Department of CIVIL ENGINEERING

Details of Lesson Plan

S.No.	Particulars	Details
1.	Course Name	Urban Transportation Planning
2.	Course Code	CE-503
3.	Academic Year	2024-25
4.	Semester	5TH
5.	Number of Lesson plans	50
6.	Faculty Assigned	Abhijeet Singh

Faculty Signature

Lesson Plan No. 1	Course Name: Urban Transportation Planning Transportation Planning Process	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Define transportation planning and its importance. b. Identify the key stages in the transportation planning process. c. Understand the factors considered in transportation planning
Teaching Aids (if any)	a. Video of NPTEL b. PPT
Teaching Development	**Introduction (5 minutes):** • Begin by asking students about their daily commute. What challenges do they face? What would make their transportation experience better? • Briefly introduce the concept of transportation planning as the process of creating efficient and sustainable transportation systems for people and goods. **Development (30 minutes):** 1. **Why Transportation Planning? (10 minutes):** o Discuss the increasing demand for transportation due to population growth and urbanization. o Highlight the challenges associated with inefficient transportation systems, such as traffic congestion, air pollution, and safety concerns. o Introduce the benefits of effective transportation planning, including improved mobility, reduced costs, and environmental sustainability. 2. **Stages of Transportation Planning Process (10 minutes):** o Explain that transportation planning is a cyclical process with several key stages: ▪ **Data Collection and Analysis:** Gather information on existing transportation systems, travel patterns, demographics, and land use. ▪ **Problem Identification and Prioritization:** Identify key transportation issues and prioritize areas for improvement. ▪ **Developing and Evaluating Alternatives:** Propose different solutions (e.g., public transport expansion, road improvements, pedestrian infrastructure) and analyze their potential impact. ▪ **Selection and Implementation:** Choose the most effective and feasible solution and implement it through construction, policy changes, or public awareness

	campaigns. ▪ **Monitoring and Evaluation:** Track the performance of the implemented solution and make adjustments as needed. 3. **Factors Considered in Transportation Planning (10 minutes):** o Discuss some key factors that transportation planners consider: ▪ **Demand:** Analyzing traffic patterns, travel needs, and population growth projections. ▪ **Capacity:** Assessing the existing infrastructure's ability to handle traffic flow. ▪ **Safety:** Designing transportation systems to minimize accidents and ensure safety for all users. ▪ **Accessibility:** Ensuring everyone has access to reliable and convenient transportation options. ▪ **Environmental Impact:** Minimizing air pollution, noise pollution, and energy consumption. ▪ **Economic Development:** Supporting economic growth by providing efficient transportation for businesses and communities. **Exercise (5 minutes):** 1. What is the main goal of transportation planning? 2. What are some of the challenges faced by inefficient transportation systems? 3. List three stages involved in the transportation planning process. **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading • https://planrva.org/transportation/ • https://highways.dot.gov/ 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. 2	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of evaluation as a decision-making process. b. Identify different types of evaluation. c. Differentiate between objective and subjective evaluation criteria
Teaching Aids (if any)	a. Videos of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Begin with a thought-provoking question: "How do you decide which movie to watch, which college to attend, or which job to accept?" • Introduce the concept of evaluation as a process of assessing options to make informed choices. • Explain that this lesson will explore the basics of evaluation and decision-making. **Development (30 minutes):** 1. **What is Evaluation? (10 minutes):** o Define evaluation as a systematic process of determining the merit, worth, or significance of something. o Explain that evaluation involves gathering and analyzing information to make informed judgments. o Provide examples of evaluation in everyday life (e.g., choosing a product, selecting a job). 2. **Types of Evaluation (10 minutes):** o Introduce different types of evaluation: ▪ **Formative Evaluation:** Ongoing assessment to improve a process or product. ▪ **Summative Evaluation:** Final judgment on the value or worth of something. ▪ **Normative Evaluation:** Comparing something to a standard or benchmark. ▪ **Summative Evaluation:** Evaluating based on personal preferences or values. o Discuss the strengths and weaknesses of each type of evaluation. 3. **Evaluation Criteria (10 minutes):**

