25CVMJ204: Transportation Systems

w. e. f. Academic Year:	**2026-27**
Semester:	**3rd (Civil Engineering)**
Category of the Course:	**Professional Core Courses (PCC)**
Prerequisite:	Students should have basic knowledge of mathematics, general science, and fundamental concepts of infrastructure. Familiarity with maps, simple measurements, and basic surveying terminology will support understanding. A preliminary idea about roads, vehicles, and city transportation helps learners easily grasp transportation systems, traffic studies, and sustainable mobility concepts introduced in this course.
Rationale:	This course provides foundational knowledge of transportation systems essential for civil engineering. It helps students understand various transport modes, their components, and operational characteristics. The syllabus builds competency in road, rail, air, and water transport along with mass transit and sustainable mobility, enabling learners to address modern transportation challenges effectively.

Course Outcomes:

After completion of the course, students will be able to:

CO No.	Course Outcome (CO)	RBT Level (Cognitive Domain)
CO1	Develop an understanding of transportation systems, their role in national development, and the classification and characteristics of different modes of transport.	Understand
CO2	Explain the components of road infrastructure including types of roads, cross-sectional elements, pavements, and various transportation surveys.	Understand
CO3	Describe the fundamentals of railway, air, and water transportation systems including permanent way components, airport layout, and harbour structures.	Understand
CO4	Analyze the need, principles, and applications of mass transportation systems such as BRTS, metro rail, monorail, and integrated multimodal systems.	Analysis
CO5	Evaluate urban transportation systems, traffic characteristics, control devices, and sustainable transport solutions including ITS, smart parking, and green mobility concepts.	Evaluation

Teaching and Evaluation Scheme:

Teaching Scheme					Evaluation Scheme				
L	**T**	**P**	**C**	**Hours/Week**	**IE**	**EE**	**CIA**	**Practical**	**Total Marks**
3	1	0	4	4	40	60	30	20	150

IE: Internal Exam
EE: External Exam (End Semester)
CIA: Continuous Internal Assessment
Practical: Practical Exam (End Semester))

Detailed Syllabus:

Unit No.	Topics	Hours	% of Weightage (Approx.)
UNIT: 1	**Introduction to Transportation Systems, Introduction to Road Transportation:** Importance and role of transportation in national development Classification: Road, Rail, Air, and Water transport, Characteristics and comparison of modes.	**05**	**10**
UNIT: 2	**Road Infrastructure and Surveys:** Types of roads (NH, SH, MDR, ODR, VR), Cross-section elements, Introduction to types of pavements, Types of Surveys	**07**	**15**
UNIT: 3	**Railway Transportation, Air and Water Transportation:** Components of permanent way- rails, sleepers, ballast, Types of railway gauges, Airport layout, Basic terms runway, taxiway, apron, Hanger, Harbours, ports, dock basics	**11**	**25**
UNIT: 4	**Mass Transportation System:** Need and advantages of mass transit, BRTS, Metro Rail, Monorail (basic concepts), Integrated multimodal systems.	**11**	**25**
UNIT: 5	**Urban transport system and Sustainable Transport Systems:** Road user & vehicle characteristics, Traffic volume & speed study basics, Traffic signs, road markings & signals, Introduction to Intelligent Transport Systems (ITS), Smart parking, Green transport, EVs, and sustainable mobility concepts.	**11**	**25**
		45	**100**

Learning Resources:

1.Textbooks and Reference Books:

1. Khanna, S.K. & Justo, C.E.G. – Highway Engineering
2. Kadiyali, L.R. – Traffic Engineering and Transport Planning
3. Hutchinson, B.G. – Principles of Urban Transport Systems Planning
4. Arora & Saxena -Air Transportation and Airport Engineering Dhanpat Rai & Co
5. S. C. Saxena & S. P. Arora -A Textbook of Railway Engineering
6. Rangwala, S.C. Railway Engineering Charotar Publishing House
7. Transportation Engineering: Railways, Airports, Docks and Harbours, Bridges and Tunnels by C. Venkataramaiah
8. Indian Roads Congress (IRC) Publications
9. Papacostas, C.S. &Prevedouros, P.D.Transportation Engineering and Planning

