



Kot Bhalwal, Jammu



Model Institute of Engineering
& Technology (Autonomous)
Dr. Arun K. Gupta Teaching-Learning Centre

Department of CIVIL ENGINEERING

Details of Lesson Plan

S.No.	Particulars	Details
1.	Course Name	HYDROLOGY AND IRRIGATION ENGINEERING
2.	Course Code	CE-601
3.	Academic Year	2024-25
4.	Semester	VI TH
5.	Number of Lesson plans	52
6.	Faculty Assigned	MR ISHAN ANAND

Faculty Signature



Lesson Plan No. 1	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Explain the concept of the continuous circulation of water on Earth. Recognize and differentiate between the main processes, including evaporation, condensation, precipitation, infiltration, and runoff. Understand the crucial role of the hydrological cycle in sustaining ecosystems, supporting human activities, and regulating climate. Demonstrate an understanding of how each stage in the hydrological cycle is interconnected and influences the others.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> Ask questions. <p>What is the hydrological cycle, and why is it essential for life on Earth?</p> <p>How does water move from the Earth's surface into the atmosphere and back again?</p> <p>How does the hydrological cycle differ in different regions or climates around the world?</p> Why is precipitation a critical component of the hydrological cycle? Highlight the perpetual movement of Earth's water. Break down evaporation, condensation, precipitation, infiltration, and runoff. Discuss how human activities can disrupt the natural flow. Connect the hydrological cycle to global climate patterns. Illustrate its impact on landscapes and societies. Development (30 minutes) <ol style="list-style-type: none"> Introduction: <ul style="list-style-type: none"> Define hydrologic cycle as the continuous movement of water on, above, and below the surface of the Earth. Processes: <ul style="list-style-type: none"> Evaporation: Water changes from liquid to vapor. Condensation: Vapor forms clouds. Precipitation: Water falls back to Earth as rain, snow, sleet, or hail. Infiltration: Precipitated water enters the soil. Runoff: Excess water flows over the land surface. Importance: <ul style="list-style-type: none"> Sustains ecosystems and human activities. Regulates climate and temperature. Human Impact: <ul style="list-style-type: none"> Altered by human activities like deforestation and urbanization.



	<p>e. Conclusion: - Emphasize the interconnectedness and significance of each stage in the hydrologic cycle.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none"> - How does the hydrological cycle influence climate patterns and temperatures on Earth? - How does the hydrological cycle differ in arid regions compared to humid climates? - In what ways do human activities impact the natural balance of the hydrological cycle? - What is the hydrological cycle, and how does it sustain life on Earth? - Can you describe the main processes involved in the hydrological cycle and their sequence? - How does water move from the Earth's surface into the atmosphere and back again?
Closure	<ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading <ul style="list-style-type: none"> - NPTEL LECTURES https://archive.nptel.ac.in/content/storage2/courses/105107129/module1/lecture1/lecture1.pdf 3. Homework <ul style="list-style-type: none"> - Explore and understand the various components and processes of the hydrologic cycle through research and reflection. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Quiz on Hydrological Cycle. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 2	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Understand the forms of precipitation. b. Understand the basic properties of precipitation. c. Understand concept of different components forms of precipitation. d. Explain the concept of the continuous circulation of water on Earth.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<p>1. Introduction (5 minutes)</p> <p>Ask questions.</p> <ul style="list-style-type: none"> - What is the hydrological cycle, and why is it essential for life on Earth? - How does water move from the Earth's surface into the atmosphere and back again? - How does the hydrological cycle differ in different regions or climates around the world? - Why is precipitation a critical component of the hydrological cycle? - Highlight the perpetual movement of Earth's water. - Break down evaporation, condensation, precipitation, infiltration, and runoff. - Discuss how human activities can disrupt the natural flow. - Connect the hydrological cycle to global climate patterns. - Illustrate its impact on landscapes and societies. - <p>2. Development (30 minutes)</p> <ul style="list-style-type: none"> a. Introduction: <ul style="list-style-type: none"> • Define Hydrologic Cycle: Continuous movement of water on, above, and below the surface of the Earth. b. Processes: <ul style="list-style-type: none"> • Evaporation: Water changes from liquid to vapor. • Condensation: Vapor turns into clouds. • Precipitation: Water falls back to Earth as rain, snow, sleet, or hail. • Infiltration: Water soaks into the ground. • Runoff: Excess water flows over the surface. c. Importance: <ul style="list-style-type: none"> • Sustains ecosystems. • Drives weather patterns. • Supports agriculture and human activities. d. Human Impact: <ul style="list-style-type: none"> • Alters natural flow through urbanization and deforestation. • Climate change impact on precipitation patterns. e. Conclusion: <ul style="list-style-type: none"> • Emphasize the interconnectedness of Earth's systems in



	<p>maintaining the hydrologic cycle.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Define the Hydrologic Cycle and its key processes.- Describe the role of evaporation in the Hydrologic Cycle.- Explain how condensation contributes to cloud formation.- Discuss the different forms of precipitation in the Hydrologic Cycle.- What is the significance of infiltration in the cycle?- How does runoff occur, and what factors influence it?- Examine the importance of the Hydrologic Cycle in sustaining ecosystems.- How does the Hydrologic Cycle drive weather patterns? Provide examples.
Closure	<p>1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>2. Suggested Reading</p> <ul style="list-style-type: none">- NPTEL LECTURES https://archive.nptel.ac.in/content/storage2/courses/105107129/module1/lecture1/lecture1.pdf <p>3. Homework</p> <ul style="list-style-type: none">- Explore and understand the various components and processes of the hydrologic cycle through research and reflection. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<p>1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.</p> <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 3	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	<p>At the end of the lesson the student shall be able to:</p> <ol style="list-style-type: none"> Recognize and differentiate between rain, snow, sleet, and hail. Describe the conditions under which rain, snow, sleet, and hail are formed. Given specific weather conditions, predict the likely form of precipitation. Understand why certain forms of precipitation are more common in specific regions.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> Ask questions. What comes to your mind when you hear the term "precipitation"? Name three forms of precipitation. How does precipitation contribute to the Earth's water cycle? Have you noticed any changes in precipitation patterns in your region? Introduce the concept of cloud. Show Figure on slide. Talk about utilities – water, electricity and build the pay-per-use concept Introduce the captivating journey of water from cloud formation to its descent as rain, snow, or other forms. Discuss how precipitation serves as a storyteller of weather patterns, reflecting the conditions in different regions. Discuss how climate change is influencing precipitation patterns globally, bringing attention to environmental challenges. Development (30 minutes) <ol style="list-style-type: none"> Introduction: <ul style="list-style-type: none"> Define precipitation as any form of water – liquid or solid – falling from the atmosphere. Types of Precipitation: <ul style="list-style-type: none"> Rain: Liquid water droplets falling from clouds. Snow: Ice crystals or snowflakes falling in colder temperatures. Sleet: Small ice pellets formed from freezing raindrops. Hail: Large balls of ice formed in strong updrafts within thunderstorms. Formation Processes: <ul style="list-style-type: none"> Rain and Snow: Result from condensation of water vapor in clouds.



	<ul style="list-style-type: none">- Sleet and Hail: Involve freezing processes in specific atmospheric conditions.d. Geographical Distribution:<ul style="list-style-type: none">- Explore regions where each type of precipitation is more prevalent.e. Impact on Ecosystems:<ul style="list-style-type: none">- Discuss how different forms of precipitation influence flora, fauna, and ecosystems.f. Human Adaptations:<ul style="list-style-type: none">- Explore how societies adapt to various forms of precipitation in construction, agriculture, and daily life.g. Conclusion:<ul style="list-style-type: none">- Summarize key points, emphasizing the significance of understanding forms of precipitation for environmental awareness and practical applications. <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Name three forms of precipitation commonly experienced.- Briefly describe the process that leads to the formation of hail.- Give a short example of how rain can positively impact a local ecosystem.- How might climate change influence the occurrence of extreme precipitation events?- Share a concise historical event where unusual precipitation affected a community.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- NPTEL LECTURES- https://archive.nptel.ac.in/courses/105/103/105103213/- https://youtu.be/thWKpvnXA8U?si=449UdW5JatvOMC3. Homework<ul style="list-style-type: none">- Investigate how different cultures represent precipitation in their traditions or folklore. Share your findings and reflect on cultural significance. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 4	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Understand the recording and non-recording gauges b. Understand concept of recording and non-recording gauges c. Understand the basic properties of precipitation.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. How does the process of precipitation occur in the atmosphere? In what ways does precipitation contribute to the distribution of water on Earth? What is precipitation, and why is it crucial for the Earth's water cycle? Are there regions where specific forms of precipitation are more common, and why?- Discuss the role of water in the Earth's atmosphere and its various forms, leading to precipitation.- Explore the concept of the water cycle and how precipitation is a key component in the continuous movement of water on Earth.- Explore how different forms of precipitation are distributed globally, showcasing regional variations.- Discuss how precipitation patterns impact human activities, agriculture, and the need for adaptation in different regions.- Discuss how different cultures perceive and adapt to various forms of precipitation, incorporating social perspectives.2. Development (30 minutes)<ol style="list-style-type: none">a. Introduction:<ul style="list-style-type: none">- Define precipitation as any form of water – liquid or solid – falling from the atmosphere.b. Types of Precipitation:<ul style="list-style-type: none">- Rain: Liquid water droplets falling from clouds.- Snow: Ice crystals or snowflakes falling in colder temperatures.- Sleet: Small ice pellets formed from freezing raindrops.- Hail: Large balls of ice formed in strong updrafts within thunderstorms.c. Formation Processes:<ul style="list-style-type: none">- Rain and Snow: Result from condensation of water vapor in clouds.- Sleet and Hail: Involve freezing processes in specific atmospheric conditions.



	<p>d. Geographical Distribution: - Explore regions where each type of precipitation is more prevalent.</p> <p>e. Impact on Ecosystems: - Discuss how different forms of precipitation influence flora, fauna, and ecosystems.</p> <p>f. Human Adaptations: - Explore how societies adapt to various forms of precipitation in construction, agriculture, and daily life.</p> <p>g. Conclusion: - Summarize key points, emphasizing the significance of understanding forms of precipitation for environmental awareness and practical applications.</p> <p>3. Exercise (5 minutes) – Give different use-cases and make students select appropriate cloud deployment models.</p> <ul style="list-style-type: none">- Can you identify the four main forms of precipitation commonly experienced on Earth?- Distinguish between rain and drizzle. What are the key differences?- Explain how hail is formed in the atmosphere.- How does the topography of an area influence its precipitation patterns?- Explore how different forms of precipitation impact local ecosystems. Give examples.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- NPTEL LECTURES- https://youtu.be/TWvxYnu6hE0?si=DQvuWOzm-Aer1HiQ3. Homework<ul style="list-style-type: none">- Observe and record the forms of precipitation experienced in your local area for a week. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 5	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	<p>At the end of the lesson the student shall be able to:</p> <ol style="list-style-type: none"> Identify and classify the various forms of precipitation, including rain, snow, sleet, hail, and drizzle. Explain the atmospheric conditions and processes leading to the formation of different types of precipitation. Recognize regional patterns of precipitation. Discuss how human communities adapt to and manage different types of precipitation.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> Ask questions. <p>What is precipitation, and why is it an essential component of Earth's water cycle?</p> <p>In what ways does the type of precipitation vary across different regions and climates?</p> <p>Do you think climate change is influencing precipitation patterns globally, and if so, how?</p> <p>Why does precipitation come in various forms, such as rain, snow, sleet, and hail?</p> Explore the interconnected dance of evaporation, condensation, and precipitation Introducing the various forms of precipitation as key players in this symphony. Showcase the variety in precipitation types, discussing their unique characteristics Draw parallels between the diverse forms of precipitation Frame precipitation as a captivating show put on by nature, with rain, snow, and hail each having their own distinct performances. Development (30 minutes) <ol style="list-style-type: none"> Introduction: <p>Begin with a captivating real-world scenario involving different types of precipitation.</p> Concept Clarification: <p>Define and discuss key terms: rain, snow, sleet, hail, and drizzle.</p> Visual Aids: <p>Employ visuals, charts, and animations to illustrate the formation processes of each precipitation type.</p> Interactive Discussion: <p>Engage students with questions about their experiences and</p>



