



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

CIVIL ENGINEERING

COURSE DESCRIPTOR

Course Title	TRANSPORTATION ENGINEERING				
Course Code	ACE013				
Programme	B.Tech				
Semester	VI	CE			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	1	4	3	2
Chief Coordinator	Dr. Shruthi Kaviti, Associate Professor				
Course Faculty	Dr. Shruthi Kaviti, Associate Professor Mr. B Suresh, Assistant Professor				

I. COURSE OVERVIEW:

The course gives an overview about the Transportation engineering with respect to planning, design, construction and maintenance of highways as per IRC standards, specifications and methods. To impart knowledge of Traffic engineering, traffic regulation, management and traffic safety with integrated approach in traffic planning as well. This course focuses on designing new transportation systems and infrastructures, including highways by analyzing data, identifying problems, and solving them with innovative solutions. Solving these complex problems typically requires the collection and evaluation of systems, traffic flow, accidents, costs, and other statistics.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	ACE002	III	Surveying	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Transportation Engineering	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✗	Chalk & Talk	✓	Quiz	✓	Assignments	✗	MOOCs
✓	LCD / PPT	✓	Seminars	✗	Mini Project	✓	Videos
✗	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each unit carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with “either” or “choice” will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	Theory		Total Marks
	CIE Exam	Quiz / AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz / Alternative Assessment Tool (AAT):

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignments/ Seminars
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Seminars
PO 3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	Assignments

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	Engineering Knowledge: Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	2	Seminars

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 2	Broadness and Diversity: Graduates will have a broad understanding of economic, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.	-	-
PSO 3	Self-Learning and Service: Graduates will be motivated for continuous self-learning in engineering practice and/or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES(COs):

The course should enable the students to:	
I	Understand the importance of highway development of India and classification of roads and road patterns.
II	Design various geometric elements like curves, gradients, super elevation etc.
III	Capable of performing various traffic surveys.
IV	Analyze traffic signals intersections and road markings and their designs.

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the importance of highway development of India and classification of roads and road patterns.	CLO 1	Understand necessity for highway planning, different road development plans.
		CLO 2	Study Classification of roads, road network patterns, highway alignment.
		CLO 3	Capable of performing various traffic surveys
		CLO 4	Study factors affecting alignment, engineering surveys, drawing and reports, highway project.
CO 2	Design various geometric elements like curves, gradients, super elevation etc.	CLO 5	Understand Importance of geometric design.
		CLO 6	Analyze factors affecting highway geometric design. Design controls and criteria.
		CLO 7	Understand highway cross section elements including shoulder, kerb, and carriageway.
		CLO 8	Analyze sight distance elements, stopping sight distance, overtaking sight distance and intermediate sight distance.
		CLO 9	Analyze design of horizontal alignment, design of super elevation and extra widening.
		CLO 10	Analyze design of transition curves, design of vertical alignment, gradients, and vertical curves.
CO 3	Capable of performing various traffic surveys and study basics of traffic engineering and regulations.	CLO 11	Study basics of traffic engineering and regulations.
		CLO 12	Predict basic parameters of traffic, volume, speed and density, traffic volume studies,
		CLO 13	Analyze Parking studies, on street and off street parking , road accidents , causes and preventive measures, accident
		CLO 14	Study and need for road markings, types of road markings, design of traffic signals, Webster method.

COs	Course Outcome	CLOs	Course Learning Outcome
CO 4	Analyze traffic signals intersections and road markings and their designs	CLO 15	Understand types of Intersections, conflicts at intersections, requirements of at-grade intersection.
		CLO 16	Understand types of at grade intersections, canalization traffic islands, types of grade separated intersections, rotary intersection,
		CLO 17	Study concept of rotary, design factors of rotary, advantages and limitations of rotary intersections.
CO 5	Understand construction of cement concrete pavements, construction of joints in cement concrete pavements joint filter.	CLO 18	Understand Highway material characterization; sub grade soil, stone aggregate.
		CLO 19	Explain construction of water bound macadam roads, construction of bituminous pavements:
		CLO 20	Study Surface dressing, bitumen bound macadam, bituminous concrete,
		CLO 21	Study various types of bitumen materials, construction of gravel roads.
		CLO 22	Understand construction of cement concrete pavements, construction of joints in cement concrete pavements joint filter.
		CLO 23	Analyze seal pavement failures, maintenance of highways.

