

CIVIL ENGINEERING DEPT.
M.Sc.- TRANSPORTATION
ENGINEERING
2024-2025

First Course :

No.	Subject	Hours		Units
		Theory	Lab.	
1.	Advanced Traffic Engineering	3	—	3
2.	Pavement Analysis and Design	3	—	3
3.	Soil Stabilization	2	—	2
4.	Advanced Engineering Statistics	2	—	2
5.	Urban Transportation Planning	2	—	2
6.	English Language	1	—	1
	Total	13		13

Second Course :

No.	Subject	Hours		Units
		Theory	Lab.	
1.	Advanced Geometric Design	2	—	2
2.	Highway Material	2	2	3
3.	Highway traffic and environmental safety	2	—	2
4.	Railway and Airport	3	—	3
5.	Finite Element Method	2	—	2
6.	English Language	1	—	1
	Total	13	1	13

Syllabus of the Highway and Transportation Courses:-

Advanced Traffic Engineering:-

- **Basic definitions and Concepts**
 - Traffic Flow Measures
 - Capacity
 - Levels of Service
 - Traffic Flow Characteristics
 - Factors Affecting
 - Levels of Analysis
 - Field data
- **Freeway Concepts**
 - Introduction
 - Freeway Segments
 - Flow Characteristics
 - Applications
- **Basic Freeway Segments**
 - Introduction
 - Determining Free Flow Speed
 - Determining Flow Rate
 - Specific Grades
 - Determining LOS
 - Applications
 - Example Problems
- **Freeway Weaving Segments**
 - Introduction
 - Weaving Segment Parameters
 - Weaving Segment Diagram and Configuration
 - Determining Type of Operation
 - Determining Weaving Segment speed
 - Determining Density
 - Determining Weaving Segment Capacity

- Applications
- Example Problems

- **Ramp and Ramp Junctions**
 - Introduction
 - Ramp types
 - Merge Influence Areas
 - Diverge Influence Areas
 - Determining Capacity
 - Determining LOS
 - Special Cases
 - Applications
 - Example Problems

- **Highway Concepts**
 - Introduction
 - Highway Types and Segments
 - Flow Characteristics
 - Applications

- **Two-lane Highways**
 - Introduction
 - Two-Way Segments
 - Determining Free-Flow Speed
 - Determining Demand Flow Rate
 - Determining LOS
 - Traffic Performance Measures
 - Directional Segments with Passing Lanes
 - Directional Segments with Climbing Lanes
 - Applications
 - Example Problems

- **Multi-lane Highways**
 - Introduction

- Determining Free Flow Speed
- Determining Flow Rate
- Specific Grades
- Determining LOS
- Applications
- Example Problems

- **Urban Streets**
 - Introduction
 - Classes
 - Determining Running Speed
 - Determining Delay
 - Determining Travel Speed
 - Determining LOS
 - Applications
 - Example Problems

- **Intersections**
 - Introduction
 - Classification and types
 - Traffic controls
 - Traffic Analysis
 - Applications

- **Signalized Intersections**
 - Introduction
 - Input Parameters
 - Lane Grouping
 - Phase Plans
 - Determining Flow Rate
 - Determining Saturation Flow Rate
 - Determining Capacity
 - Determining Delay
 - Determining Level of Service

- Signal Timing Design
- Special Procedures
- Applications
- Example Problems

Pavement Analysis and Designed:-

- Introduction
 - Pavement types
 - Road tests
 - Design factors
 - Highway pavements, airport pavements, and railroad trackbeds
- Stresses and Strains in Flexible Pavements
 - Homogenous mass
 - Layered systems
- Stresses and Deflections in Rigid Pavements
 - Stresses due to curling
 - Stresses and deflections due to loading
 - Stresses due to friction
 - Design of dowels and joints
- Traffic Loading and Volume
 - Design procedure
 - Equivalent single-wheel load
 - Equivalent axle load factor
 - Traffic analysis
- Pavement Performance
 - Distress

- Serviceability
- Surface friction
- Non-destructive deflection testing
- Pavement performance

- Flexible Pavement Design
 - Calibrated mechanistic design procedure
 - AASHTO method
 - Asphalt Institute method
 - Design of flexible pavement shoulders

- Rigid Pavement Design
 - Calibrated mechanistic design procedure
 - AASHTO method
 - Portland Cement Associations method
 - Continuous reinforced concrete pavements
 - Design of rigid pavement shoulders

- Design of Overlays
 - Types of Overlays
 - Design methodologies
 - Asphalt Institute method
 - Portland Cement Associations method
 - AASHTO method

- Computer Programing Applications
 - KENLAYER computer program
 - KENSLABS computer program

Soil Stabilization:-

Week No.	Syllabus
1	Introduction
2	Principles of Soil Stabilization
3	Problematic Soil

4,5	Mechanical and Stabilization Densification
6,7	Cement Stabilization
8,9	Lime Stabilization
10,11	Asphalt Stabilization
12,13	Special Methods of Stabilization
14,15	Methods and Machinery

Advanced Engineering Statistics:-

- Introduction and Data Presentation
- Measures of Central Tendency and Dispersion
- Probability Distribution
- Sampling and Estimation Theory
- Test Of Hypothesis
- Normal Distribution-test, Z-test
- t-test
- F-test, χ^2 Square test, Curve Fitting
- Analysis of Variance and Experimental Design
- Simple Linear Regression
- Simple Non-Linear Regression
- Multiple Linear Regression
- Step-wise Linear Regression