	○ Explain that evaluation criteria are the standards or factors used to make judgments. ○ Differentiate between objective and subjective criteria. ○ Provide examples of objective criteria (e.g., price, size, weight) and subjective criteria (e.g., style, comfort, personal preference). ○ Emphasize the importance of considering both objective and subjective criteria when making decisions. **Quiz (5 minutes):** 1. Define evaluation in your own words. 2. What is the difference between formative and summative evaluation? 3. Give an example of an objective and a subjective criterion for choosing a smartphone. **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of trip generation and its importance in transportation planning. b. Identify the factors influencing trip generation. c. Learn about different trip generation models.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about daily travel patterns and factors influencing travel decisions. • Introduce the concept of trip generation as the first step in transportation planning. • Emphasize the importance of understanding travel behavior for effective transport system planning. **Development (30 minutes):** 1. **What is Trip Generation? (10 minutes):** • Define trip generation as the process of determining the number of trips originating from or terminating at a particular zone. • Explain the difference between trip production and trip attraction. • Discuss the significance of trip generation in estimating overall travel demand. 2. **Factors Affecting Trip Generation (10 minutes):** • Identify key factors influencing trip generation, such as: o Socioeconomic characteristics (household size, income, car ownership) o Land use patterns (residential, commercial, industrial) o Accessibility to public transport o Time of day o Day of week • Explain how these factors interact to influence travel behavior. 3. **Trip Generation Models (10 minutes):**

	• Introduce different types of trip generation models:
	  ○ Home-based models
	  ○ Non-home-based models
	  ○ Combined models
	• Briefly explain the basic principles of each model type.
	• Discuss the importance of calibration and validation of trip generation models.
	
	Quiz (5 minutes):
	
	1. Define trip generation in transportation planning.
	2. Name two factors that influence trip generation.
	3. What is the difference between trip production and trip attraction?
	
	Reference URLs:
	
	• https://planrva.org/transportation/
	• https://highways.dot.gov/
	
	YouTube Video Reference:
	
	• https://www.youtube.com/watch?v=suTYujyKiwA

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 4	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the different types of trips generated in a transportation system. b. Learn about the factors influencing trip generation. c. Explore various trip generation models and their applications
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Recap the concept of trip generation introduced in the previous lesson. • Emphasize the importance of understanding trip generation patterns for effective transportation planning. • Introduce the different types of trips generated in a transportation system. **Development (30 minutes):** 1. **Types of Trips (10 minutes):** ○ Differentiate between home-based and non-home-based trips. ○ Explain the significance of trip purpose (e.g., work, shopping, leisure). ○ Discuss the concept of trip frequency and duration. ○ Introduce the idea of person trips and vehicle trips. 2. **Factors Affecting Trip Generation (10 minutes):** ○ Delve deeper into the socioeconomic factors influencing trip generation (income, household size, car ownership). ○ Explain the role of land use patterns (residential, commercial, industrial) in generating trips. ○ Discuss the impact of transportation facilities (public transit availability, road network) on trip generation. 3. **Trip Generation Models (10 minutes):** ○ Focus on specific trip generation models (e.g., linear regression, gravity model). ○ Explain the basic principles and assumptions of these models. ○ Discuss the importance of data collection and calibration for model development. ○ Highlight the limitations of trip generation models and the need for continuous refinement. **Reference URLs:**

	• https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 5	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Define transportation planning and its importance. b. Identify the key stages in the transportation planning process. c. Understand the factors considered in transportation planning
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Objectives:** • Understand the different types of trips generated in a transportation system. • Learn about the factors influencing trip generation. • Explore various trip generation models and their applications. **Introduction (5 minutes):** • Recap the concept of trip generation introduced in the previous lesson. • Emphasize the importance of understanding trip generation patterns for effective transportation planning. • Introduce the different types of trips generated in a transportation system. **Details of the Lesson (30 minutes):** 1. **Types of Trips (10 minutes):** o Differentiate between home-based and non-home-based trips. o Explain the significance of trip purpose (e.g., work, shopping, leisure). o Discuss the concept of trip frequency and duration. o Introduce the idea of person trips and vehicle trips. 2. **Factors Affecting Trip Generation (10 minutes):** o Delve deeper into the socioeconomic factors influencing trip generation (income, household size, car ownership). o Explain the role of land use patterns (residential, commercial, industrial) in generating trips. 3. **Trip Generation Models (10 minutes):** o Focus on specific trip generation models (e.g., linear regression, gravity model). o Explain the basic principles and assumptions of these models.

