, and even in the early development of Wi-Fi. ● **Discussion:** "Why do you think a simple protocol like ALOHA is not widely used in high-demand environments today?" Discuss the limitations, including low efficiency in large networks. **Exercise (10 minutes)** ● **Scenario:** "Imagine you are managing a network for a remote island, and you need a simple solution to manage communication between sensors. Would you use Pure ALOHA or Slotted ALOHA? Why?" ● Divide students into small groups (2-3) and let them discuss which ALOHA variant is more suitable and why. ● After 5 minutes of group work, ask a representative from each group to share their thoughts. Discuss the pros and cons of each solution.
Closure	Summarize the key points: what multiple access means, how ALOHA handles it, the differences between Pure and Slotted ALOHA, and the importance of collision management in networks. "How do you think ALOHA's principles apply to your Wi-Fi connection at home?" **Suggested Reading:** "Data and Computer Communications" by William Stallings, Chapter 12, pp. 415-420 (explains the ALOHA protocol in detail). "Computer Networks: A Systems Approach" by Larry L. Peterson, Chapter 5, pp. 280-295 (discusses multiple access protocols, including ALOHA). Link https://youtu.be/fTcF4ZcvDts?list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN

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Evaluation	Reflective Questions (What Why Who?). Allow students to answer and discuss.
	- What is the difference between Pure ALOHA and Slotted ALOHA? - Why is the efficiency of Slotted ALOHA higher than Pure ALOHA? - Can you think of a situation where using ALOHA would be more practical than a more complex protocol? Spend 5 minutes to wrap up and consolidate the learnings.

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Lesson Plan No. 26	**Course Name: Computer Networks** **Topic: Carrier Sense Multiple Access** **Protocols**	**Course No.: ECE-603**

Objectives	At the end of the lesson the student shall be able to:
	
	   a. Understand the concept of multiple access and how CSMA reduces collisions.
	   b. Explain the different types of CSMA protocols (CSMA/CD, CSMA/CA).
	   c. Identify real-world applications of CSMA.
	   d. Analyze the efficiency and limitations of CSMA in wired and wireless networks.
	   e. Relate the principles of CSMA to modern network technologies such as Ethernet and Wi-Fi.

Teaching Aids (if any)	a. Presentation slides.
	   b. Projector
	   c. Diagrams to show packet collisions and how CSMA handles them.

Teaching Development	**Introduction (5 minutes)**
	
	● **Ask students:**
	    ○ Have you ever noticed a slow network when many people are connected to the same Wi-Fi? Why do you think this happens?"
	    ○ Introduce the concept of multiple access and how shared channels can lead to data collisions.
	    ○ Introduce the need for protocols like CSMA to manage channel access efficiently and reduce collisions.
	
	Development (30 minutes)
	
	A. What is Carrier Sense Multiple Access (CSMA)? (10 minutes)
	
	● **Definition:** Explain CSMA as a protocol that listens to the carrier (network channel) before attempting to transmit data.
	● **Analogy:** Compare this to people in a conversation: "You wait until others stop speaking before you begin, to avoid interruptions."
	● **Types of CSMA Protocols:**
	    ○ **CSMA/CD (Collision Detection):** Used in wired networks like Ethernet.
	       ■ **Example:** Imagine two cars approaching a one-lane bridge and both stop, check, then proceed if the road is clear.
	       ■ **Real-World Application:** Early Ethernet used CSMA/CD to manage data transmission.
	    ○ **CSMA/CA (Collision Avoidance):** Used in wireless networks like Wi-Fi.
	       ■ **Example:** Imagine cars approaching an intersection and taking turns to avoid crashing.

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■ **Real-World Application:** Wi-Fi uses CSMA/CA because wireless networks can't detect collisions directly.

B. Efficiency and Limitations of CSMA (10 minutes)

- **Graphical Representation:** Show a diagram of how CSMA/CD and CSMA/CA handle collisions.
- **Discussion:** Why does CSMA work better in wired networks compared to wireless? Explore the hidden node problem in Wi-Fi networks.
- **Efficiency:** Discuss the limitations of CSMA as network load increases and how collisions still occur under heavy traffic.

C. Real-World Applications of CSMA (10 minutes)

- **Ethernet:** Explain how modern Ethernet networks evolved from CSMA/CD and why it's still relevant today in wired LANs.
- **Wi-Fi:** Discuss how CSMA/CA is used in Wi-Fi, and why avoiding collisions in wireless communication is essential.
- **Example:** "Why do you think public Wi-Fi (like at cafes or airports) often feels slower than your home Wi-Fi? What role does CSMA play?"