2. Online References:

1. https://www.irc.org.in/
2. https://morth.nic.in/
3. https://www.delhimetrorail.com/
4. https://shipmin.gov.in/

Teaching Learning Method

1. Lecture-based teaching-learning
2. Individual learning/self-study
3. Inquiry-based learning
4. Game-based learning
5. Expeditionary learning (Real-world problems)
6. Technology-based Learning
7. Learning through problem-solving

Course Outcomes Mapping:

CO. NO.	Course Outcomes (Cos)	POs/ PSOs Mapped	Cognitive Level (RBT)	Knowledge Category	Class Sessions (Lecture)
CO1	Develop an understanding of transportation systems, their role in national development, and the classification and characteristics of different modes of transport.	PO1, PO2, PO3, PO6, PO7, PO9, PO10, PO11, PSO1, PSO2	Understand	Factual, Conceptual	12
CO2	Explain the components of road infrastructure including types of roads, cross-sectional elements, pavements, and various transportation surveys.	PO1, PO2, PO3, PO4, PO5,PO6, PO7, PO9, PO10, PO11, PSO1, PSO2	Understand	Factual, Conceptual	11
CO3	Describe the fundamentals of railway, air, and water transportation systems including permanent way components, airport layout, and harbour structures.	PO1, PO2, PO3, PO5,PO6, PO7, PO9, PO10, PO11, PSO1, PSO2	Understand	Conceptual,	11
CO4	Analyze the need, principles, and applications of mass transportation systems such as BRTS, metro rail, monorail, and integrated multimodal systems.	PO1, PO2, PO3, , PO4,PO5,PO6, PO7, PO9, PO10, PO11, PSO1, PSO2	Understand, Apply	Conceptual, Procedural	08
CO5	Evaluate urban transportation systems, traffic characteristics, control devices, and sustainable transport solutions including ITS, smart parking, and green mobility concepts.	PO1, PO2, PO3, , PO4,PO5,PO6, PO7, PO9, PO10, PO11, PSO1, PSO2	Evaluate	Procedural	03

Mapping of COs with POs & PSOs:

COs	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
1	3	2	1	0	0	2	1	0	1	1	2	3	2
2	3	3	2	2	2	2	1	0	1	1	1	3	3
3	3	2	2	0	1	2	1	0	1	1	1	3	3
4	3	3	3	1	2	3	1	2	2	2	2	2	3
5	3	3	3	2	3	3	1	2	2	2	3	2	3

3: High, 2: Medium, 1: Low

Sustainable Development Goals (SDG) Integration

This course integrates sustainability by emphasizing efficient, safe, and environmentally responsible transportation systems. It focuses on multimodal transport planning, infrastructure development, traffic management, and adoption of green and intelligent transport technologies to support sustainable urban and national development. The course aligns with SDG 4, SDG 9, SDG 11, and SDG 12.

CO	Course Outcome	Relevant SDGs	Justification
CO1	Explain the importance and classification of transportation systems and their role in national development.	SDG 4, SDG 9	Develops foundational knowledge of transportation systems supporting infrastructure growth and innovation.
CO2	Describe road infrastructure components, types of roads, pavements, and survey methods.	SDG 9, SDG 11	Supports planning and development of sustainable and efficient road infrastructure.
CO3	Explain the basic components and operations of railway, air, and water transportation systems.	SDG 9, SDG 11	Enhances understanding of multimodal transport systems for sustainable connectivity.
CO4	Analyze mass transportation systems such as BRTS, metro, and integrated multimodal systems.	SDG 9, SDG 11, SDG 12	Promotes efficient public transport systems reducing congestion and environmental impact.
CO5	Analyze urban transport characteristics and evaluate sustainable and intelligent transport systems including ITS, EVs, and green mobility.	SDG 9, SDG 11, SDG 12	Encourages adoption of smart and sustainable transport solutions for future mobility challenges.