

A
Course File
on
TRANSPORTATION ENGINEERING
(Subject Code: 7CE4-01)

B. TECH IV YEAR (VII Sem.)

Prepared by
Mr. Bharat Kumar Suthar
Lecturer



Department of Civil Engineering
Techno India NJR Institute of Technology

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2020-2021

For Techno India NJR Institute of Technology
पंकज पौरवाल
Dr. Pankaj Kumar Porwal
(Principal)

Sr. No	Name of the Format	Page No.
1	Course details, RTU course no.	
2	Complete Syllabus	
3	Lecture notes, reference books, suggested online / NPTEL certifications related to the course	
4	Quiz/assignments/projects for the course	
5	Course plan showing no. of hours for each lesson/unit	
6	Objectives of Each unit/lesson	
7	Mid-II question papers with COs mapping	
8	CO and PO attainment sheet.	

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Course Details

1). Name of Subject: Transportation Engineering

2). Instructional Language: - English & Hindi

3). Introduction to subject: -

This course is designed for engineering students who would like to understand the role of railway engineering in transportation system. The course is suitable for civil, engineering students. The information provided in this course falls into three categories:

- 1) Railway engineering and its comparison with Highways,
- 2) Introduction to Bridge Engineering, and
- 3) Introduction to airport engineering.

COURSE OBJECTIVES

1. Describe the role of railway engineering and its comparison.
2. Descriptive study on permanent way and its elements.
3. Descriptions on Single and interlocking.
4. Describe the main elements of an airport master plan.
5. Estimate of various component element of bridge engineering.
6. Study on various types of bridge.
7. Describe the purpose of ATC, Passenger terminal system.
8. Describe the structural design of airfield pavements.

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Lecture notes, reference books, suggested online / NPTEL certifications related to the course.

Prerequisites of the Transportation Engineering (code: **7CE4-01**, course are:

List of Text and Reference Books

Reference Books

1. An introduction to Transportation, Engineering and Planning by Morlok, E. R., McGraw Hill Kagakusha International Student Edition.
2. Traffic Engineering and Transportation Planning by Kadiyali, L. R., Khanna Publishers, New Delhi.
3. Introduction to Transportation Engineering by Hay, W. W., John Wiley and sons, New York.
4. Fundamentals of Transportation Engineering by Papacostas, C.S. Prentice Hall of India, New Delhi.
5. Principles of Urban transportation Planning by Hutchinson, B. G., McGraw Hill Book company.
6. A text Book of Railway Engineering by Saxena, S.C.Arora, S. P., Dhanpat Rai & Sons< New Delhi.
7. Railway Track Engineering by Munday, J. S., Tata McGraw Hill, New Delhi.
8. Indian Railway Track by Agarwal, M. M., Sachdeva press, Mayapuri, New Delhi.
9. Railroad Engineering by Hay, W .W. John Wiley and sons, New York. Delhi

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Techno India NJR Institute of Technology

Civil Engineering Department

(Subject Code: 3CE3-04): Transportation Engineering

LECTURE DEPLOYMENT

S.No	Topic As Per Blown Up Syllabus	No of Lectures	Reference/ Text Book with Page Number
01.	Introduction: Importance and Role of Transportation Systems	1	KHANNA AND JASTU
02.	Technological and Operating Characteristics of Transportation Systems, Components of transportation Systems, Transportation Coordination. Transportation Modes and their comparison.	3	KHANNA AND JASTU
03.	Highway Planning: Highway Planning Process, specifically in India, Transport or Highway related Agencies in India	1	KHANNA AND JASTU
04.	Classification of Roads and Road Development Plans, Road Patterns, Controlling Factors and Surveys for Highway Alignment.	2	KHANNA AND JASTU
05	Highway Materials and Construction: Desirable Properties, Testing Procedures	2	KHANNA AND JASTU
06.	Standards and standard values relating to Soil, Stone Aggregates, Bitumen and Tar, fly-ash/pond-ash.	2	KHANNA AND JASTU
07.	Methods of constructing different types of roads viz. Earth roads, Stabilized roads, WBM roads, fly ash embankments, Bituminous roads and Concrete roads. Specific features of rural roads. Equipments for highway construction of rigid and flexible pavements.	4	KHANNA AND JASTU

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08.	Highway Geometric Design: Cross Sectional Elements, camber, Sight Distances – definition and analysis of SSD and OSD	2	KHANNA AND JASTU
09.	Design of Horizontal Alignment – Super elevation, extra widening, transition curves.	2	KHANNA AND JASTU
10.	Design of Vertical Alignment – Gradients, Vertical curves.	2	KHANNA AND JASTU
11.	Recommendations Indian Road congress code of Practice.	2	KHANNA AND JASTU
12	Elementary Traffic Engineering: Significance of different Traffic Engineering Studies viz. Speed, Volume, O & D, Parking and Accident's Study.	4	KHANNA AND JASTU
13	Importance and types of Traffic Signs, Signals, Road Markings and Road Intersections.	4	KHANNA AND JASTU
14	Structural design of Highway Pavements: Design of Flexible Pavements by G. I. and CBR methods.	3	KHANNA AND JASTU
15	Design of Rigid Pavements by Westergard and modified methods.	3	KHANNA AND JASTU
16	Design as guide lines of relevant Indian Road congress code of Practice.	2	KHANNA AND JASTU

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RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Scheme & Syllabus

IV Year- VII & VIII Semester: B. Tech. (Civil Engineering)