Exercise (10 minutes)

- "Imagine you are tasked with setting up a Wi-Fi network in a large office building. What challenges related to multiple access would you face, and how would CSMA/CA help?"
- Break students into small groups (2-3) and let them brainstorm how CSMA/CA can be used to improve the performance of Wi-Fi in crowded areas.
- After 5 minutes, each group presents their solution, followed by a discussion on the effectiveness of CSMA in different environments.

Closure	Recap the key points: multiple access, how CSMA/CD and CSMA/CA manage collisions, and the differences between wired and wireless applications. "Which version of CSMA (CD or CA) do you think will continue to be relevant in the future, and why?" **Suggested Reading:** "Data and Computer Communications" by William Stallings, Chapter 12, pp. 421-425 (explains CSMA/CD and CSMA/CA in detail). "Computer Networks: A Systems Approach" by Larry L. Peterson, Chapter 5, pp. 296-310 (discusses the evolution of Ethernet and CSMA protocols). Link:
Evaluation	Reflective Questions (What Why Who?). Allow students to answer and discuss. ● How does CSMA/CD differ from CSMA/CA? ● Why is CSMA/CA preferred in wireless networks over CSMA/CD? ● Can you think of a scenario where CSMA/CD might still be used today? Spend 5 minutes to wrap up and consolidate the learnings.

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Lesson Plan No. 27	Course Name: Computer Networks Topic: Collision Free Protocols	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to:
	   a. Define collision-free protocols and explain their significance in network communication.
	   b. Identify key collision-free protocols like TDMA (Time Division Multiple Access) and Token Passing.
	   c. Understand the advantages and limitations of collision-free protocols.
	   d. Discuss real-world examples of collision-free protocols in modern networks.
	   e. Engage in a discussion about the applicability of these protocols in various networking scenarios.

Teaching Aids (if any)	a. Presentation slides.
	   b. Projector
	   c. Diagrams to illustrate time-slotting and token passing mechanisms.

Teaching Development	**Introduction (5 minutes)**
	
	● **Ask students:**
	   ○ "Have you ever noticed delays or data loss when too many people try to access the same network at once?"
	   ○ Introduce the concept of collision-free protocols and why avoiding collisions is critical for smooth network operations.
	   ○ Provide a brief overview of why these protocols are crucial in environments where collisions would drastically reduce network performance, such as in real-time communication systems.
	
	Development (30 minutes)
	
	A. What are Collision-Free Protocols? (10 minutes)
	
	● **Definition:** Explain that collision-free protocols ensure that data transmission happens without conflicts or collisions by reserving transmission opportunities for each device.
	● **Why Needed:** Discuss how traditional multiple access protocols like CSMA can result in collisions and why collision-free protocols are required for time-sensitive or high-traffic environments.
	
	B. Types of Collision-Free Protocols (15 minutes)
	
	● **Time Division Multiple Access (TDMA) (7 minutes)**
	   ○ **How it works:** Explain how TDMA divides the channel into time slots, with each device assigned its own time slot to avoid collisions.
	   ○ **Analogy:** Compare it to taking turns speaking in a meeting, where each participant is allotted a specific time to speak.
	   ○ **Real-World Example:** Show how TDMA is used in cellular networks (2G, 4G) to allow multiple users to share the same

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frequency band without interference.

	Illustration: Use a diagram to show how time slots are allocated to different users.
	 ● **Token Passing Protocol (8 minutes)**
	  ○ **How it works:** Explain the token-passing method, where a token circulates within the network, and only the device holding the token is allowed to transmit data.
	  ○ **Example:** Compare this to a classroom where a "talking stick" is passed around, and only the person holding the stick can speak.
	  ○ **Real-World Application:** Discuss how Token Ring networks used token passing to avoid collisions, and how modern industrial networks like PROFIBUS use similar mechanisms.
	  ○ **Illustration:** Use a diagram to show how the token circulates and controls access in the network.
	
	C. Advantages and Limitations of Collision-Free Protocols (5 minutes)
	
	 ● **Advantages:** High efficiency in networks with real-time communication needs, reduced collisions, and better use of network resources.
	 ● **Limitations:** Discuss the complexity of managing tokens in large networks and the overhead introduced by time-slotting in TDMA.
	 ● **Discussion:** Ask students, "In which situations would collision-free protocols be preferred over CSMA-based protocols?"
	
	Exercise (10 minutes)
	
	 ● "You are setting up a network for a manufacturing plant with machines that must communicate in real-time. Which collision-free protocol would you use, and why?"
	 ● Divide students into small groups (2-3) and let them discuss the application of TDMA or Token Passing in various real-world scenarios, such as industrial automation or mobile communications.
	 ● After 5 minutes of discussion, have each group present their thoughts on the best collision-free protocol for their scenario.