	○ Discuss the importance of data collection and calibration for model development. ○ Highlight the limitations of trip generation models and the need for continuous refinement. **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz on Cloud Computing Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 6	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the basic principles of highway geometric design. b. Identify the key elements of highway cross-section. c. Explain the importance of sight distance in highway design.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about road accidents and their causes. • Introduce the concept of highway geometric design as a tool to improve road safety and efficiency. • Highlight the importance of well-designed highways for smooth traffic flow. **Development(30 minutes):** 1. **Basic Principles of Highway Design (10 minutes):** o Discuss the importance of design speed in determining highway geometric elements. o Explain the concept of functional classification of highways (arterial, collector, local). o Introduce the role of traffic volume and land use in highway design. 2. **Highway Cross-Section Elements (10 minutes):** o Explain the components of a typical highway cross-section: ▪ Pavement surface ▪ Shoulders ▪ Median/divider ▪ Ditches ▪ Side slopes o Discuss the design considerations for each element. 3. **Sight Distance (10 minutes):** o Define sight distance and its importance in highway safety. o Differentiate between stopping sight distance and overtaking sight distance. o Explain the factors affecting sight distance (e.g., design speed, vertical curves).

	Reference URLs: • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 7	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the components of a highway cross-section. b. Learn the functions of different elements in a highway cross-section. c. Analyze the factors affecting the design of highway cross-sections.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Start with a discussion about the importance of road safety and efficiency. • Introduce the concept of a highway cross-section as a vertical slice of a highway. • Explain how understanding the components of a highway cross-section is crucial for effective highway design. **Development (30 minutes):** 1. **Components of a Highway Cross-Section (10 minutes):** o Explain the basic elements of a highway cross-section: ▪ Pavement: types (rigid, flexible), thickness, materials. ▪ Shoulders: width, type, function. ▪ Median/divider: types (raised, depressed), width, safety features. ▪ Ditches: purpose, design, and maintenance. ▪ Side slopes: design considerations, stability, and vegetation. 2. **Design Considerations (10 minutes):** o Discuss the factors affecting the design of highway cross-section elements: ▪ Traffic volume and design speed. ▪ Terrain and soil conditions. ▪ Drainage requirements. ▪ Environmental considerations. ▪ Safety standards. o Explain how these factors influence the dimensions and materials used in the cross-section.

	3.**Cross-Section Design for Different Highway Types (10 minutes):** o Briefly discuss the variations in cross-section design for different highway types (urban, rural, expressway). o Highlight the importance of considering the surrounding environment and land use in cross-section design. **Quiz (5 minutes):** 1. What are the main components of a highway cross-section? 2. Why is the width of shoulders important in highway design? 3. What factors influence the design of a median? **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 8	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of sight distance in highway design. b. Differentiate between various types of sight distances. c. Explain the importance of sight distance in ensuring road safet
Teaching Aids (if any)	a. Video of NPTEL
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about road accidents caused by poor visibility. • Introduce the concept of sight distance as the distance visible to a driver under specific conditions. • Highlight the importance of adequate sight distance for safe driving. **Developmen (30 minutes):** 1. **Stopping Sight Distance (10 minutes):** ○ Define stopping sight distance as the minimum distance required for a driver to perceive an obstacle, react, and stop the vehicle before a collision. ○ Discuss the factors affecting stopping sight distance (e.g., design speed, reaction time, friction coefficient). ○ Explain the concept of perception-reaction time and braking distance. 2. **Overtaking Sight Distance (10 minutes):** ○ Define overtaking sight distance as the minimum distance required for a driver to safely overtake a slower vehicle. ○ Explain the components of overtaking sight distance (safe passing sight distance, minimum sight distance). ○ Discuss the factors affecting overtaking sight distance (e.g., design speed, vehicle characteristics, road geometry). 3. **Other Sight Distances (10 minutes):** ○ Briefly introduce other types of sight distances (e.g., intersection sight distance, curve sight distance). ○ Explain the importance of these sight distances in specific road design situations. ○ Discuss the relationship between different types of sight distances. **Quiz (5 minutes):** 1. What is stopping sight distance?

	2. What are the two components of overtaking sight distance? 3. Why is sight distance important in highway design? **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 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. 9	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of horizontal alignment in highway design. b. Identify the basic elements of horizontal alignment. c. Explain the importance of design speed in horizontal alignment.
Teaching Aids (if any)	a. Video of NPTEL
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about winding roads and their impact on driving experience and safety. • Introduce the concept of horizontal alignment as the geometric design of a road in the horizontal plane. • Highlight the importance of proper horizontal alignment for smooth traffic flow and accident prevention. **Development (30 minutes):** 1. **Elements of Horizontal Alignment (10 minutes):** • Define key terms like tangent, curve, simple curve, compound curve, and reverse curve. • Explain the concept of superelevation and its role in highway design. • Discuss the importance of transition curves in connecting tangents and curves. 2. **Design Considerations (10 minutes):** • Explain the factors affecting the design of horizontal alignment (e.g., design speed, terrain, traffic volume). • Discuss the relationship between radius of curvature and design speed. • Introduce the concept of minimum radius of curvature. 3. **Design Standards (10 minutes):** • Briefly discuss the role of design standards in ensuring highway safety. • Mention common design standards used in highway engineering (e.g., AASHTO, IRC). • Explain the importance of adhering to design standards for consistent and safe road design.