	<p>observations related to different forms of precipitation.</p> <ul style="list-style-type: none">e. Hands-On Activities: Conduct experiments or simulations to demonstrate how varying atmospheric conditions lead to different types of precipitation.f. Regional Variation Exploration: Explore how geography and climate influence the prevalence of specific precipitation types in different regions.g. Case Studies: Analyze case studies to understand the impact of various precipitation types on communities and ecosystems.h. Technology Integration: Utilize online resources, simulations, or virtual tours for an immersive learning experience.i. Group Projects: Assign collaborative projects for in-depth research and presentations on a chosen precipitation type.j. Assessment and Reflection: Conclude with assessments and reflective discussions to reinforce learning and understanding. <p>3. Exercise (5 minutes) – Give different use-cases and make students select appropriate cloud deployment models.</p> <ul style="list-style-type: none">- Can you identify the different types of precipitation based on their characteristics? Describe each.- Compare and contrast the characteristics of hail and sleet. What distinguishes one from the other?- Explain the atmospheric conditions and processes leading to the formation of rain. How does it differ from the formation of snow?- Investigate and discuss the typical types of precipitation in a tropical region versus a polar region. What factors contribute to these patterns?- How do temperature and humidity levels influence the type of precipitation a region might experience? Provide examples.- Explore how different forms of precipitation impact local ecosystems. Give specific examples.
Closure	<ul style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://youtu.be/pxXsyE-TXg?si=r04gNR2qrvw7nQoL- Homework- Research how climate change is affecting global precipitation patterns. Discuss potential consequences and adaptations



	required in different regions. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. 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. 6	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Recognize tools for measuring rain. b. Describe techniques for precipitation measurement. c. Interpret data from precipitation measurements.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<p>1. Introduction (5 minutes)</p> <ul style="list-style-type: none">- Ask questions. <p>What is the primary purpose of measuring precipitation? How does a rain gauge work, and what does it measure? Why is it important to consider wind effects when measuring precipitation? Discuss the role of precipitation measurement in water resource management.</p> <ul style="list-style-type: none">- Highlight the crucial role of measuring precipitation in understanding climate, weather patterns, and water resource management.- Introduce the complexities involved in measuring precipitation due to its diverse forms, regional variations, and technological considerations.- Discuss the practical implications of accurate precipitation measurements, from agricultural planning to flood prediction and water supply management.- Discuss the practical implications of accurate precipitation measurements, from agricultural planning to flood prediction and water supply management. <p>2. Development (30 minutes)</p> <ul style="list-style-type: none">a. Introduction to Measurement Significance: Emphasize the importance of precise precipitation measurements in meteorology, hydrology, and environmental science.b. Instrument Overview: Introduce various instruments used for measuring precipitation, including rain gauges, snow gauges, and advanced technologies like weather radars.c. Methodologies and Techniques:



	<p>Explore different measurement methodologies, discussing the challenges and advancements in collecting accurate precipitation data.</p> <p>d. Hands-On Application: Incorporate practical exercises, allowing students to use rain gauges and understand the process of manual and automated precipitation measurements.</p> <p>e. Data Interpretation: Teach students how to interpret and analyze precipitation data, linking measurement outcomes to weather patterns, climate studies, and water resource management.</p> <p>f. Environmental Impact: Discuss the broader implications of precise precipitation measurement in mitigating natural disasters, supporting agriculture, and ensuring sustainable water resource utilization.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Quickly demonstrate how a rain gauge works, emphasizing its simplicity and accuracy.- Present a scenario where students must decide the most suitable precipitation measurement tool for a specific situation, encouraging quick thinking.- Briefly introduce a case study of a precipitation-related event. In pairs, students rapidly discuss the impact and potential improvements with accurate measurements.- In a fast-paced brainstorming session, have students list technological advancements in precipitation measurement, fostering quick idea generation.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://youtu.be/MHwppnaccpO8?si=JeVoy2j1-0y00S2D3. Homework<ul style="list-style-type: none">- Research different types of rain gauges and create a comparative report on their features, advantages, and disadvantages. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 7	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Explain measurement challenges and solutions. Interpret precipitation data for analysis. Discuss technological advancements in measurement.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. How do meteorologists convert precipitation measurements into meaningful data for analysis? Why is it important to consider wind effects when measuring precipitation? Discuss the role of precipitation measurement in water resource management. - Explore the interconnected dance of evaporation, condensation, and precipitation - Introducing the various forms of precipitation as key players in this symphony. - Showcase the variety in precipitation types, discussing their unique characteristics - Draw parallels between the diverse forms of precipitation - Frame precipitation as a captivating show put on by nature, with rain, snow, and hail each having their own distinct performances. Development (30 minutes) <ol style="list-style-type: none"> Introduction to Significance: Emphasize the critical role of precise precipitation measurement in climate studies, weather forecasting, and water resource management. Instruments Overview: Introduce rain gauges, snow gauges, and weather radars, explaining their functions and applications in quantifying precipitation. Methodologies and Challenges: Discuss various measurement techniques, highlighting challenges such as wind effects and technological advancements addressing these issues. Practical Application:



	<p>Engage students in hands-on activities with rain gauges, fostering a deeper understanding of manual and automated measurement processes.</p> <p>e. Data Interpretation: Teach students to interpret and analyze precipitation data, emphasizing its relevance to weather patterns, climate studies, and environmental sustainability.</p> <p>f. Environmental Impact: Explore how precise precipitation measurement contributes to disaster preparedness, agriculture, and effective water resource management, connecting theoretical knowledge to real-world applications.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none"> - Quickly demonstrate how a rain gauge works, emphasizing its simplicity and accuracy. - Present a scenario where students must decide the most suitable precipitation measurement tool for a specific situation, encouraging quick thinking. - Briefly introduce a case study of a precipitation-related event. In pairs, students rapidly discuss the impact and potential improvements with accurate measurements. - In a fast-paced brainstorming session, have students list technological advancements in precipitation measurement, fostering quick idea generation.
Closure	<ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading <ul style="list-style-type: none"> - https://youtu.be/MHwppnacpO8?si=JeVoy2j1-0y00S2D - Homework - Explore the connection between precipitation data and agricultural planning. Discuss how farmers utilize precipitation measurements for decision-making <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 8	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Recognize standard, tipping bucket, and weighing rain gauges. Comprehend how each rain gauge functions Differentiate between gauges, considering precision and applications.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. which email service do the students use? where is your email account stored? do you know the location of your email data? Where is your bank data stored? - Introduce the variety of rain gauge types, from standard to automated instruments, each designed to capture and quantify rainfall in specific ways. - Provide a brief overview of how different rain gauges function, highlighting the unique mechanisms employed by each type for accurate precipitation measurement. - Illuminate the crucial role rain gauges play in meteorology and hydrology, serving as fundamental tools for measuring precipitation. Development (30 minutes) <ol style="list-style-type: none"> Introduction to Precipitation Measurement: Emphasize the importance of rain gauges in understanding and quantifying precipitation, a key aspect of meteorology. Diversity of Rain Gauges: Explore various rain gauge types, from traditional standard gauges to modern automated systems, showcasing their design variations. Functionality and Mechanisms: Delve into the working mechanisms of each rain gauge type, explaining how they capture and measure rainfall, fostering a deeper understanding. Applications in Meteorology:



	<p>Connect rain gauge types to real-world applications in meteorology, hydrology, and environmental science, illustrating their pivotal role in data collection and analysis for accurate weather predictions.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none"> - Present characteristics of two rain gauge types. In pairs, students must quickly compare and contrast their features, encouraging swift analysis. - Assign each group a rain gauge type. In a rapid-fire brainstorm, students list potential applications and benefits associated with their assigned type. - Divide students into roles representing various rain gauge types. Engage in a brief role-play scenario where each type explains its advantages and applications.
<p>Closure</p>	<p>1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>2. Suggested Reading</p> <ul style="list-style-type: none"> - https://youtu.be/ <p>3. Homework</p> <ul style="list-style-type: none"> - Explore regional differences in rain gauge usage. Investigate which types are prevalent in specific climates and the reasons behind these choices. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
<p>Evaluation</p>	<p>1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.</p> <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 9	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> a. Articulate the concept of precipitation covering a geographic region. b. Recognize tools like rain gauges, radars. c. Describe how precipitation patterns influence climate.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. Chalk and talk
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. How do climate and precipitation correlate? Discuss the significance of accurate precipitation measurements. In what ways does precipitation affect communities? Describe the environmental implications of heavy precipitation. - Emphasize the critical role of understanding precipitation over a geographic area in climate studies, water resource management, and environmental planning. - Introduce the various forms of precipitation, from rain to snow, and highlight how their distribution over an area contributes to regional climate patterns. - Discuss the profound effects of precipitation on ecosystems, agriculture, and human communities, underlining the importance of accurate measurements for informed decision-making. 2. Development (30 minutes) <ol style="list-style-type: none"> a. Contextual Introduction: Set the stage by explaining the relevance of understanding precipitation patterns over geographic areas, emphasizing its impact on climate, ecosystems, and society. b. Exploration of Precipitation Forms: Delve into the various forms of precipitation, illustrating how rain, snow, and other types contribute to the overall hydrological balance of a region. c. Environmental Implications: Connect precipitation over an area to its direct influence on ecosystems, agriculture, and water resources, fostering an understanding of the broader environmental implications.



	<p>d. Instrumentation and Measurement Techniques: Introduce the tools and technologies used for measuring area-wide precipitation, providing insights into the methods that help quantify and analyze these essential meteorological phenomena.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none"> - Conduct a brief quiz asking students to identify how precipitation over an area affects regional climate. Encourage rapid responses for engagement. - Create a quiz highlighting different tools used to measure precipitation over an area. Challenge students to quickly match tools with their functions. - Divide students into small groups. In five minutes, each group discusses and presents the environmental impact of area-wide precipitation, fostering collaborative learning.
Closure	<ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading <ul style="list-style-type: none"> - https://youtu.be/4RZF1L70mRY?si=HbZOH4ANDiQ44Wts 3. Homework <ul style="list-style-type: none"> - Research and compare different tools used to measure precipitation over an area. Evaluate their accuracy, advantages, and limitations in a written report. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 10	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Explore applications in agriculture, ecology, planning. Recognize tools like rain gauges, radars. Describe how precipitation patterns influence climate.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. What are the main forms of precipitation? How does precipitation impact ecosystems? Name two tools used to measure precipitation. What factors influence regional precipitation patterns? - Emphasize the critical role of understanding precipitation over a geographic area in climate studies, water resource management, and environmental planning. - Introduce the various forms of precipitation, from rain to snow, and highlight how their distribution over an area contributes to regional climate patterns. - Discuss the profound effects of precipitation on ecosystems, agriculture, and human communities, underlining the importance of accurate measurements for informed decision-making. Development (30 minutes) <ol style="list-style-type: none"> Contextual Introduction: Set the stage by explaining the relevance of understanding precipitation patterns over geographic areas, emphasizing its impact on climate, ecosystems, and society. Exploration of Precipitation Forms: Delve into the various forms of precipitation, illustrating how rain, snow, and other types contribute to the overall hydrological balance of a region. Environmental Implications: Connect precipitation over an area to its direct influence on ecosystems, agriculture, and water resources, fostering an understanding of the broader environmental implications. Instrumentation and Measurement Techniques:



	<p>Introduce the tools and technologies used for measuring area-wide precipitation, providing insights into the methods that help quantify and analyze these essential meteorological phenomena.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Divide students into small groups. In five minutes, each group discusses and presents the environmental impact of area-wide precipitation, fostering collaborative learning.- Display images or descriptions of different precipitation forms. In a rapid-fire session, have students match each form with its name and characteristics.- Present quick scenarios involving area-wide precipitation. In small groups, students brainstorm and discuss the potential implications on agriculture, ecosystems, and communities.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://youtu.be/4RZF1L70mRY?si=HbZOH4ANDiQ44Wts3. Homework<ul style="list-style-type: none">- Keep a rain gauge observation diary for a week. Record the type of rain gauge used in your area and any notable weather patterns during this period. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 11	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Articulate understanding of mass curves. b. Demonstrate graph creation skills. c. Understand the hydrological applications of mass curves.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. How does a Mass Curve differ from a hydrograph? Explain the purpose of creating a Mass Curve. What type of data does a Mass Curve represent? Describe the steps to construct a Mass Curve. In hydrology, why is a Mass Curve useful?- Introduce the Mass Curve as a powerful tool in hydrology, emphasizing its role in analyzing and visualizing the cumulative distribution of streamflow data.- Illustrate the concept with a simple example, showcasing how a mass curve graphically presents the cumulative inflow or outflow of water over time.- Discuss the practical applications of mass curves in hydrology, such as assessing water availability, designing reservoirs, and understanding streamflow characteristics.2. Development (30 minutes)<ol style="list-style-type: none">a. Initiate the lesson by introducing the concept of a Mass Curve, emphasizing its significance in hydrology for analyzing and interpreting cumulative streamflow data.b. Graphical Representation: Illustrate the graphical representation of a Mass Curve, elucidating how it visually displays the cumulative distribution of water inflow or outflow over time.c. Construction Techniques: Provide step-by-step guidance on constructing a Mass Curve, ensuring students grasp the practical aspects of creating this essential hydrological tool.d. Hydrological Applications: Explore diverse applications of Mass Curves, from assessing



