Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NCEC531	Advanced Highway Design and Analysis	3	1	0	4

Course Objective

This course aims to equip students with advanced knowledge and computational skills for highway design and analysis, integrating modern software tools and methodologies. It covers key aspects of geometric design, intersection and interchange planning, road safety, and infrastructure for vulnerable road users (VRUs).

Learning Outcomes

- **Apply advanced geometric design principles** using computational tools for efficient and safe highway infrastructure.
- **Analyse and optimize highway alignments, intersections, and interchanges** to improve traffic flow, safety, and capacity.
- **Understand how to design inclusive and safe highway infrastructure for VRUs,** ensuring accessibility and safety for all road users.

Unit no.	Topics to be covered	Contact Hours	Learning outcome
1	**Fundamentals of Advanced Highway Design:** Overview of Highway Engineering, Design Controls and Standards, Introduction to Software used in Highway Design, Data Acquisition, Design of Highway Cross-Section Elements	10L+ 6T	Understand fundamental highway design principles and utilize software tools for highway planning
2	**Design of Horizontal and Vertical Alignment:** Horizontal Alignment: Curve Types, Superelevation Design, Transition Curve Computation, Vertical Alignment: Gradients, Summit & Valley Curves, Integration of Horizontal and Vertical Alignment, Earthwork Balancing and Cost Optimization	10L+ 3T	Understand the principles of designing and integrating horizontal and vertical alignments.
3	**Intersection and Interchange Design:** At-Grade Intersection Design: Signalized and Unsignalized, Roundabout Design, Interchange Design: Cloverleaf, Stack, Diamond Interchanges, Weaving Sections and Ramp Design	10L+ 3T	Understand the design and analysis of intersections and interchanges to enhance traffic flow and safety.
4	**Highway Design for Road Safety:** Safety Considerations in Horizontal and Vertical Alignment, Road Safety Audits, Roadside Barriers, Clear Zone concept, Impact Attenuation, Traffic Calming	8L+ 1T	Understand how to incorporate road safety principles into highway design to reduce accident risks.
5	**Infrastructure Design for Vulnerable Road Users (VRUs) on Highways:** Understanding VRUs needs and risk factors on highways, Geometric Planning for Pedestrians and Cyclists	4L+ 1T	Understand how to design inclusive and safe highway infrastructure for VRUs
	Total Contact Hours	**42L+ 14T**	

Text-books:

1. Goswami, S. and Sarkar, P. *Computer-Aided Highway Engineering.* CRC Press, 1st Edition, 2021.
2. Wolhuter, K.M. *Geometric Design of Roads Handbook.* CRC Press, 1st Edition, 2015.

Reference Books:

1. AASHTO (American Association of State Highway and Transportation Officials). *A Policy on Geometric Design of Highways and Streets (Green Book).* AASHTO, 7th Edition, 2018.
2. Kadiyali, L.R. and Lal, N.B. *Highway Engineering*. Khanna Publishers, 10th Edition, 2020.