	Quiz (5 minutes): 1. What is the difference between a simple curve and a compound curve? 2. Why is superelevation provided on horizontal curves? 3. What is the significance of design speed in horizontal alignment?**Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 5. Homework 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. 10	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of vertical alignment in highway design. b. Identify the elements of vertical alignment. c. Explain the importance of vertical curves in highway design.
Teaching Aids (if any)	a. Video of NPTEL
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about the importance of smooth driving experience. • Introduce the concept of vertical alignment as the vertical shape of a highway. • Highlight the impact of vertical curves on driver comfort and safety. **Development (30 minutes):** 1. **Elements of Vertical Alignment (10 minutes):** ○ Define vertical curve, summit curve, and valley curve. ○ Explain the concept of grade, gradient, and rate of grade. ○ Discuss the importance of proper vertical alignment in achieving desired sight distances. 2. **Design Considerations (10 minutes):** ○ Discuss the factors affecting the design of vertical curves (e.g., design speed, terrain, drainage). ○ Explain the concept of K-value and its role in vertical curve design. ○ Introduce the concept of crest vertical curve and sag vertical curve. 3. **Design Standards (10 minutes):** ○ Briefly discuss the role of design standards in vertical alignment. ○ Mention the importance of considering driver comfort and safety in vertical curve design. ○ Explain the concept of minimum length of vertical curves. **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/

	YouTube Video Reference: • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 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. 11	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of superelevation in highway design. b. Explain the purpose of superelevation. c. Calculate the required superelevation for a given design speed and radius of curvature.
Teaching Aids (if any)	a. Video of NPTEL
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about the discomfort experienced by passengers while travelling on curved roads. • Introduce the concept of superelevation as a banking of the road to counteract centrifugal force. • Highlight the importance of superelevation in ensuring vehicle safety and comfort. **Development (30 minutes):** 1. **Concept of Superelevation (10 minutes):** o Define superelevation as the transverse slope provided to the road surface on horizontal curves. o Explain the relationship between superelevation and centrifugal force. o Discuss the role of superelevation in maintaining vehicle stability. 2. **Factors Affecting Superelevation (10 minutes):** o Identify factors influencing the amount of superelevation (e.g., design speed, radius of curvature, pavement width). o Explain the concept of maximum superelevation and its limitations. o Discuss the role of transition curves in gradually introducing superelevation. 3. **Superelevation Calculation (10 minutes):** o Introduce the basic formula for calculating superelevation. o Provide a numerical example to illustrate the calculation process. o Discuss the importance of considering friction factor in superelevation calculations.

	Reference URLs: • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 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. 12	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of road widening as a traffic management strategy. b. Identify the factors influencing the decision to widen a road. c. Discuss the potential impacts and challenges of road widening.
Teaching Aids (if any)	a. Video of NPTEL
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about traffic congestion in urban areas. • Introduce the concept of road widening as a common solution to alleviate traffic congestion. • Highlight the importance of considering alternatives to road widening. **Development(30 minutes):** 1. **Reasons for Road Widening (10 minutes):** • Explain the primary reasons for road widening: o Increased traffic volume o Safety concerns o Accommodation of additional lanes (e.g., bus rapid transit, bike lanes) • Discuss the short-term benefits of road widening in terms of increased capacity. 2. **Impacts of Road Widening (10 minutes):** • Discuss the potential negative impacts of road widening: o Induced traffic o Environmental effects (e.g., habitat loss, air pollution) o Social impacts (displacement of residents, businesses) • Emphasize the importance of considering alternatives to road widening. 3. **Alternatives to Road Widening (10 minutes):** • Introduce the concept of demand management strategies (e.g., public transportation, carpooling, telecommuting). • Discuss the benefits of improving public transportation and active transportation modes.