	<p>water availability to aiding in reservoir design, fostering an understanding of its broader role in water resource management.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present a sample Mass Curve graph. In a quick exercise, have students interpret the graph's patterns and discuss the implications.- Break students into small groups. In five minutes, each group discusses and presents the significance of Mass Curves in hydrology and water resource management.- Provide a snapshot of a real-world case where Mass Curves were instrumental. In pairs, students discuss the scenario's details and share potential insights.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://youtu.be/4RZF1L70mRY?si=HbZOH4ANDiQ44Wts3. Homework<ul style="list-style-type: none">- Investigate real-world applications of Mass Curves in hydrology. Provide examples and discuss their significance in water resource management. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 12	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> a. Proficiently create a Dad Curve graph. b. Analyze and interpret data patterns displayed on Dad Curves. c. Understand and discuss hydrological applications of Dad Curves.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. which email service do the students use? where is your email account stored? do you know the location of your email data? Where is your bank data stored? - Briefly explain the origin of the term "Dad Curve" and its relation to the curve's representation of duration, aiding in easy recall and understanding. - Illustrate the graphical representation of a Dad Curve, highlighting its unique characteristics and how it efficiently communicates information about streamflow. - Discuss practical applications of Dad Curves in hydrology, emphasizing their role in flood analysis, water resource management, and decision-making processes. 2. Development (30 minutes) <ol style="list-style-type: none"> a. Introducing the Dad Curve as a hydrological tool, emphasizing its role in depicting streamflow duration and magnitude. b. Historical Context: Provide a brief historical context, explaining the origin of the term "Dad Curve" and its connection to the graphical representation used in hydrology. c. Graphical Representation Insights: Dive into the graphical representation of Dad Curves, elucidating the components that make up this distinctive curve and how it efficiently communicates temporal characteristics of streamflow events. d. Practical Applications: Explore real-world applications of Dad Curves in hydrology,



	<p>discussing their relevance in flood analysis, water resource planning, and understanding streamflow dynamics.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Challenge students to discuss, within five minutes, how the Dad Curve efficiently represents the relationship between streamflow duration and magnitude.- Provide a set of streamflow data and guide students in creating a simple Dad Curve graph within the time constraint, fostering hands-on learning and practical application.- Begin with a rapid-fire session asking students to recall the meaning of "Dad Curve" and its primary function.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://youtu.be/4RZF1L70mRY?si=HbZOH4ANDiQ44Wts3. Homework<ul style="list-style-type: none">- Investigate real-world applications of Dad Curves in hydrology. Provide examples and discuss how they contribute to flood analysis and water resource management. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 13	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Clearly articulate the concept of water losses. b. Recognize common causes and sources. c. Understand the impact and mitigation strategies.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. What role do leaks play in water losses? How can technology help detect leaks? Name two strategies for water loss mitigation. What is the economic impact of water losses?- Introduce the various factors leading to water losses, spanning from leakages and pipe bursts to inefficiencies in distribution networks.- Provide an overview of methods and technologies used for measuring water losses, highlighting the significance of accurate assessment in water management.- Discuss the broader implications of water losses on communities and ecosystems, setting the stage for exploring effective mitigation strategies in the subsequent lesson.- Emphasize the importance of addressing water losses in distribution systems, stressing its impact on water availability and sustainability.2. Development (30 minutes)<ol style="list-style-type: none">a. Introduction to Water Losses: Initiate the lesson by highlighting the critical issue of water losses in distribution systems, underscoring its impact on water conservation and sustainability.b. Identification of Causes: Delve into the diverse causes of water losses, ranging from physical infrastructure issues like leaks to operational inefficiencies within water supply networks.c. Measurement Techniques Overview: Present an overview of various measurement techniques employed to quantify water losses, offering insights into the tools and technologies used for accurate assessment.d. Emphasis on Mitigation:



	<p>Stress the importance of addressing water losses not only for resource preservation but also for enhancing the efficiency of water supply systems. Introduce the concept of mitigation strategies to manage and reduce water losses effectively.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none"> - In five minutes, have students brainstorm and list various causes of water losses, fostering quick thinking and engagement. - Prepare a brief quiz on different measurement techniques for water losses. Encourage quick responses to test understanding of assessment methods. - Break students into small groups. In five minutes, each group discusses and presents potential mitigation strategies for addressing water losses in distribution systems.
Closure	<ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading <ul style="list-style-type: none"> - https://youtu.be/IOSHRWOZvsQ?si=or5_Clk9L1tFtd9S 3. Homework <ul style="list-style-type: none"> - Evaluate water losses in your local area. Research and discuss potential causes, measurements, and propose strategies for mitigation. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 14	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Identify causes of water losses. b. Discuss impact on water systems. c. Introduce methods for mitigation.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. Name three common causes of water losses. How can water losses impact communities? Discuss one method for measuring water losses. Why is mitigating water losses important?- Introduce the various factors leading to water losses, spanning from leakages and pipe bursts to inefficiencies in distribution networks.- Provide an overview of methods and technologies used for measuring water losses, highlighting the significance of accurate assessment in water management.- Discuss the broader implications of water losses on communities and ecosystems, setting the stage for exploring effective mitigation strategies in the subsequent lesson.- Emphasize the importance of addressing water losses in distribution systems, stressing its impact on water availability and sustainability.2. Development (30 minutes)<ol style="list-style-type: none">a. Introduction to Water Losses: Initiate the lesson by highlighting the critical issue of water losses in distribution systems, underscoring its impact on water conservation and sustainability.b. Identification of Causes: Delve into the diverse causes of water losses, ranging from physical infrastructure issues like leaks to operational inefficiencies within water supply networks.c. Measurement Techniques Overview: Present an overview of various measurement techniques employed to quantify water losses, offering insights into the tools and technologies used for accurate assessment.d. Emphasis on Mitigation:



	<p>Stress the importance of addressing water losses not only for resource preservation but also for enhancing the efficiency of water supply systems. Introduce the concept of mitigation strategies to manage and reduce water losses effectively.</p> <p>3. Exercise (5 minutes) – Give different use-cases and make students select appropriate cloud deployment models.</p> <ul style="list-style-type: none">- Prepare a brief quiz on different measurement techniques for water losses. Encourage quick responses to test understanding of assessment methods.- Present scenarios related to water losses. Have students identify potential causes and sources within each scenario in a rapid-fire session.- Prompt students to list causes of water losses within a 5-minute timeframe, encouraging rapid thinking and engagement.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://youtu.be/IOSHRWOZvsQ?si=or5_Clk9L1tFtd9S3. Homework<ul style="list-style-type: none">- Choose a case study involving a water loss incident. Analyze the situation, the impact on the community, and suggest measures for future prevention. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



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Lesson Plan No. 15	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Define empirical relationships concept clearly. b. Understand applications in various fields. c. Introduce examples of empirical relationships.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. Define empirical relationships in water management. How do empirical relationships aid in mitigating water losses? Provide an example of an empirical relationship used in water losses. Why are empirical relationships crucial in hydrology? Explain how empirical relationships help understand data patterns.- Begin by establishing a conceptual foundation, defining water losses and their impact on distribution systems.- Transition to introducing empirical relationships, emphasizing their role in quantifying and understanding complex phenomena like water losses.- Illustrate how empirical relationships are applied in studying and mitigating water losses, providing practical examples to bridge theory and application.2. Development (30 minutes)<ol style="list-style-type: none">a. Exploration of Empirical Relationships: Dive into the concept of empirical relationships, explaining how they provide valuable insights into complex phenomena like water losses and aid in quantifying relationships through observed data.b. Applications in Water Losses: Explore specific applications of empirical relationships in studying and mitigating water losses. Present examples to illustrate their practical utility in addressing challenges within water distribution systems.c. Importance in Water Management: Emphasize the broader importance of empirical relationships in effective water management, enabling informed decision-making and sustainable practices in the field.3. Exercise (5 minutes) –



	<ul style="list-style-type: none">- Initiate a challenge for students to quickly define both "water losses" and "empirical relationships" within a 5-minute timeframe.- Present scenarios involving water losses. Challenge students to identify potential empirical relationships that could be applied to analyze and address the issues.- Initiate a challenge for students to quickly define both "water losses" and "empirical relationships" within a 5-minute timeframe.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://youtu.be/Xbf1Pjc64eo?si=PlyXi0V_ttMoFmVL3. Homework<ul style="list-style-type: none">- Explore and identify empirical relationships commonly used in water management to address water losses. Discuss their applications and significance. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 16	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Understand applications in various fields. b. Introduce examples of empirical relationships. c. Explore significance in scientific research.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. Discuss the significance of empirical relationships in water management. How can empirical relationships contribute to efficient water use? In what ways do empirical relationships benefit water conservation efforts? Name two factors influencing empirical relationships in water losses.- Begin by establishing a conceptual foundation, defining water losses and their impact on distribution systems.- Transition to introducing empirical relationships, emphasizing their role in quantifying and understanding complex phenomena like water losses.- Illustrate how empirical relationships are applied in studying and mitigating water losses, providing practical examples to bridge theory and application.2. Development (30 minutes)<ol style="list-style-type: none">a. Empirical Relationships Overview: Introduce the concept of empirical relationships, highlighting their role in quantifying complex phenomena such as water losses.b. Examples in Water Losses: Provide examples of empirical relationships commonly used in studying and mitigating water losses, demonstrating their practical application in water management.c. Understanding Data Patterns: Discuss how empirical relationships help in understanding data patterns related to water losses, emphasizing their importance in identifying causes and developing effective mitigation strategies.d. Integration with Hydrology:



	<p>Explore the integration of empirical relationships with hydrological principles, showcasing their significance in analyzing and managing water distribution systems.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none"> - Initiate a challenge for students to quickly define both "water losses" and "empirical relationships" within a 5-minute timeframe. - Present scenarios involving water losses. Challenge students to identify potential empirical relationships that could be applied to analyze and address the issues. - Initiate a challenge for students to quickly define both "water losses" and "empirical relationships" within a 5-minute timeframe.
Closure	<ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading <ul style="list-style-type: none"> - https://youtu.be/Xbf1Pjc64eo?si=PlyXi0V_ttMoFmVL 3. Homework <ul style="list-style-type: none"> - Compare two empirical models used in studying water losses. Discuss their strengths, limitations, and applications in different contexts. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



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Lesson Plan No. 17	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Understand its Role in Water Losses. b. Identify Factors Influencing Infiltration. c. Introduce Techniques for Mitigation.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. Define Infiltration Process in water management. Why is understanding infiltration crucial? Name two factors influencing infiltration. How does land use impact infiltration?- Start by presenting an overview of the infiltration process, focusing on its significance in water losses within distribution systems.- Discuss how understanding the infiltration process is crucial for effective water management, emphasizing its impact on water distribution efficiency.- Introduce key factors influencing infiltration, such as soil characteristics and land use, setting the stage for a deeper exploration of these components.2. Development (30 minutes)<ol style="list-style-type: none">a. Infiltration Process Insight: Begin with an insightful exploration of the infiltration process, elucidating its role in water losses within distribution systems.b. Understanding Key Factors: Delve into the factors influencing infiltration, including soil properties, land use, and vegetation cover, providing students with a comprehensive understanding.c. Interactive Exploration: Foster engagement by encouraging students to explore real-world examples and case studies illustrating the impact of infiltration on water distribution networks.d. Mitigation Techniques Preview: Provide a preview of upcoming lessons, introducing strategies and technologies aimed at mitigating water losses associated with the infiltration process, building anticipation for further exploration.