X. COURSE LEARNING OUTCOMES(CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
ACE013.01	CLO 1	Understand necessity for highway planning, different road development plans.	PO1, PO2	2
ACE013.02	CLO 2	Study Classification of roads, road network patterns, highway alignment,	PO1	3
ACE013.03	CLO 3	Capable of performing various traffic surveys	PO1, PO2	2
ACE013.04	CLO 4	Study factors affecting alignment, engineering surveys, drawing and reports, highway project.	PO1	3
ACE013.05	CLO 5	Understand Importance of geometric design.	PO3	3
ACE013.06	CLO 6	Analyze factors affecting highway geometric design. Design controls and criteria.	PO3	2
ACE013.07	CLO 7	Understand highway cross section elements including shoulder, kerb, and carriageway.	PO2, PO3	2
ACE013.08	CLO 8	Analyze sight distance elements, stopping sight distance, overtaking sight distance and intermediate sight distance.	PO3	2
ACE013.09	CLO 9	Analyze design of horizontal alignment, design of super elevation and extra widening.	PO3	2
ACE013.10	CLO 10	Analyze design of transition curves, design of vertical alignment, gradients, and vertical curves.	PO3	2
ACE013.11	CLO 11	Study basics of traffic engineering and regulations.	PO1	2
ACE013.12	CLO 12	Predict basic parameters of traffic, volume, speed and density, traffic volume studies,	PO3	2
ACE013.13	CLO 13	Analyze Parking studies, on street and off street parking , road accidents , causes and preventive measures, accident	PO2	2
ACE013.14	CLO 14	Study road markings, need for road markings, types of road markings, design of traffic signals, Webster method.	PO2, PO3	2
ACE013.15	CLO 15	Understand types of Intersections, conflicts at intersections, requirements of at-grade intersection.	PO1, PO3	3

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
ACE013.16	CLO 16	Understand types of at grade intersections, canalization traffic islands, types of grade separated intersections, rotary intersection,	PO1	3
ACE013.17	CLO 17	Study concept of rotary, design factors of rotary, advantages and limitations of rotary intersections.	PO3	3
ACE013.18	CLO 18	Understand Highway material characterization; sub-grade soil, stone aggregate.	PO1	3
ACE013.19	CLO 19	Explain construction of water bound macadam roads, construction of bituminous pavements:	PO3	3
ACE013.20	CLO 20	Study Surface dressing, bitumen bound macadam, bituminous concrete,	PO1	3
ACE013.21	CLO 21	Study various types of bitumen materials, construction of gravel roads.	PO1	3
ACE013.22	CLO 22	Understand construction of cement concrete pavements, construction of joints in cement concrete pavements joint filter.	PO2	2
ACE013.23	CLO 23	Analyze seal pavement failures, maintenance of highways.	PO1	1

3= High; 2 = Medium; 1 = Low

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes and Program Specific Outcomes (POs and PSOs)			
	PO1	PO2	PO 3	PSO 1
CO 1	3	2		3
CO 2		2	2	2
CO 3	2	2	2	2
CO 4	3		3	3
CO 5	3	2	3	2

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XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

CLO	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3	1											3		
CLO 2	3												3		
CLO 3	3	2													
CLO 4	3												3		
CLO 5			3												
CLO 6			2												
CLO 7		2	2										2		

CLO	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 8			2												
CLO 9			2												
CLO 10			2												
CLO 11	2												2		
CLO 12			2												
CLO 13		2													
CLO 14		2	2												
CLO 15	3		2										3		
CLO 16	3												2		
CLO 17			3												
CLO 18	3												2		
CLO 19			3												
CLO 20	3														
CLO 21	3												3		
CLO 22		2											2		
CLO 23	1												2		

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XIII. ASSESSMENT METHODOLOGIES –DIRECT

CIE Exams	PO1,PO2, P03,PSO1	SEE Exams	PO1,PO2, P03,PSO1	Assignments	PO1, PO3	Seminars	PO1, PO3
Laboratory Practices	PO2, P03 PSO1	Student Viva	-	Mini Project	-	Certification	-
Term Paper	-						

XIV. ASSESSMENT METHODOLOGIES-INDIRECT

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✗	Assessment of Mini Projects by Experts		