Closure	Summarize the key points: what collision-free protocols are, the two main types (TDMA and Token Passing), and their real-world applications. **Suggested Reading:** "Data and Computer Communications" by William Stallings, Chapter 13, pp. 450-460 (discusses collision-free protocols in detail). "Computer Networking: A Top-Down Approach" by James Kurose and Keith Ross, Chapter 4, pp. 190
Evaluation	Reflective Questions (What Why Who?). Allow students to answer and discuss. ● How does TDMA differ from Token Passing in terms of managing collisions? ● What are the key advantages of using a collision-free protocol in time-sensitive networks like industrial automation? ● Can you think of other protocols that also aim to minimize collisions? Spend 5 minutes to wrap up and consolidate the learnings.

Lesson Plan No. 28	Course Name: Computer Networks Topic: IEEE standards-802.3, 802.4, 802.5	Course No.: ECE-603

Objectives	At the end of the lesson the student shall be able to:
	  a. Understand the key IEEE standards (802.3, 802.4, and 802.5) and their significance in network communication.
	  b. Compare the characteristics, advantages, and limitations of each standard.
	  c. Identify real-world applications of these standards and their relevance in modern networking.
	  d. Engage in a discussion on the evolution of these protocols and why some have become obsolete while others remain in use.

Teaching Aids (if any)	a. Presentation slides.
	  b. Projector
	  c. Diagrams to illustrate the difference between Ethernet, Token Bus, and Token Ring.

Teaching Development	**Introduction (5 minutes)**
	
	● **Ask students:**
	    ○ "How do the devices on your home or office network communicate with each other without interference?"
	    ○ Introduce the IEEE standards that define the rules for wired network communication: 802.3 (Ethernet), 802.4 (Token Bus), and 802.5 (Token Ring).
	    ○ Briefly explain that these standards ensure efficient data transmission in local area networks (LANs).
	
	Development (30 minutes)
	
	A. IEEE 802.3: Ethernet (10 minutes)
	
	● **Definition:** Explain IEEE 802.3 as the Ethernet standard, which governs the most widely used LAN technology.
	● **How it works:** Use CSMA/CD (Carrier Sense Multiple Access/Collision Detection) to manage communication between devices.
	● **Real-World Example:** Discuss how Ethernet is used in most home, office, and industrial networks today.
	● **Advantages:** Simple, cost-effective, scalable.
	● **Limitations:** Inefficiencies under high traffic due to collisions in legacy systems.
	● **Illustration:** Show a diagram of an Ethernet network setup.
	
	B. IEEE 802.4: Token Bus (10 minutes)
	
	● **Definition:** Explain IEEE 802.4 as a standard for Token Bus networks, a now largely obsolete protocol.
	● **How it works:** Describe how devices are arranged in a logical bus but pass a token to control access to the network.

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	• **Real-World Application:** Token Bus was used in industrial environments such as factory automation where deterministic access was important. • **Advantages:** Predictable network access, collision-free communication. • **Limitations:** Complexity in implementation, limited scalability. • **Illustration:** Use a diagram to show the token-passing mechanism in a bus topology. **C. IEEE 802.5: Token Ring (10 minutes)** • **Definition:** Explain IEEE 802.5, the standard for Token Ring networks. • **How it works:** Devices are arranged in a physical ring, and a token is passed around the ring to control who can transmit data. • **Real-World Application:** Token Ring was used in IBM networks during the 1980s and 1990s. • **Advantages:** Collision-free, fair access to network resources. • **Limitations:** Slower than Ethernet, more expensive to implement, difficult to troubleshoot. • **Illustration:** Show a diagram of a Token Ring network setup. **Exercise (10 minutes)** • "If you were setting up a network for a large office building in the 1980s, which protocol would you have chosen and why?" • Divide students into small groups (2-3) to discuss the benefits and drawbacks of Ethernet, Token Bus, and Token Ring in different networking environments (e.g., office, factory, home). • After 5 minutes, have each group present their thoughts on which protocol they would have chosen and why.
Closure	Recap the key points: what IEEE 802.3, 802.4, and 802.5 are, and how they differ in terms of structure, performance, and use cases. **Suggested Reading:** • "Data and Computer Communications" by William Stallings, Chapter 13, pp. 460-475 (discusses IEEE 802 standards in detail). • "Computer Networking: A Top-Down Approach" by James Kurose and Keith Ross, Chapter 5, pp. 200-210 (covers Ethernet and Token Ring standards). Link; https://youtu.be/aV-J8vZ2n2E?list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN
Evaluation	Reflective Questions (What Why Who?). Allow students to answer and discuss. • What are the major differences between IEEE 802.3, 802.4, and 802.5? • Why is Ethernet more scalable compared to Token Bus and Token Ring? • What are the use cases where Token Bus or Token Ring might still be useful today? Spend 5 minutes to wrap up and consolidate the learnings.