	<p>3. Exercise (5 minutes) – Give different use-cases and make students select appropriate cloud deployment models.</p> <ul style="list-style-type: none">- List common mitigation techniques for infiltration-related water losses. In pairs, students discuss and identify the advantages and limitations of each technique within the 5-minute period.- Share a real-world scenario where infiltration significantly impacted water distribution. Students discuss the challenges posed and propose potential solutions within the time constraint.- Challenge students to brainstorm key factors influencing infiltration within a 5-minute timeframe, encouraging rapid recall and engagement.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://youtu.be/IP3jj1T6a_s?si=y1X2T1Cje8caVye03. Homework<ul style="list-style-type: none">- Investigate and identify the key factors influencing infiltration in water distribution systems. Discuss their significance and potential impact on water losses. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 18	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Understand its Role in Water Losses. Identify Factors Influencing Infiltration. Introduce Techniques for Mitigation.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> Ask questions. <ul style="list-style-type: none"> Provide an example of infiltration-related water losses. What mitigation techniques address infiltration issues? How can technology assist in infiltration management? Explain the significance of infiltration in water distribution. Start by presenting an overview of the infiltration process, focusing on its significance in water losses within distribution systems. Discuss how understanding the infiltration process is crucial for effective water management, emphasizing its impact on water distribution efficiency. Introduce key factors influencing infiltration, such as soil characteristics and land use, setting the stage for a deeper exploration of these components. Development (30 minutes) <ol style="list-style-type: none"> Infiltration Process Insight: Begin with an insightful exploration of the infiltration process, elucidating its role in water losses within distribution systems. Understanding Key Factors: Delve into the factors influencing infiltration, including soil properties, land use, and vegetation cover, providing students with a comprehensive understanding. Interactive Exploration: Foster engagement by encouraging students to explore real-world examples and case studies illustrating the impact of infiltration on water distribution networks. Mitigation Techniques Preview: Provide a preview of upcoming lessons, introducing strategies and technologies aimed at mitigating water losses associated with the infiltration process, building anticipation for further exploration.



	<p>3. Exercise (5 minutes) – Give different use-cases and make students select appropriate cloud deployment models.</p> <ul style="list-style-type: none">- List common mitigation techniques for infiltration-related water losses. In pairs, students discuss and identify the advantages and limitations of each technique within the 5-minute period.- Share a real-world scenario where infiltration significantly impacted water distribution. Students discuss the challenges posed and propose potential solutions within the time constraint.- Challenge students to brainstorm key factors influencing infiltration within a 5-minute timeframe, encouraging rapid recall and engagement.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://youtu.be/IP3jj1T6a_s?si=y1X2T1Cje8caVye03. Homework<ul style="list-style-type: none">- Research and write a report on emerging trends and innovations in managing infiltration-related water losses. Discuss potential advancements, challenges, and technological solutions. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 19	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> a. Understand the recording and non-recording gauges b. Understand concept of recording and non-recording gauges c. Understand the basic properties of precipitation.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. Chalk and talk
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. How does land use impact infiltration? Discuss the role of soil characteristics. Why is vegetation cover relevant to infiltration? Provide an example of infiltration-related water losses - Highlight the implications of infiltration on water distribution efficiency, emphasizing its role in reducing available water for consumption. - Preview mitigation strategies aimed at managing infiltration-related water losses, setting the stage for further exploration in subsequent lessons. - Discuss key factors such as soil characteristics, land use, and vegetation cover, which influence the rate and extent of infiltration. - Introduce the infiltration process as a significant factor contributing to water losses in distribution systems. 2. Development (30 minutes) <ol style="list-style-type: none"> a. Infiltration Process Overview: Begin by explaining the infiltration process, emphasizing its significance in water distribution systems and its role in contributing to water losses. b. Factors Influencing Infiltration: Delve into the various factors that influence infiltration, including soil type, land use, vegetation cover, and slope, highlighting their impact on infiltration rates. c. Real-world Examples: Provide real-world examples or case studies illustrating how infiltration affects water losses in different environments or regions, fostering a deeper understanding of the concept. d. Discussion on Mitigation Techniques:



	<p>Conclude by introducing mitigation techniques used to manage infiltration-related water losses, such as soil management practices, vegetation control, and engineering solutions.</p> <p>3. Exercise (5 minutes) – Give different use-cases and make students select appropriate cloud deployment models.</p> <ul style="list-style-type: none">- Prompt students to brainstorm factors influencing infiltration within a 5-minute timeframe, encouraging rapid recall and engagement.- List common mitigation techniques for infiltration-related water losses. In small groups, students discuss and identify the advantages and limitations of each technique within the 5-minute period.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://youtu.be/IP3jj1T6a_s?si=y1X2T1Cje8caVye03. Homework<ul style="list-style-type: none">- Investigate and identify the key factors influencing infiltration in water distribution systems. Discuss their significance and potential impact on water losses.
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 20	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> a. Understand its Importance in Hydrology. b. Introduce Common Measurement Techniques. c. Explore Applications in Water Management.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. Chalk and talk
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. What factors influence infiltration measurement accuracy? How does infiltration measurement contribute to agriculture? Discuss the role of infiltration measurement in hydrology. What is a tension infiltrometer? - Introduce the importance of measuring infiltration, emphasizing its role in understanding and managing water movement in soils. - Provide an overview of common techniques used to measure infiltration, preparing students for an in-depth exploration of these methods. - Highlight the practical applications of infiltration measurement in water management, setting the stage for discussions on its relevance in addressing water losses. - Place the topic within a hydrological context, discussing how accurate measurement of infiltration is essential for effective water resource management. 2. Development (30 minutes) <ol style="list-style-type: none"> a. Exploration of Infiltration Measurement: Embark on an exploration of the measurement of infiltration, underscoring its pivotal role in understanding and managing water movement in soil. b. Diverse Measurement Techniques: Delve into various measurement techniques such as infiltrometers and soil moisture sensors, offering insights into their applications and advantages. c. Practical Applications in Water Management: Explore real-world applications of infiltration measurement, emphasizing its significance in optimizing irrigation, managing groundwater resources, and addressing environmental challenges. d. Anticipation of Practical Skills:



	<p>Conclude by expressing the anticipation for students to acquire practical skills in measuring infiltration, aligning theoretical knowledge with hands-on applications for effective water resource management.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- List factors influencing infiltration measurement. In pairs, students discuss and identify how each factor can impact the accuracy of infiltration measurements within the 5-minute period.- Challenge students to brainstorm real-world applications of infiltration measurement in diverse fields. Encourage quick thinking and collaborative discussions within the time constraint.- Prepare a brief quiz on various infiltration measurement techniques. Encourage students to provide concise explanations within a 5-minute timeframe.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://youtu.be/NikByUnGcZg?si=WC6X-AQWYZXMzjX3. Homework<ul style="list-style-type: none">- Investigate two different techniques for measuring infiltration rates. Compare their principles, advantages, and limitations, and discuss which might be more suitable in different scenarios. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 21	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> a. Understand its Importance in Hydrology. b. Introduce Common Measurement Techniques. c. Discuss Applications in Water Management.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. Chalk and talk
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. Discuss the role of infiltration measurement in hydrology. What is a tension infiltrometer? Explain the difference between steady-state and transient infiltration. How do soil moisture sensors measure infiltration? - Introduce various techniques used to measure infiltration rates, including double-ring infiltrometers, tension infiltrometers, and the use of soil moisture sensors. - Discuss practical applications of infiltration measurement in fields such as agriculture, hydrology, and environmental engineering, emphasizing its role in optimizing irrigation practices and mitigating water-related risks. - Conclude by outlining the expected learning outcomes, setting the stage for students to gain a deeper understanding of infiltration measurement techniques and their significance in water management. 2. Development (30 minutes) <ol style="list-style-type: none"> a. Measurement Techniques Overview: Provide an overview of various techniques used to measure infiltration, such as double-ring infiltrometers, tension infiltrometers, and the use of soil moisture sensors. b. Factors Influencing Measurement: Discuss factors that influence infiltration measurement, including soil type, vegetation cover, and antecedent soil moisture conditions, to provide context for understanding variability in results. c. Practical Applications: Explore practical applications of infiltration measurement in agriculture, hydrology, and environmental engineering, demonstrating its importance in optimizing irrigation practices, managing water resources, and assessing soil health.



	<p>d. Hands-on Activities: Incorporate hands-on activities or demonstrations to allow students to gain practical experience with infiltration measurement techniques, enhancing their understanding and skills in this area.</p> <p>3. Exercise (5 minutes) – Give different use-cases and make students select appropriate cloud deployment models.</p> <ul style="list-style-type: none">- List factors influencing infiltration measurement accuracy. In small groups, students discuss and identify how each factor may impact measurement results within the 5-minute period.- Share a real-world scenario where accurate infiltration measurement was crucial. Students discuss the implications and propose potential strategies within the time constraint.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://youtu.be/zAm9mvLz3es?si=hetTfNXHzsSOIZKc3. Homework<ul style="list-style-type: none">- Investigate two different techniques for measuring infiltration rates. Compare their principles, advantages, and limitations, and discuss which might be more suitable in different scenarios. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 22	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Explore their Role in Hydrology. b. Introduce Common Infiltration Indices. c. Discuss Applications in Water Management.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. Discuss the role of infiltration measurement in hydrology. What is a tension infiltrometer? Explain the difference between steady-state and transient infiltration. How do soil moisture sensors measure infiltration?- Provide an overview of common infiltration indices such as the Horton, Philip, and Green-Ampt models, highlighting their theoretical foundations and applications.- Discuss the role of infiltration indices in hydrology and agriculture, emphasizing how they aid in predicting soil water movement, optimizing irrigation practices, and managing water resources.- Conclude by outlining the expected learning outcomes, setting the stage for students to grasp the applications and nuances of infiltration indices in subsequent lessons.2. Development (30 minutes)<ol style="list-style-type: none">a. Infiltration Indices Overview: Provide an overview of infiltration indices, emphasizing their role in quantifying and characterizing soil water movement, crucial for effective water management.b. Theoretical Foundations: Delve into the theoretical foundations of common infiltration indices such as the Horton, Philip, and Green-Ampt models, elucidating their mathematical principles and applications.c. Practical Applications: Explore practical applications of infiltration indices in hydrology and agriculture, showcasing how they facilitate predictions of soil water movement, optimization of irrigation strategies, and sustainable water resource management.



	<p>d. Hands-on Exercises or Simulations: Consider incorporating hands-on exercises or simulations to allow students to apply infiltration indices, enhancing their understanding through practical application.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- List factors influencing the choice of infiltration indices. In pairs, students discuss and identify how these factors may impact the selection process within the 5-minute period.- Share a real-world scenario where the use of infiltration indices played a crucial role. Students discuss the implications and propose potential adjustments within the time constraint.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://youtu.be/caklKXXrHW4?si=MDadfnlURcbzLjrL3. Homework<ul style="list-style-type: none">- Investigate recent advancements and emerging trends in infiltration indices. Write a summary discussing how new developments contribute to improved accuracy and efficiency in water management. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 23	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Define Factors Affecting Runoff Clearly. b. Understand Their Impact on Hydrology. c. Introduce Key Influencing Variables.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<p>1. Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions. What is runoff in hydrology? Name two key variables affecting runoff. How does precipitation influence runoff? Discuss the impact of land use on runoff. Explain the role of soil type in runoff. - Begin by emphasizing the importance of understanding factors influencing runoff, crucial for effective water management and predicting hydrological processes. - Provide an overview of key variables affecting runoff, such as precipitation, land use, soil type, and topography, setting the stage for in-depth exploration. - Discuss how these factors impact hydrological processes, influencing the volume and timing of runoff. Highlight their role in shaping watershed behavior and response to precipitation events. - Conclude by outlining the practical applications of knowledge about runoff factors, offering a glimpse into how this understanding aids in sustainable water resource management. <p>2. Development (30 minutes)</p> <ul style="list-style-type: none"> a. Factors Affecting Runoff Overview: Delve into an overview of factors influencing runoff, emphasizing their significance in understanding hydrological processes and managing water resources effectively. b. Precipitation, Land Use, Soil, and Topography: Explore the key factors such as precipitation patterns, land use changes, soil characteristics, and topographical features. Explain how variations in these variables impact the generation and movement of runoff. c. Complex Interactions:



	<p>Discuss the intricate interactions among these factors, illustrating how their combined influence shapes the runoff patterns in watersheds. Emphasize the dynamic nature of runoff processes.</p> <p>d. Practical Implications for Water Managers: Highlight the practical implications for water managers, showcasing how a comprehensive understanding of runoff factors aids in decision-making for sustainable water resource planning and flood control.</p> <p>3. Exercise (5 minutes) – Give different use-cases and make students select appropriate cloud deployment models.</p> <ul style="list-style-type: none"> - Challenge students to identify and briefly explain two key variables affecting runoff within a 5-minute timeframe, promoting rapid recall and engagement. - Present a brief case study involving the impact of runoff factors. In small groups, students discuss the implications and propose potential solutions within the time constraint. - Provide a map of a hypothetical watershed. In pairs, students mark areas influenced by different runoff factors and briefly discuss their choices within the 5-minute period.
Closure	<ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Homework <ul style="list-style-type: none"> - Choose two different regions with distinct runoff characteristics. Research and compare the influencing factors, discussing how they contribute to varying runoff patterns. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 24	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Explore Hydrological Influencing Variables. b. Introduce Key Factors in Watersheds. c. Discuss Applications in Water Management.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. Explain the role of soil type in runoff. How does topography affect runoff patterns? Name a human-induced factor influencing runoff. What is the significance of vegetation in runoff? Discuss how urbanization influences runoff.- Begin by emphasizing the importance of understanding factors influencing runoff, crucial for effective water management and predicting hydrological processes.- Provide an overview of key variables affecting runoff, such as precipitation, land use, soil type, and topography, setting the stage for in-depth exploration.- Discuss how these factors impact hydrological processes, influencing the volume and timing of runoff. Highlight their role in shaping watershed behavior and response to precipitation events.2. Development (30 minutes)<ol style="list-style-type: none">a. Comprehensive Runoff Factors Overview: Provide students with a comprehensive overview of factors influencing runoff, emphasizing their importance in hydrology and water management.b. Exploration of Key Variables: Delve into essential variables such as precipitation, land use, soil characteristics, and topography, elucidating their individual and collective impacts on runoff patterns.c. Real-world Applications: Explore real-world applications and case studies illustrating how runoff factors influence hydrological processes, connecting theoretical concepts to practical scenarios for a deeper understanding.