	• Explain the role of land use planning in reducing traffic congestion.**Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 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. 13	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the importance of material properties in highway construction. b. Identify the desirable properties of soil, stone aggregates, bitumen, tar, and fly ash/pond ash. c. Learn about standard testing procedures for highway materials.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	Introduction (5 minutes): • Begin with a discussion about the impact of material quality on road performance. • Introduce the concept of highway materials and their role in road construction. • Highlight the importance of testing materials to ensure they meet required standards. Development (30 minutes): 1. **Desirable Properties of Highway Materials (10 minutes):** ○ Discuss the essential properties of soil (e.g., gradation, plasticity, strength). ○ Explain the desired characteristics of stone aggregates (strength, hardness, durability). ○ Describe the key properties of bitumen and tar (viscosity, ductility, adhesion). ○ Highlight the potential benefits of using fly ash/pond ash as a road material (e.g., cost-effectiveness, environmental benefits). 2. **Standard Testing Procedures (10 minutes):** ○ Introduce standard testing methods for soil (e.g., sieve analysis, liquid limit, plastic limit). ○ Explain the importance of aggregate tests (e.g., crushing strength, abrasion test, impact test). ○ Discuss bitumen and tar testing (e.g., penetration test, softening point, viscosity). ○ Briefly mention standard testing procedures for fly ash/pond ash.

	3. **Role of Materials in Road Performance (10 minutes):** ○ Explain how the properties of materials affect pavement performance (e.g., durability, strength, ride quality). ○ Discuss the importance of material selection based on traffic volume, climatic conditions, and cost. ○ Highlight the need for quality control during material production and construction. Quiz (5 minutes): 1. What are the two main types of pavement materials? 2. Name three properties of good quality aggregates. 3. Why is it important to test highway materials before use? • **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 14	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the importance of material properties in highway construction. b. Identify the desirable properties of soil, stone aggregates, bitumen, tar, and fly ash/pond ash. c. Learn about standard testing procedures for highway materials.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about the impact of material quality on road performance. • Introduce the concept of highway materials and their role in road construction. • Highlight the importance of testing materials to ensure they meet required standards. **Development (30 minutes):** 1. **Desirable Properties of Highway Materials (10 minutes):** ○ Discuss the essential properties of soil (e.g. Plasticity). ○ Explain the desired characteristics of stone aggregates (strength, hardness,). 2. **Standard Testing Procedures (10 minutes):** ○ Introduce standard testing methods for soil (e.g., sieve analysis, liquid limit, plastic limit). ○ Explain the importance of aggregate tests (e.g., crushing strength, abrasion test, impact test). ○ . 3. **Role of Materials in Road Performance (10 minutes):** ○ Explain how the properties of materials affect pavement performance (e.g., durability, strength, ride quality). ○ **Quiz (5 minutes):** 1. What are the two main types of pavement materials? 2. Name three properties of good quality aggregates.

	3. Why is it important to test highway materials before use? • **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 15	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the importance of material properties in highway construction. b. Identify the desirable properties of soil, stone aggregates, bitumen, tar, and fly ash/pond ash. c. Learn about standard testing procedures for highway materials.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about the impact of material quality on road performance. • Introduce the concept of highway materials and their role in road construction. • Highlight the importance of testing materials to ensure they meet required standards. **Development (30 minutes):** 1. **Desirable Properties of Highway Materials (10 minutes):** o Describe the key properties of bitumen and tar (viscosity, ductility, adhesion). o Highlight the potential benefits of using fly ash/pond ash as a road material (e.g., cost-effectiveness, environmental benefits). 2. **Standard Testing Procedures (10 minutes):** o Explain the importance of aggregate tests (e.g., crushing strength, abrasion test, impact test). o Discuss bitumen and tar testing (e.g., penetration test, softening point, viscosity). o Briefly mention standard testing procedures for fly ash/pond ash. 3. **Role of Materials in Road Performance (10 minutes):** o Discuss the importance of material selection based on traffic volume, climatic conditions, and cost. o Highlight the need for quality control during material production and construction. **Quiz (5 minutes):** 1. What are the two main types of pavement materials?