Advanced Geometric Design:-

- **Basic definitions and Concepts**
 - Principles of Highway Location
 - Factors Influencing Highway Design
 - Highway Design Standards
 - Applications
- **Highway Functional Classification**
 - Introduction
 - Functional System of Urban Roads
 - Functional System of Rural Roads
 - Applications
- **Design Controls and Criteria**
 - Introduction
 - Design Vehicles
 - Turning Characteristics
 - Vehicle Performance
 - Driver Performance
 - Driving Task
 - Highway Capacity
 - Access Control and Management
 - Pedestrian Considerations and Characteristics
 - Bicycle Facilities
 - Applications
- **Sight Distance**
 - Introduction
 - Stopping Sight Distance
 - Decision Sight Distance
 - Passing Sight Distance
 - Effect of Grades
 - Criteria for Measuring Sight Distance
 - Applications

- Example Problems
- **Horizontal Alignment**
 - Introduction
 - Types of Horizontal Curves
 - Superelevation
 - Side Friction Factor
 - Minimum Radius
 - Design Superelevation
 - Methods of Attaining Superelevation
 - Effect of Grades
 - Transition Design Controls
 - Offtracking
 - Traveled Way Widening
 - Application of Widening on Curves
 - Special Cases
 - Applications
 - Example Problems
- **Vertical Curves**
 - Introduction
 - Crest Vertical Curves
 - Sag Vertical Curves
 - Design Controls
 - Climbing Lanes
 - Emergency Escape Ramps
 - Applications
 - Example Problems
- **Cross Section Elements**
 - Introduction
 - Surface Type
 - Right of Way
 - Cross slope

- Lane Widths
 - Shoulders
 - Medians
 - Side Slopes
 - Roadside and Median Barriers
 - Curbs
 - Frontage Roads
 - Tunnels
 - Pedestrian Facilities
 - Bus Turnouts
 - Applications
- **Grade Separation and Interchange**
 - Introduction
 - Warrants
 - Factors Influencing Design
 - Design Standards and Considerations
 - Types of Interchanges
 - Applications

Highway Material:-

Week No.	Syllabus
1	Introduction
2	Soil Characteristics
3	Basic Engineering Properties of Soil
4	Classification of Soil for highway Uses
5	Soil Survey for highway Construction
6,7	Properties of Asphaltic Materials
8,9	Tests for Asphaltic Materials
10,11,12	Asphaltic Concrete Mixtures
13,14,15	Superior Performing Asphalt Pavements (Superpave)

Urban Transportation Planning:-

Week No.	Syllabus
1	Introduction
2	Transportation Plan
3	Overview of Information Needs
4	Travel forecasting
5,6	Trip generation(Technique and Analysis)
7,8	Trip Distribution(Method and Analysis)
9,10	Mode Split(Method and Analysis)
11,12	Trip Assignment(Method and Analysis)
13	Calibration and Validation
14	Load Use Plan
15	Travel Data

Railway and Airport Engineering:-**Railway Engineering**

- Introduction to railway engineering
 - Historic development
 - Railways
 - Tramways and metro
 - Operational aspects
- Function of track components
 - Rails
 - Ties
 - Ballast
 - Subballast
 - Subgrade
 - Drainage
- Geometry of a railway line
 - Clearances
 - Alignment
 - Turnouts and crossing
- Track analysis

- Track as a structure
- Track analysis
- Track stiffness
- Distribution of pressure

- Track system characteristics
 - Rails
 - Ties
 - Wood ties
 - Steel ties
 - Concrete ties
 - Artificial ties

- Fastening system
- Ballast
 - Ballasted track
 - Slab track

- Subballast
- Subgrade

- Track maintenance

Airport Engineering

- Introduction to airport engineering
- Aircraft characteristics related to airport design
 - Dimensional standards
 - Landing gear configurations
 - Aircraft weight
 - Engine type
 - Atmospheric conditions affecting aircraft performance
 - Aircraft performance characteristics

- Airport design,
 - Geometric design of the airfield

- Structural design of airport pavements
 - Airport lighting marking and signage
 - Planning and design of the terminal areas
- Heliports.

Finite Element Method

Week No.	Syllabus
1-2	Introduction -Fundamental requirements -Method process -Finite element technique -Force –deflection relation -Type of elements -Procedures
3-4	The Concept of Stiffness Analysis -General -Stiffness matrix for single elastic spring -Stiffness matrix for assembly of springs
5	Formation of the Element Stiffness Matrix $[K^e]$
6	Principle of Virtual Work
7	Convergence Requirements
8-9	Two-Dimensional Analysis -Triangular Finite element for Plane Elasticity - Rectangular element (Isoparametric element)
10	Three-Dimensional Analysis
11	Numerical Integration
12	Axisymmetric Stress Analysis
13	Analysis of Beams
14-15	Review on Finite Element Applications

Traffic Simulation Syllabus:

Week	Syllabus
1	Introduction to computer simulation.
2	System simulation.
3	Probability concepts and statistical distributions.
4	Arrival patterns and service times.

5	The role of random numbers.
6-7	Model built
8-9	Simulation programming.
10-11	Calibration and validation of simulation models.
12-13	Implementations in traffic engineering.
14-15	Applications in simulation Models.

Highway traffic and environmental safety

1. Introduction and essential concepts of traffic safety
2. Fundamental characteristics of highway accidents
3. Factors which affecting highway accidents
4. Causes of traffic accidents
5. Accident reporting systems and analysis
6. Engineering and traffic considerations for highway traffic safety
7. Concept of highway environmental safety
8. Air pollution safety on highways
9. Traffic noise study
10. Engineering and traffic considerations for highway environmental safety
11. Highway tools and implements
12. Traffic signs, markings and signals.