	<p>d. Implications for Water Management: Discuss the implications of runoff factors on water management practices, emphasizing the significance of considering these factors for sustainable and effective water resource management.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Challenge students to identify and briefly explain two key factors affecting runoff within a 5-minute timeframe, promoting rapid recall and engagement.- Present a brief case study involving the impact of runoff factors. In small groups, students discuss the implications and propose potential solutions within the time constraint.- Provide a map of a hypothetical watershed. In pairs, students mark areas influenced by different runoff factors and briefly discuss their choices within the 5-minute period.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Homework<ul style="list-style-type: none">- Investigate recent advancements and emerging trends in infiltration indices. Write a summary discussing how new developments contribute to improved accuracy and efficiency in water management. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 25	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> a. Students will be able to define runoff. b. Students will be able to identify the key factors affecting runoff. c. Students will be able to explain how each factor influences the amount of runoff.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. Chalk and talk
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. What is runoff in hydrology? Name two key variables affecting runoff. How does precipitation influence runoff? Discuss the impact of land use on runoff. Explain the role of soil type in runoff. - Begin by asking students what happens to rainwater after it falls to the ground. - Briefly explain the water cycle and introduce the concept of runoff - the portion of precipitation that flows over the land surface. - Show an image or short video clip of a flooded street or overflowing river (be mindful of age appropriateness). - Ask students why they think runoff might be a concern. 2. Development (30 minutes) <ol style="list-style-type: none"> a. Physical Factors: <ul style="list-style-type: none"> Rainfall: Explain how the amount, intensity, and duration of rainfall affect runoff. Slope: Discuss how steeper slopes allow for less infiltration and more runoff. Soil Type: Explain how different soil types (e.g., clay vs. sand) have varying infiltration capacities, impacting runoff. b. Human Factors: <ul style="list-style-type: none"> Urbanization: Discuss how replacing natural surfaces with pavement reduces infiltration and increases runoff. Deforestation: Explain how trees and vegetation help absorb water, reducing runoff. Land Management Practices: Briefly mention how farming techniques (e.g., tilling) can affect soil structure and infiltration.



	<p>c. Real-World Examples: Show students pictures of different landscapes (e.g., forest, farmland, city) and ask them to predict which would have the most runoff and why. Discuss real-world consequences of high runoff, such as flooding and soil erosion.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none"> - What is runoff? - How does the amount of rainfall affect runoff? - Why might a parking lot have more runoff than a grassy field?
Closure	<p>1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>2. Suggested Reading</p> <ul style="list-style-type: none"> - https://www.tutor2u.net/geography/reference/factors-affecting-runoff <p>3. Homework</p> <ul style="list-style-type: none"> - Divide students into small groups. - Provide them with pictures of different landscapes (forest, city street, desert) and ask them to discuss how each landscape would affect runoff. - Have each group share their reasoning with the class. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<p>1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.</p> <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 26	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Students will be able to define a hydrograph. Students will be able to interpret the different parts of a hydrograph. Students will be able to explain how hydrographs help us understand streamflow patterns.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> Ask questions. <ul style="list-style-type: none"> What does the peak discharge on a hydrograph represent? How does the shape of the rising limb differ from the falling limb of a hydrograph? What information about a watershed can a hydrograph provide? Begin by asking students if they have ever seen a graph that shows water levels in a river or stream over time. Briefly introduce the concept of a hydrograph as a graphical representation of discharge (water flow) in a river or stream at a specific location over time. Show an image of a simple hydrograph with labeled axes (time and discharge). Ask students what information they can gather from this graph. Development (30 minutes) <ol style="list-style-type: none"> Components of a Hydrograph: Explain the key parts of a hydrograph: base flow, rising limb, peak discharge, falling limb, and return flow. Define each term and explain how they represent changes in streamflow following a precipitation event. Hydrograph Interpretation: Discuss how hydrographs can be used to understand the characteristics of a watershed, such as drainage area, vegetation cover, and soil type. Explain how a steeper rising limb indicates rapid runoff, while a gentler slope suggests slower infiltration. Applications of Hydrographs: Highlight the importance of hydrographs in various fields like flood prediction, water resource management, and



	<p>environmental monitoring. Briefly mention how hydrographs can help assess the impact of human activities on streamflow patterns.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Provide students with a few real-world hydrographs (different watersheds) and ask them to identify the different parts of the graph (base flow, peak discharge, etc.).- Encourage them to discuss what they can infer about the characteristics of each watershed based on the hydrograph. <p>Use Nearpod to collect responses and discuss the answers.</p>
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://m.youtube.com/watch?v=HEKE_Ot9dSI3. Homework<ul style="list-style-type: none">- Research a specific flood event and find a corresponding hydrograph. Explain how the hydrograph helps us understand the event's severity and timing.
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 27	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Students will be able to define runoff. b. Students will be able to identify the key factors affecting runoff. c. Students will be able to explain how each factor influences the amount of runoff.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<p>1. Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions. Which type of precipitation is more likely to cause runoff: a light drizzle or a heavy downpour? How does vegetation affect runoff? What happens to runoff on a steep slope compared to a gentle slope? - Begin by asking students what happens to rainwater after it falls to the ground. - Briefly introduce the concept of runoff as the portion of precipitation that flows over the land surface instead of soaking into the ground. - Show an image or short video clip of a flooded street or overflowing river (be mindful of location and age appropriateness). - Ask students why they think runoff happens and what might affect the amount of runoff generated. <p>2. Development (30 minutes)</p> <ul style="list-style-type: none"> a. Precipitation: Explain that the amount, intensity, and duration of rainfall all influence runoff. Heavy rain falling over a short period is more likely to cause runoff than light rain spread over a longer time. Discuss how very dry or frozen ground can also be less receptive to absorbing water. b. Land Cover: Explain how different surfaces like forests, grasslands, and paved areas affect runoff. Vegetation slows down and absorbs rainwater, reducing runoff. Paved surfaces prevent water infiltration, leading to higher runoff.



	<p>c. Slope and Soil Type: Discuss how steeper slopes have less time for water to infiltrate, leading to more runoff. Explain how soil types like sand are more permeable than clay, allowing for better water absorption and less runoff.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Provide students with a few real-world hydrographs (with different shapes) and ask them to identify the key parts (baseflow, peak discharge, etc.).- Challenge them to discuss what each hydrograph might tell them about the rainfall event that caused it.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://water.weather.gov/3. Homework<ul style="list-style-type: none">- Find a news report about a recent flooding event. See if you can find a hydrograph related to the event and explain what information it provides about the flood. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 28	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Students will be able to define a hydrograph. Students will be able to interpret the different parts of a hydrograph. Students will be able to explain how hydrographs are used to understand streamflow patterns.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. What does the peak discharge on a hydrograph represent? How can a hydrograph indicate the presence of fast runoff? What are one-way hydrographs are used in water management? - Begin by asking students if they have ever seen a graph that shows water levels in a river or stream over time. - Briefly introduce the concept of a hydrograph as a graphical representation of streamflow discharge over a specific period. - Show an image of a simple hydrograph with labeled axes (time and discharge). - Ask students what information they think they can learn from a hydrograph. Development (30 minutes) <ol style="list-style-type: none"> Components of a Hydrograph: Explain the key parts of a hydrograph: base flow, rising limb, peak discharge, falling limb, and time. Define base flow as the minimum, continuous flow of water in a stream during dry periods. Discuss how rising limb represents the increasing water discharge after a precipitation event. Explain how peak discharge is the highest point on the hydrograph, indicating the maximum flow rate. Define falling limb as the decrease in water discharge following the peak. Interpreting Hydrographs: Explain how hydrographs can reveal information about the characteristics of a watershed, such as size, vegetation cover, and drainage patterns. Discuss how a steep rising limb indicates rapid runoff, while a



	<p>gentler slope suggests slower infiltration. Show students examples of hydrographs from different types of watersheds (urban, rural) to highlight variations.</p> <p>c. Uses of Hydrographs: Explain how hydrographs are valuable tools for water resource management, flood prediction, and understanding the health of a watershed. Discuss how hydrologists use hydrographs to predict potential flooding events and develop mitigation strategies. Briefly mention how hydrographs can also be used to assess the impact of human activities on streamflow patterns.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Provide students with a sample hydrograph and a scenario (recent heavy rain, long dry spell).- Ask them to interpret the hydrograph based on the scenario and explain what information they can learn about the streamflow.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://waterwatch.usgs.gov/?id=ww_toolkit3. Homework<ul style="list-style-type: none">- Find a news article about a recent flood event. Analyze the hydrograph (if provided) and explain how it relates to the flood. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 29	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Students will be able to define a hydrograph. b. Students will be able to interpret the different parts of a hydrograph. c. Students will be able to explain how hydrographs are used to understand streamflow patterns.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. What does the base flow on a hydrograph represent? What part of the hydrograph shows the increase in streamflow after precipitation? Discuss the impact of land use on runoff. How can hydrographs be helpful in predicting floods?- Begin by asking students if they have ever seen a graph that shows water levels in a river or stream over time.- Briefly introduce the concept of a hydrograph as a graphical representation of discharge (water flow) in a river or stream at a specific location over time.- Show an image of a simple hydrograph with labeled axes (time and discharge).2. Development (30 minutes)<ol style="list-style-type: none">a. Components of a Hydrograph: Explain the key parts of a hydrograph: Base flow: The low, steady flow of water in a stream during dry periods. Rising limb: The portion of the graph that shows the increase in discharge after precipitation. Peak discharge: The highest point on the graph, representing the maximum flow rate. Falling limb: The portion of the graph that shows the decrease in discharge after the peak.b. Interpreting Hydrographs: Discuss how hydrographs can reveal information about the: Timing and intensity of precipitation events. Drainage basin characteristics (size, slope, vegetation). Potential for flooding.



	<p>c. Uses of Hydrographs: Explain how hydrographs are valuable tools for water resource management, flood prediction, and understanding watershed health.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none"> - Provide students with a few real-world hydrographs (different watersheds or rainfall events). - Ask them to work in pairs to identify the different parts of the hydrograph and discuss what information they might reveal about the streamflow patterns.
Closure	<ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading <ul style="list-style-type: none"> - https://waterwatch.usgs.gov/?id=ww_toolkit 3. Homework <ul style="list-style-type: none"> - Find a news article about a recent flood event. See if you can find a hydrograph of the river involved and explain how it relates to the flood. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 30	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Students will be able to define runoff. b. Students will be able to identify the key factors affecting runoff. c. Students will be able to explain how each factor influences the amount of runoff.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<p>1. Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions. Which type of precipitation is more likely to cause runoff: a light drizzle or a heavy downpour? How does vegetation affect runoff? What happens to runoff on a steep slope compared to a gentle slope? - Begin by asking students what happens to rainwater after it falls to the ground. - Briefly introduce the concept of runoff as the portion of precipitation that flows over the land surface instead of soaking into the ground. - Show an image or short video clip of a flooded street or overflowing river (be mindful of location and age appropriateness). - Ask students why they think runoff happens and what might affect the amount of runoff generated. <p>2. Development (30 minutes)</p> <ul style="list-style-type: none"> a. Precipitation: Explain that the amount, intensity, and duration of rainfall all influence runoff. Heavy rain falling over a short period is more likely to cause runoff than light rain spread over a longer time. Discuss how very dry or frozen ground can also be less receptive to absorbing water. b. Land Cover: Explain how different surfaces like forests, grasslands, and paved areas affect runoff. Vegetation slows down and absorbs rainwater, reducing runoff. Paved surfaces prevent water infiltration, leading to higher runoff.