XV. SYLLABUS

UNIT - I	HIGHWAY DEVELOPMENT AND PLANNING:
Highway development in India, necessity for highway planning, different road development plans; Classification of roads, road network patterns, highway alignment, factors affecting alignment, engineering surveys, drawing and reports, highway project.	
UNIT - II	HIGHWAY GEOMETRIC DESIGN:
Importance of geometric design, factors affecting highway geometric design. Design controls and criteria, highway cross section elements, sight distance elements, stopping sight distance, overtaking sight distance and intermediate sight distance, design of horizontal alignment, design of superelevation and extra widening, design of transition curves, design of vertical alignment, gradients, vertical curves	
UNIT - III	TRAFFIC ENGINEERING AND REGULATIONS:
Basic parameters of traffic, volume, speed and density, traffic volume studies, data collection and presentation, speed studies, data collection and presentation, origin and destinations studies. Parking studies, on-street and off-street parking, road accidents, causes and preventive measures, accident data recording, condition diagram and collision diagrams, traffic signs, types and specifications, road markings, need for road markings, types of road markings, design of traffic signals, Webster method	
UNIT - IV	INTERSECTION DESIGN:
Types of Intersections, conflicts at intersections, requirements of at-grade intersection, types of at grade intersections, canalization, traffic islands, types of grade separated intersections, rotary intersection, concept of rotary, design factors of rotary, advantages and limitations of rotary intersections	
UNIT-V	HIGHWAY MATERIAL, CONSTRUCTION AND MAINTENANCE:
Highway material characterization; subgrade soil, stone aggregate, bitumen materials, construction of gravel roads, construction of water bound macadam roads, construction of bituminous pavements: Surface dressing, bitumen bound macadam, bituminous concrete, construction of cement concrete pavements, construction of joints in cement concrete pavements joint filter and seal pavement failures, maintenance of highways, highway drainage.	
Text Books:	
1. Highway Engineering – S.K.Khanna & C.E.G. Justo, Nemchand & Bros., 7 th edition (2000). 2. Traffic Engineering & Transportation Planning – Dr.L.R.Kadyali, Khanna	
Reference Books:	
1. Principles of Traffic and Highway Engineering – Garber & Hoel, Cengage Learning. 2. Principles of Practices of Highway Engineering – Dr.L.R.Kadyali, and Dr.N.B.Lal-Khanna publications 3. Highway Engineering – S.P.Bindra, Dhanpat Rai & Sons. – 4 th Edition (1981)	

XVI. COURSEPLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	To know the highway development in India	CLO1	T1:24.6
2	To know the necessity of highway	CLO2	T1:12.14
3-5	To know the types of road plans.	CLO3	T1:3.10
6-7	To know the classification of roads and its patterns.	CLO4	T4:3.11
8-9	To know the concept of highway alignment.	CLO5	T1:16.2
10	To understand the geometric design of roads	CLO6	T1:16.5
11	Able to know the highway elements	CLO7	T1:16.6.2
12	Able to know the measurement of cross sectional elements.	CLO8	T1:16.6.2
13	Able to know the measurement of sight distances	CLO9	T2:26.9
14	Able to know the measurement of sight distances	CLO10	T2:26.11

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
15-16	Able to know the measurement of sight distances	CLO11	T1:16.7
17-18	Able to know the design horizontal curve	CLO12	T2:26
19-21	Able to know the design of super elevation and extra widening	CLO13	T2:20.4
23-24	Able to know the design transition curves	CLO14	T2:23.4
25-26	Able to know the design horizontal curve	CLO15	T2:20.9
27-28	To know about gradient	CLO16	T4:5.13
29	To able to design vertical curves.	CLO17	T2:21.1
30-31	To know about traffic volume.	CLO18	T2:21.3
32	To understand the parameters of speed and density	CLO18	T2:21.5-21.6
33-36	Able to understand the traffic volume studies,	CLO19	T2:7.1-7.3
37-38	Able to understand the speed studies	CLO20	T2:27.2
32	To understand the parameters of speed and density	CLO21	T2:21.5-21.6
33-36	Able to understand the traffic volume studies,	CLO22	T2:7.1-7.3
37-38	Able to understand the speed studies	CLO23	T2:27.2
39	To know about the concept of solving the problems on speed studies	CLO21	T2:27.9
40-42	To know about the parking studies	CLO22	T2:27.9
43-44	To understand the concept of accident studies	CLO23	T3:27.10
45-46	To know about the specifications of traffic markings and specification	CLO20	T2:27.11
47-48	To know about the road markings	CLO21	T2:27.12
49-50	To design traffic signal	CLO22	T2:10.7
50-51	To understand about the intersection	CLO23	T2:10.8
52-54	To know about the types of intersections	CLO21	T2:10.10
55	To get the knowledge of Traffic islands	CLO22	T2:13.8
56-58	To understand the concept of rotary intersection	CLO23	T2:13.9

XVII.GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSIONREQUIREMENTS:

S No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Design and analysis of rigid and flexible pavements.	NPTEL	PO1	PSO 1
2	Travel demand analysis and transportation planning.	Seminars /NPTEL	PO 1, PO2	PSO 1
3	Modern construction materials used in the design of pavements.	Seminars /NPTEL	PO1, PO3	PSO 1

Prepared by:

Dr. Shruthi Kaviti, Associate Professor.

HOD, CE