	2. Name three properties of good quality aggregates. 3. Why is it important to test highway materials before use? • **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 16	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the importance of material properties in highway construction. b. Identify the desirable properties of soil, stone aggregates, bitumen, tar, and fly ash/pond ash. c. Learn about standard testing procedures for highway materials.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Introduce the concept of highway materials and their role in road construction. • Highlight the importance of testing materials to ensure they meet required standards. **Development (30 minutes):** 1. **Desirable Properties of Highway Materials (10 minutes):** o Describe the key properties of bitumen and tar (viscosity, ductility, adhesion). o Highlight the potential benefits of using fly ash/pond ash as a road material (e.g., cost-effectiveness, environmental benefits). 2. **Standard Testing Procedures (10 minutes):** o Explain the importance of aggregate tests (e.g., crushing strength, abrasion test, impact test). o Discuss bitumen and tar testing (e.g., penetration test, softening point, viscosity). o Briefly mention standard testing procedures for fly ash/pond ash. 3. **Role of Materials in Road Performance (10 minutes):** o Discuss the importance of material selection based on traffic volume, climatic conditions, and cost. o Highlight the need for quality control during material production and construction. **Quiz (5 minutes):** 1. What are the two main types of pavement materials? 2. Name three properties of good quality aggregates.

	3. Why is it important to test highway materials before use? • **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 18	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the importance of material properties in highway construction. b. Identify the desirable properties of soil, stone aggregates, bitumen, tar, and fly ash/pond ash. c. Learn about standard testing procedures for highway materials.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Introduce the concept of highway materials and their role in road construction. • Highlight the importance of testing materials to ensure they meet required standards. **Development (30 minutes):** 1. **Desirable Properties of Highway Materials (10 minutes):** o Describe the key properties of bitumen and tar (viscosity, ductility, adhesion). 2. **Standard Testing Procedures (10 minutes):** o Discuss bitumen and tar testing (e.g., penetration test, softening point, viscosity). o Briefly mention standard testing procedures for fly ash/pond ash. 3. **Role of Materials in Road Performance (10 minutes):** o Discuss the importance of material selection based on traffic volume, climatic conditions, and cost. o Highlight the need for quality control during material production and construction. **Quiz (5 minutes):** 1. What are the two main types of pavement materials? 2. Name three properties of good quality aggregates. 3. Why is it important to test highway materials before use?

	• **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 19	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the function of filler in bituminous mixtures. b. Learn about the types of fillers used in road construction. c. Understand the specifications for rigid pavements.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	Introduction (5 minutes): • Briefly recap the importance of materials in road construction. • Introduce the concept of filler as a fine-grained material used in bituminous mixtures. • Highlight the significance of rigid pavements in road infrastructure. Development (30 minutes): 1. **Role of Filler in Bituminous Mix (10 minutes):** ○ Explain the functions of filler in bituminous mixtures (e.g., improving workability, stability, and water resistance). ○ Discuss the types of fillers used (e.g., mineral fillers, fly ash). ○ Explain the relationship between filler content and bitumen content in the mixture. 2. **Specifications for Rigid Pavement (10 minutes):** ○ Introduce the components of rigid pavement (cement concrete, reinforcement, joints). ○ Discuss the factors affecting the design of rigid pavements (e.g., traffic load, soil conditions, climate). ○ Explain the concept of design mix for cement concrete. 3. **DLC and PQC for Rigid Pavement (10 minutes):** ○ Define deflection and cracking in rigid pavements. ○ Explain the importance of deflection and cracking tests (DLC and PQC) in evaluating pavement performance. ○ Discuss the relationship between DLC, PQC, and pavement life. Quiz (5 minutes): 1. What is the primary function of filler in bituminous mix? 2. Name two components of rigid pavement.

	3. What is the significance of DLC and PQC tests in rigid pavement evaluation? • **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 19	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the function of filler in bituminous mixtures. b. Learn about the types of fillers used in road construction. c. Understand the specifications for rigid pavements.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Briefly recap the importance of materials in road construction. • Introduce the concept of filler as a fine-grained material used in bituminous mixtures. • Highlight the significance of rigid pavements in road infrastructure. **Development (30 minutes):** 1. **Role of Filler in Bituminous Mix (10 minutes):** o Explain the functions of filler in bituminous mixtures (e.g., improving workability, stability, and water resistance). o Discuss the types of fillers used (e.g., mineral fillers, fly ash). o Explain the relationship between filler content and bitumen content in the mixture. 2. **Specifications for Rigid Pavement (10 minutes):** o Introduce the components of rigid pavement (cement concrete, reinforcement, joints). o Discuss the factors affecting the design of rigid pavements (e.g., traffic load, soil conditions, climate). o Explain the concept of design mix for cement concrete. 3. **DLC and PQC for Rigid Pavement (10 minutes):** o Define deflection and cracking in rigid pavements. o Explain the importance of deflection and cracking tests (DLC and PQC) in evaluating pavement performance. o Discuss the relationship between DLC, PQC, and pavement life. **Quiz (5 minutes):** 1. What is the primary function of filler in bituminous mix? 2. Name two components of rigid pavement. 3. What is the significance of DLC and PQC tests in rigid pavement