	<p>c. Slope and Soil Type: Discuss how steeper slopes have less time for water to infiltrate, leading to more runoff. Explain how soil types like sand are more permeable than clay, allowing for better water absorption and less runoff.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Provide students with a few real-world hydrographs (with different shapes) and ask them to identify the key parts (baseflow, peak discharge, etc.).- Challenge them to discuss what each hydrograph might tell them about the rainfall event that caused it.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://water.weather.gov/3. Homework<ul style="list-style-type: none">- Find a news report about a recent flooding event. See if you can find a hydrograph related to the event and explain what information it provides about the flood. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 31	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Students will be able to define runoff. b. Students will be able to identify the key factors affecting runoff. c. Students will be able to explain how each factor influences the amount of runoff.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<p>1. Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions. Which type of precipitation is more likely to cause runoff: a light drizzle or a heavy downpour? How does vegetation affect runoff? What happens to runoff on a steep slope compared to a gentle slope? - Begin by asking students what happens to rainwater after it falls to the ground. - Briefly introduce the concept of runoff as the portion of precipitation that flows over the land surface instead of soaking into the ground. - Show an image or short video clip of a flooded street or overflowing river (be mindful of location and age appropriateness). - Ask students why they think runoff happens and what might affect the amount of runoff generated. <p>2. Development (30 minutes)</p> <ul style="list-style-type: none"> a. Precipitation: Explain that the amount, intensity, and duration of rainfall all influence runoff. Heavy rain falling over a short period is more likely to cause runoff than light rain spread over a longer time. Discuss how very dry or frozen ground can also be less receptive to absorbing water. b. Land Cover: Explain how different surfaces like forests, grasslands, and paved areas affect runoff. Vegetation slows down and absorbs rainwater, reducing runoff. Paved surfaces prevent water infiltration, leading to higher runoff.



	<p>c. Slope and Soil Type: Discuss how steeper slopes have less time for water to infiltrate, leading to more runoff. Explain how soil types like sand are more permeable than clay, allowing for better water absorption and less runoff.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none"> - Provide students with a few real-world hydrographs (with different shapes) and ask them to identify the key parts (baseflow, peak discharge, etc.). - Challenge them to discuss what each hydrograph might tell them about the rainfall event that caused it.
Closure	<ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading <ul style="list-style-type: none"> - https://water.weather.gov/ 3. Homework <ul style="list-style-type: none"> - Find a news report about a recent flooding event. See if you can find a hydrograph related to the event and explain what information it provides about the flood. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 32	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Students will be able to define a hydrograph. Students will be able to interpret the different parts of a hydrograph. Students will be able to explain how hydrographs help us understand streamflow patterns.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> Ask questions. <ul style="list-style-type: none"> What does the peak discharge on a hydrograph represent? How does the shape of the rising limb differ from the falling limb of a hydrograph? What information about a watershed can a hydrograph provide? Begin by asking students if they have ever seen a graph that shows water levels in a river or stream over time. Briefly introduce the concept of a hydrograph as a graphical representation of discharge (water flow) in a river or stream at a specific location over time. Show an image of a simple hydrograph with labeled axes (time and discharge). Ask students what information they can gather from this graph. Development (30 minutes) <ol style="list-style-type: none"> Components of a Hydrograph: Explain the key parts of a hydrograph: base flow, rising limb, peak discharge, falling limb, and return flow. Define each term and explain how they represent changes in streamflow following a precipitation event. Hydrograph Interpretation: Discuss how hydrographs can be used to understand the characteristics of a watershed, such as drainage area, vegetation cover, and soil type. Explain how a steeper rising limb indicates rapid runoff, while a gentler slope suggests slower infiltration. Applications of Hydrographs: Highlight the importance of hydrographs in various fields like flood prediction, water resource management, and



	<p>environmental monitoring. Briefly mention how hydrographs can help assess the impact of human activities on streamflow patterns.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Provide students with a few real-world hydrographs (different watersheds) and ask them to identify the different parts of the graph (base flow, peak discharge, etc.).- Encourage them to discuss what they can infer about the characteristics of each watershed based on the hydrograph.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://m.youtube.com/watch?v=HEKE_Ot9dSI3. Homework<ul style="list-style-type: none">- Research a specific flood event and find a corresponding hydrograph. Explain how the hydrograph helps us understand the event's severity and timing. <p>Spend 5 minutes to wrap up and consolidate the learnings</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 33	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Students will define flood frequency and recurrence interval through an interactive activity. b. Students will explain the importance of flood frequency studies for communities. c. Students will interpret basic flood frequency data using a simulation.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">Introduction (5 minutes)<ul style="list-style-type: none">Ask questions. Imagine flipping a coin. Heads represents a flood event, tails represent no flood. What is the chance of getting heads (flood) 3 times in a row? Why is understanding flood frequency important for people living near rivers? A "10-year flood" means there's a guaranteed flood every 10 years, right?Start with a quick brainstorming session: What are some dangers of floods? (Show pictures if needed)Introduce the concept of flood frequency studies as a way to predict the likelihood of future floods.Development (30 minutes)<ol style="list-style-type: none">Interactive Activity: Flood Frequency Simulation: Divide students into small groups. Provide each group with a bag containing colored marbles. Explain that the bag represents historical flood data for a river. Each color represents a different flood size. Have students take turns drawing marbles (without replacement) and record the results. After a set number of draws (e.g., 20), ask them to calculate the frequency of each flood size (number of times drawn divided by total draws). Discuss the concept of recurrence interval by relating it to the number of draws between similar sized floods (e.g., time between drawing red marbles).Real-World Data & Importance: Briefly introduce flood frequency data presented on a graph



	<p>(find a free image online). Explain the x-axis (flood discharge) and y-axis (recurrence interval). Discuss how this information helps communities make informed decisions (e.g., building placement, flood plain development).</p> <p>c. Group Discussion: Ask students to discuss the limitations of flood frequency studies (e.g., doesn't account for future climate changes). Briefly mention factors affecting flood frequency (e.g., rainfall patterns, land use changes).</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present a real-world scenario (e.g., a family is considering buying a house near a river).- Ask students to explain how flood frequency data can help them make an informed decision.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://www.fema.gov/flood-maps3. Homework<ul style="list-style-type: none">- Research a flood event in your local area or anywhere in the world. Explain the flood's impact and how understanding flood frequency might have been helpful in preparing for it. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 34	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Students will define flood frequency and recurrence interval. Students will interpret a basic flood frequency curve. Students will explain the limitations of using recurrence intervals.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> Ask questions. <p>Which type of precipitation is more likely to cause runoff: a light drizzle or a heavy downpour?</p> <p>How does vegetation affect runoff?</p> <p>What happens to runoff on a steep slope compared to a gentle slope?</p> Start with a picture of a flooded town. Ask students what challenges floods pose to communities. Briefly discuss the concept of flood prediction and introduce flood frequency studies as a more reliable way to understand flood risks. Development (30 minutes) <ol style="list-style-type: none"> Flood Frequency: Explain that floods are not random. Studying past flood events helps us estimate how often floods of different sizes (magnitudes) might occur in the future. This is called flood frequency. Recurrence Interval: Introduce the concept of recurrence interval as the average time between floods of a similar size. Emphasize that it's an average, not a guarantee. Flood Frequency Curve: Show a simplified flood frequency curve (discharge vs. recurrence interval) and explain how to interpret it. Highlight that higher discharge values have lower recurrence intervals (less likely). Exercise (5 minutes) – <ul style="list-style-type: none"> Show students two scenarios: Town A with limited development near a river and Town B with extensive development in the floodplain. Ask students to discuss, in pairs, which town would benefit more from flood frequency data and why.



Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://timeforgeography.co.uk/videos-list/rivers/floodplains/3. Homework<ul style="list-style-type: none">- Imagine you are a town planner. Research the flood history of your local area or a chosen location. Explain how flood frequency data would be used in planning for future development. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 35	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Students will define flood frequency and recurrence interval. b. Students will explain the importance of flood frequency studies for communities. c. Students will be able to interpret a basic flood frequency curve.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<p>1. Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions. What is the difference between flood frequency and recurrence interval? Why are flood frequency studies important for communities? A flood frequency curve shows the relationship between what two things? - Show an image of a flooded town. Ask students what the dangers of floods are and how communities might prepare. - Introduce the concept of flood frequency studies. Explain that these studies help us understand how often floods of different sizes might occur. <p>2. Development (30 minutes)</p> <ul style="list-style-type: none"> a. Flood Frequency vs. Recurrence Interval: Explain the difference. Flood frequency refers to how often floods of a certain size happen (e.g., every 50 years). Recurrence interval is the average time between those floods (e.g., a 50-year flood). b. Flood Frequency Data & Curves: Introduce the concept of historical data on flood heights or discharges. Explain how this data is used to create flood frequency curves, which show the probability of floods of different sizes occurring. c. Importance for Communities: Discuss how flood frequency studies help communities make informed decisions about: Land Use: Avoiding building critical infrastructure in high-risk flood zones. Flood Plain Management: Regulating development in floodplains to minimize damage. Emergency Preparedness: Planning for potential floods based on risk levels.



	<p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Show students a simplified flood frequency curve with discharge (flood size) on one axis and recurrence interval on the other.- Ask them to interpret the curve. For example, what size flood has a 1% chance of occurring in a given year?
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://m.youtube.com/watch?v=Fwn9W_ajV303. Homework<ul style="list-style-type: none">- Imagine your town is building a new park. Research the concept of Flood Insurance Rate Maps (FIRMs). Explain how FIRMs and flood frequency data can help choose a safe location for the park. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 36	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Students will be introduced to Gumbel's Method, a statistical technique for flood frequency analysis. b. Students will understand the concept of flood routing, predicting flood wave movement downstream.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. Briefly explain what a flood frequency analysis helps us determine. What does the term "flood routing" refer to in hydrology? Imagine a dam releases a large volume of water. How can flood routing be helpful downstream?- Briefly recap the concept of flood frequency studies and their importance.- Introduce the need for more advanced methods to analyse flood data for risk assessment and infrastructure design.2. Development (30 minutes)<ol style="list-style-type: none">a. Gumbel's Method: Explain that Gumbel's Method is a statistical approach used in flood frequency analysis. Introduce the concept of plotting annual flood data on a specific probability scale (Gumbel's plotting position). Briefly explain how this method helps estimate flood events with higher return periods (e.g., 100-year flood) Show a simplified example of a Gumbel plot.b. Flood Routing: Introduce the concept of flood routing - predicting how a flood wave moves downstream over time. Explain why flood routing is important for dam safety, flood forecasting, and designing levees. Briefly mention different methods of flood routing (e.g., simple hydrologic routing) without going into complex calculations.3. Exercise (5 minutes) –<ul style="list-style-type: none">- Present a scenario: A community is building a new bridge near a river. Why would understanding flood frequency and flood



	<p>routing be important for this project?</p> <ul style="list-style-type: none">- Ask students to discuss in pairs.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading<ul style="list-style-type: none">- https://water.weather.gov/3. Homework<ul style="list-style-type: none">- Research a specific example of a dam or levee project. Briefly describe the project and explain how flood frequency analysis and/or flood routing might have been used in the design process. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 37	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Students will be able to define flood routing. Students will be able to explain the importance of flood routing in flood management. Students will be able to identify different methods of flood routing.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> Ask questions. <ul style="list-style-type: none"> What is flood routing? Why is flood routing important in flood management? Name two methods of flood routing. Briefly introduce the concept of floods and their devastating impacts. Discuss the importance of flood management strategies. Introduce the concept of flood routing as a crucial tool in flood management. Development (30 minutes) <ol style="list-style-type: none"> Flood Routing Definition (5 minutes): <p>Define flood routing as the technique used to predict the movement and transformation of flood waves as they travel downstream in a river system.</p> <p>Use an analogy (e.g., traffic flow) to explain the concept in simpler terms.</p> Importance of Flood Routing (10 minutes): <p>Explain how flood routing helps predict flood peaks and arrival times at different locations along a river.</p> <p>Discuss the significance of this information in issuing flood warnings, evacuations, and taking necessary measures to minimize flood damage.</p> <p>Briefly mention the application of flood routing in designing dams, levees, and other flood control structures.</p> Methods of Flood Routing (15 minutes): <p>Introduce two common methods of flood routing:</p> <ul style="list-style-type: none"> Hydraulic Method: Briefly explain how this method uses the physical characteristics of the river channel and flow equations to calculate flood wave movement.



	<ul style="list-style-type: none"> • Muskingum Method: Briefly explain this simplified method that uses empirical relationships to estimate flood wave propagation. <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none"> - Present a scenario with a river system and basic flood wave data. - Ask students to identify how flood routing can be applied in this scenario to predict the flood wave's movement downstream.
Closure	<ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading <ul style="list-style-type: none"> - https://m.youtube.com/watch?v=thPV48SCXKM 3. Homework <ul style="list-style-type: none"> - Research and write a short report on a specific flood routing method (e.g., Muskingum method in detail) explaining its calculations and applications. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 38	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Students will be able to define flood routing and its importance in hydrology. b. Students will be able to differentiate between reservoir routing and channel routing. c. Students will be able to explain the basic principles behind flood routing methods.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. What is flood routing, and why is it important for water resource management? Briefly describe the two main types of flood routing. What kind of information is needed to perform flood routing calculations?- Begin by asking students if they have ever witnessed a flood. Briefly discuss the destructive impacts of floods.- Introduce the concept of flood routing as a method to predict how flood waves travel through a river system.- Explain the importance of flood routing in flood forecasting, reservoir operation, and designing flood protection structures.2. Development (30 minutes)<ol style="list-style-type: none">a. Reservoir Routing: Explain that reservoirs can store and regulate floodwaters. Introduce the concept of storage equation ($\text{Volume} = \text{Area} \times \text{Depth}$). Briefly discuss the Muskingum method (a simple technique) for reservoir routing.b. Channel Routing: Explain that flood waves change as they travel downstream due to factors like channel slope and friction. Introduce the concept of continuity equation ($\text{inflow} = \text{outflow} + \text{storage change}$). Briefly discuss the Muskingum-Cunge method (a more advanced technique) for channel routing.3. Exercise (5 minutes) –



	<ul style="list-style-type: none">- Present a simplified scenario of a flood wave entering a reservoir.- Provide students with basic data (inflow, initial storage, etc.) and guide them through calculating the outflow using the storage equation.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://www.usbr.gov/tsc/techreferences/mands/manuals.html3. Homework<ul style="list-style-type: none">- Research and explain the differences between the Muskingum and Muskingum-Cunge methods for flood routing. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, why, who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 39	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> a. Students will define flood routing and its importance in flood management. b. Students will explain the two main types of flood routing: channel routing and reservoir routing. c. Students will be able to identify the factors affecting flood wave propagation.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. Chalk and talk
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. What is flood routing, and why is it important? What are the two main types of flood routing? Briefly describe one factor that affects flood wave propagation. - Begin by asking students if they have ever witnessed a flood. Briefly discuss the dangers and impacts of floods. - Introduce the concept of flood routing as a method to predict the movement and transformation of flood waves downstream. - Explain how flood routing helps in flood management by allowing us to forecast peak flow rates and flood arrival times at different locations. 2. Development (30 minutes) <ol style="list-style-type: none"> a. Channel Routing: Explain that channel routing predicts how a flood wave travels through a river channel. Discuss the factors affecting flood wave propagation, such as channel slope, roughness, and geometry. Briefly introduce different channel routing methods (e.g., Muskingum method, kinematic wave method) without going into complex calculations. b. Reservoir Routing: Explain that reservoir routing predicts how a flood wave behaves as it passes through a reservoir. Discuss the storage effects of reservoirs on flood peaks and how they can mitigate downstream flooding. Briefly introduce the concept of storage equation and its use in reservoir routing.



	<p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present a simplified scenario of a flood wave entering a river channel.- Divide students into groups and ask them to discuss the factors that would influence the movement of the flood wave downstream.- Encourage them to consider factors like channel slope and presence of obstacles.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://www.noaa.gov/3. Homework<ul style="list-style-type: none">- Research and explain the concept of a unit hydrograph and its role in flood routing. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 40	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Students will define flood routing and its importance in hydrology. b. Students will explain the two main types of flood routing: channel routing and reservoir routing. c. Students will be able to identify the factors affecting flood wave propagation.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">Introduction (5 minutes)<ul style="list-style-type: none">Ask questions. What is flood routing, and why is it important for water resource management? Differentiate between channel routing and reservoir routing. Describe two factors that influence how a flood wave travels through a river channel.Briefly discuss the concept of floods and their potential dangers.Introduce the concept of flood routing as a method to predict how flood waves move downstream.Highlight the importance of flood routing for flood forecasting, dam operations, and designing flood protection measures.Development (30 minutes)<ol style="list-style-type: none">Channel Routing: Explain that channel routing predicts how a flood wave changes as it travels through a river channel. Discuss the factors affecting channel routing, such as channel slope, geometry (width and depth), and roughness. Briefly mention different methods of channel routing (e.g., Muskingum method, kinematic wave method).Reservoir Routing: Define reservoir routing as the process of predicting how a flood wave changes as it passes through a reservoir. Discuss the storage function of a reservoir and its impact on the flood wave. Introduce the concept of inflow and outflow hydrographs in reservoir routing.Exercise (5 minutes) –



	<ul style="list-style-type: none">- Present a simplified scenario involving a flood wave traveling through a river channel.- Ask students to identify the factors that would influence the peak flow and travel time of the flood wave.- Alternatively, provide a basic example of inflow and outflow hydrographs for a reservoir and ask students to explain the resulting change in the flood wave.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://waterdata.usgs.gov/nwis/rt3. Homework<ul style="list-style-type: none">- Research and describe a real-world example of how flood routing is used in flood management practices. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 41	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Students will be able to define flood routing and its importance in hydrology. b. Students will be able to explain the two main types of flood routing: channel routing and reservoir routing. c. Students will be able to identify the factors affecting flood wave propagation.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. What is flood routing, and why is it important for water resource management? Differentiate between channel routing and reservoir routing. Describe two factors that influence how a flood wave travels through a river channel. - Briefly discuss the concept of floods and their devastating impacts. - Introduce the concept of flood routing as a method to predict how flood waves move downstream. - Highlight the importance of flood routing in flood forecasting and warning systems. 2. Development (30 minutes) <ol style="list-style-type: none"> a. Channel Routing: Explain how flood waves travel through river channels, considering wave celerity and attenuation. Briefly introduce the Muskingum method (simple explanation) as a common technique for channel routing. b. Reservoir Routing: Discuss the concept of reservoir storage and its impact on flood waves. Introduce the storage equation and the continuity equation used in reservoir routing. c. Factors Affecting Flood Wave Propagation: Discuss the influence of channel geometry (slope, roughness) on flood wave movement. Briefly mention the effect of tributaries and floodplain storage



	<p>on flood wave behavior.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present a simple scenario with a river channel and a known inflow hydrograph.- Ask students to qualitatively predict how the flood wave will change downstream (peak discharge, time of arrival).
Closure	<p>1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>2. Suggested Reading https://m.youtube.com/watch?v=pHFQu3BszmU</p> <p>3. Homework</p> <ul style="list-style-type: none">- Research and describe a real-world example of flood routing application (e.g., dam operation during a flood event). <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<p>1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.</p> <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 42	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Students will be able to define flood routing. b. Students will be able to explain the importance of flood routing in flood management. c. Students will be able to differentiate between reservoir routing and channel routing.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<p>1. Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions. What is flood routing? Why is flood routing important in flood management? Briefly describe the difference between reservoir routing and channel routing. - Briefly discuss the negative impacts of floods. - Introduce the concept of flood routing as a tool used to predict how flood waves travel through a river system. - Mention the two main types of flood routing: reservoir routing and channel routing. <p>2. Development (30 minutes)</p> <ul style="list-style-type: none"> a. Reservoir Routing (10 minutes): Explain that reservoir routing predicts flood wave behavior within a reservoir. Discuss the storage equation (Inflow - Outflow = Change in Storage) used in reservoir routing. Briefly mention different methods of reservoir routing (graphical, analytical) without going into complex calculations. b. Channel Routing (10 minutes): Explain that channel routing predicts flood wave behavior as it travels along a river channel. Discuss the concept of wave propagation and the factors affecting it (slope, channel geometry, roughness). Briefly mention different methods of channel routing (Muskingum method, kinematic wave method) without complex equations. c. Importance of Flood Routing (10 minutes): Discuss how flood routing helps predict flood peaks and arrival times at downstream locations. Explain how this information is crucial for issuing flood



	<p>warnings and implementing flood management strategies (evacuation, dam operation). Briefly mention the use of flood routing models in flood risk assessment and mitigation planning.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present a simplified scenario with an inflow hydrograph into a reservoir.- Ask students to predict how the outflow hydrograph would be different from the inflow hydrograph (consideration of storage).- Discuss the concept of peak attenuation and time lag due to reservoir storage.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://www.youtube.com/watch?v=LOcT0azrY3w3. Homework<ul style="list-style-type: none">- Find a news report about a recent flooding event. See if you can find a hydrograph related to the event and explain what information it provides about the flood. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 43	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> a. Students will be able to define irrigation and its importance in agriculture. b. Students will be able to identify the main components of an irrigation system. c. Students will be able to explain the different methods of irrigation.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. Chalk and talk
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. What is irrigation, and why is it crucial for agricultural production? Name three essential components of a typical irrigation system. Briefly describe two different methods of irrigation and their advantages/disadvantages. - Begin by discussing the importance of water in plant growth and the challenges of relying solely on rainfall. - Introduce the concept of irrigation as the artificial application of water for agricultural purposes. - Briefly highlight the benefits of irrigation, such as increased crop yields and reduced dependence on weather patterns. 2. Development (30 minutes) <ol style="list-style-type: none"> a. Components of an Irrigation System: Explain the functions of key components like water source (rivers, wells, canals), conveyance structures (canals, pipes), and application structures (sprinklers, drip irrigation systems). b. Irrigation Methods: Discuss different methods like surface irrigation (flood, furrow), sprinkler irrigation, and drip irrigation. Highlight the advantages and disadvantages of each method (water efficiency, cost, suitability for crops). c. Water Requirements for Crops: Introduce the concept of evapotranspiration (ET) and its role in determining irrigation needs. Briefly explain how factors like climate, soil type, and crop stage influence ET rates.



	<p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present a scenario with a specific crop and its growing conditions (climate, soil type).- Ask students to choose an appropriate irrigation method based on the information presented.
Closure	<p>1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>2. Suggested Reading http://www.climasouth.eu/sites/default/files/FAO%2056.pdf</p> <p>3. Homework</p> <ul style="list-style-type: none">- Research a specific irrigation technology (e.g., precision irrigation) and explain its benefits and potential drawbacks. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<p>1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.</p> <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 44	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Students will be able to define irrigation and its importance in agriculture. b. Students will be able to differentiate between various types of irrigation systems based on water application methods. c. Students will be able to explain the advantages and disadvantages of common irrigation systems.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">Introduction (5 minutes)<ul style="list-style-type: none">Ask questions. What is irrigation, and why is it essential for sustainable agriculture? Describe two different methods for applying water in irrigation systems. Identify one advantage and one disadvantage of a center pivot irrigation system.Begin by discussing the importance of water for plant growth and the challenges of relying solely on rainfall.Introduce the concept of irrigation as a way to provide supplemental water to crops.Briefly highlight the impact of irrigation on food security and global agriculture.Development (30 minutes)<ol style="list-style-type: none">Types of Irrigation Systems: Explain the difference between traditional methods (flood irrigation) and modern systems. Discuss three main irrigation methods based on water application:<ul style="list-style-type: none">Surface irrigation (e.g., gravity flow, furrow)Sprinkler irrigation (e.g., center pivot, traveling guns)Micro-irrigation (e.g., drip irrigation)Advantages and Disadvantages: Briefly compare and contrast the water efficiency, cost, and labor requirements of each system. Discuss factors influencing the choice of irrigation system (e.g., crop type, soil conditions, topography).