	evaluation? • **Reference URLs:** • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 20	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the function of filler in bituminous mixtures. b. Learn about the types of fillers used in road construction. c. Understand the specifications for rigid pavements.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Introduce the concept of filler as a fine-grained material used in bituminous mixtures. • Highlight the significance of rigid pavements in road infrastructure. **Development (30 minutes):** 1. **Role of Filler in Bituminous Mix (10 minutes):** o Discuss the types of fillers used (e.g., mineral fillers, fly ash). o Explain the relationship between filler content and bitumen content in the mixture. 2. **Specifications for Rigid Pavement (10 minutes):** o Discuss the factors affecting the design of rigid pavements (e.g., traffic load, soil conditions, climate). o Explain the concept of design mix for cement concrete. 3. **DLC and PQC for Rigid Pavement (10 minutes):** o Explain the importance of deflection and cracking tests (DLC and PQC) in evaluating pavement performance. o Discuss the relationship between DLC, PQC, and pavement life. **Quiz (5 minutes):** 1. What is the primary function of filler in bituminous mix? 2. Name two components of rigid pavement. 3. What is the significance of DLC and PQC tests in rigid pavement evaluation?

	Reference URLs: • https://planrva.org/transportation/ • https://highways.dot.gov/ **YouTube Video Reference:** • https://www.youtube.com/watch?v=suTYujyKiwA
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://highways.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 21	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of runway length and its importance in airport design. b. Identify the factors affecting runway length determination. c. Learn about the different types of runway lengths and their significance.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about the takeoff and landing process of airplanes. • Introduce the concept of runway length as a critical factor in airport design. • Highlight the safety implications of inadequate runway length. **Development of the Lesson (30 minutes):** 1. **Factors Affecting Runway Length (10 minutes):** ○ Discuss the primary factors influencing runway length determination: ▪ Aircraft type and size ▪ Aircraft performance characteristics (takeoff and landing distances) ▪ Terrain and altitude of the airport ▪ Climate conditions (temperature, wind) ▪ Obstacle clearance requirements ○ Explain the relationship between these factors and runway length. 2. **Types of Runway Lengths (10 minutes):** ○ Introduce different types of runway lengths: ▪ Take-off run available (TORA) ▪ Take-off distance available (TODA) ▪ Landing distance available (LDA) ▪ Clearway ▪ Stopway ○ Explain the significance of each type of runway length in airport operations. 3. **Safety Considerations (10 minutes):** ○ Discuss the importance of adequate runway length for safety.

	○ Explain the role of runway length in emergency procedures. ○ Highlight the need for considering runway length in relation to other airport facilities (e.g., terminal, taxiways). **Quiz (5 minutes):** 1. What is the primary factor determining runway length? 2. Explain the difference between TORA and TODA. 3. Why is adequate runway length important for safety?
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://airport.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 22	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the factors influencing airport size determination. b. Learn about the methods used to estimate airport capacity. c. Discuss the concept of airport terminal sizing.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about the growth of air travel and increasing passenger numbers. • Introduce the concept of airport size planning as a crucial aspect of airport development. • Highlight the importance of matching airport capacity with demand. **Development of the Lesson (30 minutes):** 1. **Factors Affecting Airport Size (10 minutes):** • Discuss the key factors influencing airport size determination (e.g., catchment area, population, economic activity). • Explain the role of forecasting passenger and aircraft movements. • Introduce the concept of peak hour traffic and its impact on airport size. 2. **Airport Capacity Estimation (10 minutes):** • Explain different methods of estimating airport capacity (e.g., runway capacity, terminal capacity, apron capacity). • Discuss the concept of level of service (LOS) and its relationship to airport capacity. • Highlight the importance of considering future growth in airport capacity planning. 3. **Terminal Sizing (10 minutes):** • Introduce the factors affecting terminal size (e.g., number of passengers, peak hour traffic, check-in counters, security checkpoints). • Discuss the concept of passenger flow and its impact on terminal design. • Explain the importance of considering retail and commercial spaces