	<p>c. Sustainability in Irrigation: Briefly introduce the concept of water conservation in agriculture. Mention the importance of selecting appropriate irrigation systems for efficient water use.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present pictures or diagrams of different irrigation systems.- Ask students to identify the system type and explain its potential benefits and drawbacks for a specific crop.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://directives.sc.egov.usda.gov/17837.wba3. Homework<ul style="list-style-type: none">- Research a specific irrigation system (e.g., drip irrigation) and create a short presentation highlighting its technology, benefits, and potential applications. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 45	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Students will define the concept of water requirement in plants. Students will explain the factors affecting a crop's water needs. Students will identify methods for estimating crop water requirements.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. What is the difference between transpiration and evaporation in plants? List two factors that can increase a crop's water requirement. Briefly describe one method for estimating a crop's water needs. - What is the difference between transpiration and evaporation in plants? - List two factors that can increase a crop's water requirement. - Briefly describe one method for estimating a crop's water needs. Development (30 minutes) <ol style="list-style-type: none"> Factors Affecting Water Requirement: Explain the role of transpiration (plant water loss) in water requirement. Discuss how environmental factors like temperature, humidity, and wind speed influence transpiration rates. Briefly mention the impact of plant growth stage and crop variety on water needs. Methods for Estimating Water Requirement: Introduce the concept of evapotranspiration (combined water loss from soil and plants). Explain how reference evapotranspiration (ET_o) data can be used for estimating crop water needs. (Simple explanation, avoid complex formulas) Briefly mention the concept of crop coefficients (K_c) used to adjust ET_o for specific crops. Importance of Water Management: Discuss the importance of efficient water management in



	<p>agriculture to conserve water resources. Briefly mention irrigation practices that can optimize water use (e.g., drip irrigation).</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present a scenario with a specific crop and environmental conditions (temperature, humidity).- Ask students to predict if the crop's water requirement will be high or low and explain their reasoning (based on factors discussed).
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://www.fao.org/3/t0231e/t0231e0c.htm3. Homework<ul style="list-style-type: none">- Research a specific water-saving irrigation technique used in agriculture and create a short presentation on its benefits and limitations. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 46	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Students will be able to define the purpose and function of canals. Students will be able to identify the key components of a canal system. Students will understand the basic principles considered during canal design.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> Ask questions. <ul style="list-style-type: none"> What are the main purposes for which canals are built? What are the different components of a typical canal system? Name two important factors to consider when designing the capacity of a canal. What are the main purposes for which canals are built? What are the different components of a typical canal system? Name two important factors to consider when designing the capacity of a canal. Development (30 minutes) <ol style="list-style-type: none"> Canal Components: List and explain the functions of key canal components: headworks, canal section, lining, control structures, and drainage ditches. Canal Capacity Design: Introduce the concept of canal capacity (flow rate) and its relation to water demand. Discuss factors affecting canal capacity such as: <ul style="list-style-type: none"> Design discharge (amount of water to be delivered) Slope of the canal bed Roughness of the canal lining Canal Design Considerations: Briefly mention other important design aspects: <ul style="list-style-type: none"> Alignment (minimizing bends and curves) Sedimentation control Maintenance access Exercise (5 minutes) –



	<ul style="list-style-type: none">- Present a simplified scenario with a specific water demand for an agricultural area.- Ask students to brainstorm and discuss the factors they would consider when designing a canal to meet this demand.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://www.usbr.gov/tsc/techreferences/designstandards-datacollectionguides/designstandards.html3. Homework<ul style="list-style-type: none">- Research a specific type of canal (e.g., irrigation canal, navigation canal) and create a diagram with labeled components. Briefly explain the design considerations specific to that canal type. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 47	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Students will be able to define the purpose and function of canals. Students will be able to identify the key components of a canal system. Students will understand the basic principles involved in designing a canal.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> Ask questions. What are the main purposes for which canals are built? Name three essential components of a typical canal system. Briefly explain one factor to consider when designing the capacity of a canal. Begin by showing a picture or video of a well-known canal (e.g., Panama Canal, Suez Canal). Discuss the historical and modern significance of canals for transportation and irrigation. Introduce the concept of canal design as the process of planning and building a canal to meet specific needs. Development (30 minutes) <ol style="list-style-type: none"> Canal Components: Briefly explain the functions of the following: headworks, canal section (bed, banks, lining), and tailworks. Canal Capacity Design: Introduce the concept of canal capacity (flow rate) and its relation to water demand. Discuss factors influencing capacity, such as slope, roughness, and cross-sectional area. Canal Design Considerations: Briefly mention the importance of factors like soil type, water availability, and environmental impact during design. Exercise (5 minutes) – <ul style="list-style-type: none"> Present a simplified scenario with a specific water demand and terrain characteristics.



	<ul style="list-style-type: none">- Ask students to brainstorm key design considerations for a canal to meet that demand.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://www.asce.org/membership3. Homework<ul style="list-style-type: none">- Research a specific type of canal (e.g., irrigation canal, navigation canal) and create a short presentation highlighting its design features. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 48	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Students will be able to explain the purpose and benefits of canal lining. b. Students will be able to identify different types of canal linings and their properties. c. Students will be able to discuss the factors considered when choosing a canal lining material.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. Why is lining used in canals, and what are some benefits of lining canals? Describe two different types of canal linings. What are some factors to consider when selecting a material for canal lining? - Briefly discuss the importance of canals in water resource management and irrigation. - Introduce the concept of canal lining and its role in reducing water loss and improving canal efficiency. - Show an image or video of a lined canal and an unlined canal for comparison. 2. Development (30 minutes) <ol style="list-style-type: none"> a. Functions of Canal Lining: Explain how canal lining reduces water loss through seepage and evaporation. Discuss the impact of lining on canal maintenance and sediment control. b. Types of Canal Linings: Introduce common lining materials like concrete, geomembranes (plastic sheets), and clay tiles. Briefly discuss the advantages and disadvantages of each type of lining. c. Selection of Canal Lining Materials: Explain how factors like soil type, water flow rate, and budget influence the choice of lining material. Briefly mention the importance of considering environmental



	<p>impact and long-term durability.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present a scenario describing a specific canal project with given conditions (soil, flow rate).- Ask students to discuss, in small groups, which type of canal lining they would recommend and justify their choice.
Closure	<p>1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>2. Suggested Reading https://www.fao.org/documents/card/en?details=f8608163-75f8-59b4-a560-398ca7855f00</p> <p>3. Homework</p> <ul style="list-style-type: none">- Research and report on a specific case study of a canal lining project, highlighting the chosen lining material and its benefits. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<p>1. Reflective Questions (What, why, Who?). Allow students to answer and discuss.</p> <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 49	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Students will be able to define flow nets and their importance in dam design. Students will understand the concepts behind Bligh's theory and Khosla's theory. Students will be able to identify the key differences and applications of these theories.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. What is a flow net, and how does it help analyze seepage below a dam? Briefly explain the principle behind Bligh's creep line theory. How does Khosla's theory differ from Bligh's theory in terms of pressure distribution? - What is a flow net, and how does it help analyze seepage below a dam? - Briefly explain the principle behind Bligh's creep line theory. - How does Khosla's theory differ from Bligh's theory in terms of pressure distribution? Development (30 minutes) <ol style="list-style-type: none"> Bligh's Creep Line Theory: Explain the concept of the creep line (phreatic line) and its significance in dam stability. Discuss the assumptions and limitations of Bligh's theory. Briefly mention the concept of the uplift pressure and its relation to the creep line. Khosla's Theory (Theory of Course of Flow): Introduce Khosla's concept of a flow net with no uplift pressure. Explain the idea of the lane of creep and its role in pressure distribution. Compare and contrast the pressure distribution assumptions in Bligh's and Khosla's theories. Applications and Considerations: Discuss the suitability of each theory for different dam designs



	<p>and foundation conditions. Briefly mention the importance of considering factors like soil properties and pore pressure.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present a simplified diagram of a dam foundation.- Ask students to sketch the expected phreatic line for both Bligh's and Khosla's theories on the diagram.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://www.cbip.org/index.html3. Homework<ul style="list-style-type: none">- Research a real-world dam project and identify the flow net theory likely used in its design. Explain your reasoning. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 50	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: <ol style="list-style-type: none"> Students will be able to define water logging and its causes. Students will be able to explain the different impacts of water logging. Students will be able to identify potential solutions for managing water logging.
Teaching Aids (if any)	<ol style="list-style-type: none"> Chalk and talk
Teaching Development	<ol style="list-style-type: none"> Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions. What is water logging, and what are the main factors that cause it? Describe two negative consequences of water logging on the environment or agriculture. Briefly mention one strategy for preventing or mitigating water logging. - Begin by showing an image or video depicting a waterlogged area. - Ask students to brainstorm what water logging means and its potential effects. - Introduce the term "water logging" and its significance. Development (30 minutes) <ol style="list-style-type: none"> Causes of Water Logging: Discuss factors like poor drainage, rising water tables, and excessive irrigation. Briefly mention the role of urbanization and deforestation in some cases. Impacts of Water Logging: Explain how water logging can harm crops by affecting root respiration and nutrient uptake. Discuss the negative effects on infrastructure and property damage. Briefly mention potential health issues associated with stagnant water. Solutions for Water Logging: Introduce improved drainage systems (e.g., canals, ditches) as a primary solution.



	<p>Discuss the importance of water conservation practices in agriculture. Briefly mention strategies like rainwater harvesting and permeable pavements.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Divide students into groups and present a scenario with a waterlogged area.- Ask each group to brainstorm and suggest potential solutions to address the problem.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading https://www.iwmi.cgiar.org/publications/iwmi-research-reports/3. Homework<ul style="list-style-type: none">- Research a specific case study of water logging in a particular region.- Briefly describe the causes, impacts, and any implemented solutions. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 51	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Students will be able to define water logging and its causes. b. Students will be able to explain the negative impacts of water logging on the environment and society. c. Students will be able to identify potential solutions and preventative measures for water logging.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. What is water logging, and what are the main causes of this phenomenon? Describe two negative impacts of water logging on the environment. Briefly mention one strategy to prevent water logging in an urban area.- Start with a picture or video showcasing a waterlogged area.- Ask students to describe what they see and discuss the challenges faced in such situations.- Introduce the term "water logging" and its significance.2. Development (30 minutes)<ol style="list-style-type: none">a. Causes of Water Logging: Explain how inadequate drainage, rising water tables, and excessive irrigation contribute to water logging. Briefly mention the role of urbanization and soil compaction.b. Impacts of Water Logging: Discuss the negative effects of water logging on plant growth and soil health. Explain how water logging can lead to the spread of waterborne diseases and damage infrastructure.c. Solutions and Prevention: Introduce strategies like improved drainage systems, rainwater harvesting, and permeable pavements. Briefly discuss the importance of maintaining natural drainage channels and promoting responsible water use.3. Exercise (5 minutes) –



	<ul style="list-style-type: none">- Divide the class into groups and present them with a scenario (e.g., a new development project in a low-lying area).- Each group has to brainstorm solutions to prevent water logging in that scenario.
Closure	<ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading http://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0718-583920150003000063. Homework<ul style="list-style-type: none">- Research a specific case study of a region facing water logging issues.- Briefly describe the causes and impacts, and propose potential solutions. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 52	Course Name: Hydrology And Irrigation Engineering	Course No.: CE-601
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Objectives	At the end of the lesson the student shall be able to: a. Students will be able to define water logging and its causes. b. Students will be able to explain the negative impacts of water logging on the environment and society. c. Students will be able to identify potential solutions for mitigating water logging.
Teaching Aids (if any)	a. Chalk and talk
Teaching Development	<ol style="list-style-type: none">1. Introduction (5 minutes)<ul style="list-style-type: none">- Ask questions. What is water logging, and what are the main factors that cause it? Describe two negative consequences of water logging on the environment. Briefly mention one strategy for preventing or reducing water logging.- Begin with a quick discussion on the importance of healthy soil and drainage.- Introduce the concept of water logging as a condition of excessive water saturation in the soil.- Briefly highlight the growing concern of water logging in various parts of the world.2. Development (30 minutes)<ol style="list-style-type: none">a. Causes of Water Logging: Explain how factors like poor drainage, rising water tables, and excessive irrigation contribute to water logging. Briefly mention the role of urbanization and land-use changes in hindering natural drainage.b. Impacts of Water Logging: Discuss the negative effects of water logging on soil fertility and crop production. Explain how water logging can lead to problems like salinization and increased mosquito breeding.c. Solutions for Water Logging: Introduce the concept of improved drainage systems (e.g., canals, ditches). Discuss the importance of water management practices like



	<p>rainwater harvesting and controlled irrigation. Briefly mention the potential of using water-tolerant plant species in affected areas.</p> <p>3. Exercise (5 minutes) –</p> <ul style="list-style-type: none">- Present students with a scenario of a region experiencing water logging.- Ask them to brainstorm and suggest potential solutions to address this issue.
Closure	<p>1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>2. Suggested Reading https://www.internationaljournals.org/IJAES/current-issue.html</p> <p>3. Homework</p> <ul style="list-style-type: none">- Research a specific case study of water logging in a particular region.- Briefly explain the causes, impacts, and any implemented solutions for this case. <p>Spend 5 minutes to wrap up and consolidate the learnings.</p>
Evaluation	<p>1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.</p> <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>