	within the terminal. **Quiz (5 minutes):** 1. What are the primary factors influencing airport size? 2. How is airport capacity measured? 3. What is the relationship between terminal size and passenger traffic? **Video Link:**
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://airport.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 23	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the key components and functions of an airport terminal. b. Identify the factors influencing terminal design and layout. c. Learn about the passenger flow within an airport terminal.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about the passenger experience at an airport. • Introduce the concept of an airport terminal as the heart of an airport. • Highlight the importance of efficient terminal design for passenger comfort and satisfaction. **Development of the Lesson (30 minutes):** 1. **Components of an Airport Terminal (10 minutes):** o Explain the essential components of an airport terminal: ▪ Check-in counters ▪ Security checkpoints ▪ Boarding gates ▪ Retail and food outlets ▪ Baggage claim area ▪ Waiting lounges o Discuss the relationship between these components and passenger flow. 2. **Passenger Flow and Terminal Design (10 minutes):** o Explain the concept of passenger flow analysis. o Discuss the importance of efficient passenger circulation within the terminal. o Describe different terminal layouts (linear, pier, satellite). 3. **Terminal Size and Capacity (10 minutes):** o Explain the factors influencing terminal size (e.g., number of passengers, peak hours). o Discuss the concept of terminal capacity and its relationship to passenger comfort. o Introduce the idea of modular terminal design for flexibility. **Quiz (5 minutes):**

	1. What is the primary function of a check-in counter in an airport terminal? 2. Explain the concept of passenger flow analysis. 3. What factors influence the size of an airport terminal? **Video Link:**
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://airport.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 24	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the importance of site selection for airport development. b. Identify the key factors influencing airport site selection. c. Evaluate the trade-offs between different factors in site selection.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about the challenges of building an airport. • Introduce the concept of site selection as a critical first step in airport planning. • Highlight the impact of site selection on airport operations and efficiency. **Development of the Lesson (30 minutes):** 1. **Geographic and Topographic Factors (10 minutes):** o Discuss the importance of terrain, elevation, and land availability. o Explain the impact of obstacles (e.g., mountains, bodies of water) on airport operations. o Introduce the concept of runway orientation and prevailing winds. 2. **Accessibility and Connectivity (10 minutes):** o Explain the significance of proximity to major population centers and transportation hubs. o Discuss the role of road and rail infrastructure in airport accessibility. o Highlight the importance of considering future transportation needs. 3. **Environmental and Socioeconomic Factors (10 minutes):** o Discuss the environmental impact of airports (noise pollution, air pollution, land use). o Explain the importance of considering community needs and concerns. o Introduce the concept of sustainable airport development. **Quiz (5 minutes):**

	1. What is the most important factor to consider when selecting an airport site? 2. How does accessibility impact airport operations? 3. What are the potential environmental impacts of airport development? **Video Link:**
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://airport.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 25	Course Name: Urban Transportation Planning	Course No.: CE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of runway length and its importance in airport design. b. Identify the factors affecting runway length determination. c. Learn about the different types of runway lengths and their significance.
Teaching Aids (if any)	a. Video of NPTEL b. Use of Nearpod tool for online quiz
Teaching Development	**Introduction (5 minutes):** • Begin with a discussion about the takeoff and landing process of airplanes. • Introduce the concept of runway length as a critical factor in airport design. • Highlight the safety implications of inadequate runway length. **Development of the Lesson (30 minutes):** 1. **Factors Affecting Runway Length (10 minutes):** ○ Discuss the primary factors influencing runway length determination: ▪ Aircraft type and size ▪ Aircraft performance characteristics (takeoff and landing distances) ▪ Terrain and altitude of the airport ▪ Climate conditions (temperature, wind) ▪ Obstacle clearance requirements ○ Explain the relationship between these factors and runway length. 2. **Types of Runway Lengths (10 minutes):** ○ Introduce different types of runway lengths: ▪ Take-off run available (TORA) ▪ Take-off distance available (TODA) ▪ Landing distance available (LDA) ▪ Clearway ▪ Stopway ○ Explain the significance of each type of runway length in airport operations. 3. **Safety Considerations (10 minutes):** ○ Discuss the importance of adequate runway length for safety.

	○ Explain the role of runway length in emergency procedures. ○ Highlight the need for considering runway length in relation to other airport facilities (e.g., terminal, taxiways). **Quiz (5 minutes):** 1. What is the primary factor determining runway length? 2. Explain the difference between TORA and TODA. 3. Why is adequate runway length important for safety?
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading 3. https://planrva.org/transportation/ 4. https://airport.dot.gov/ 5. Homework Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Nearpod Quiz Spend 5 minutes to evaluate student assimilation of the lesson contents