Teaching & Examination Scheme B.Tech.: Civil Engineering 4th Year - VII Semester

THEORY											
SN	Category	Course Code	Course Title	Hours Per Week			Marks				Cr
				L	T	P	Exm Hrs	IA	ETE	Total	
1	PCC	7CE4-01	Transportation Engineering	3	0	0	3	30	120	150	3
2	OE		Open Elective-I	3	0	0	3	30	120	150	3
Sub Total				6	0	0		60	240	300	6
PRACTICAL & SESSIONAL											
3	PCC	7CE4-21	Road Material Testing Lab	0	0	2		30	20	50	1
4		7CE4-22	Professional Practices & Field Engineering Lab	0	0	2		30	20	50	1
5		7CE4-23	Soft Skills Lab	0	0	2		30	20	50	1
6		7CE4-24	Environmental Monitoring and Design Lab	0	0	2		30	20	50	1
7	PSIT	7CE7-30	Practical Training	1	0	0		75	50	125	2.5
8		7CE7-40	Seminar	2	0	0		60	40	100	2
9	SODECA	7CE8-00	SODECA	0	0	0		0	25	25	0.5
Sub- Total				3	0	8		255	195	450	9
TOTAL OF VII SEMESTER				9	0	8		315	435	750	15

L: Lecture, **T:** Tutorial, **P:** Practical, **Cr:** Credits
ETE: End Term Exam, **IA:** Internal Assessment

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RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

IV Year- VII & VIII Semester: B. Tech. (Civil Engineering)

7CE4-01: Transportation Engineering

Credit 3

Max. Marks: 150(IA:30, ETE:120)

3L+0T+0P

End Term Exam: 3Hours

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course	1
2	Highway planning and alignment: Different modes of transportation - historical Development of road construction-Highway Development in India -Classification of roads- Road pattern - Highway planning in India- Highway alignment - Engineering Surveys for alignment - Highway Project- Important Transport/Highway related agencies in India. PMGSY project. Introduction about IRC, NRRDA	5
3	Geometric Design of highways: The highway crosses sectional elements- Camber-Sight Distance - Types of sight distances -Design of horizontal alignments - Super elevation, Widening of Pavements on horizontal curves- transition Curves- Design of Vertical alignments - Gradients- summit and Valley Curves- Recommendations of IRC Codes of Practice.	7
4	Highway Materials: Desirable Properties, Testing Procedures, Standards and standard values relating to Soil, Stone Aggregates, Bitumen and Tar, fly- ash/pond-ash. Role of filler in Bituminous mix, materials of filler. Specifications of DLC and PQC for rigid pavement	6
5	Highway Construction and Equipments: Methods of constructing different types of roads viz. Earth roads, Stabilized roads, WBM, WMM roads, earthen embankments, DLC and embankments with fly ash. Bituminous roads and Concrete roads. Berms and Shoulders, Features of rural roads including those in PMGSY. Hot mix plant for Bituminous roads-components, layout, control panel, quality assurance. Highway construction of rigid and flexible pavements including types of road rollers, specifications of compaction of different layers of bituminous roads, modern pavers for CC roads. Roller compacted concrete road construction	8
6	Design of flexible and rigid pavements as per IRC: IRC provisions including those of IRC 37, IRC 58	5
7	Introduction of Railway Engineering: Types and Selection of Gauges, Selection of Alignment, Ideal Permanent Ways and Cross-sections in different conditions, Drainage, Salient Features and types of Components viz. Rails, Sleepers, Ballast, Rail Fastenings.	3
8	Introduction of Airports and Harbours: Airport Engineering: - Introduction: Requirements to Airport Planning, Airport Classifications, Factors in Airport Site Selection, Airport Size. Planning of Airport: Requirements of Airport- Terminal Area, Runway Length etc. Harbours: history of water transportation, modern trends in water transportation, components of harbour, classification of harbours. Ports and docks.	5
Total		40

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Syllabus of 4th Year B. Tech. (CE) for students admitted in Session 2017-18 onwards

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RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

IV Year- VII & VIII Semester: B. Tech. (Civil Engineering)

Text / Reference Books:	
1	Highway Engineering by Khanna SK & CG Justo, Nem Chand & Brothers, Roorkee.
2	Highway Engg. By LR Kadyali, Khanna Tech Publications, Delhi.
3	Specifications for Roads & Bridges by Ministry of Road Transport & Highways and Indian Road Congress.
4	Railway Engineering by Satish Chandra and MM Agarwal, Oxford University Press, Delhi.
5	Railway Engineering by Saxena SC and Arora SP, Dhanpat Rai Publishers, Delhi.
6	S C Rangwala, airport engineering, Charotar publication house.
7	Gautam H. Oza, Dock & Harbour Engineering, Charotar publication House.

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Syllabus of 4th Year B. Tech. (CE) for students admitted in Session 2017-18 onwards

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Techno India NJR Institute of Technology
Academic Administration of Techno NJR Institute
Syllabus Deployment

Name of Faculty: Mr. Bharat Kr. Suthar	Subject Code: 7CE4-01
Department: Department of Civil Engineering	SEM: VII
Total No. of Lectures Planned: 40	Sub. Transportation Engineering

COURSE OUTCOMES HERE (4 OUTCOMES)

At the end of this course students will be able to:

CO1: Interpret geometric Design fundamentals.

CO2: Demonstrate traffic Control devices.

CO3: To study about these aspects of roads, railways and bridges so as to develop their understanding.

Lecture No.	Unit	Topic
1	1	Introduction: Objective, scope and outcome of the course.
2	2	Different modes of transportation, historical Development of road construction.
3	2	Highway Development in India –Classification of roads- Road pattern.
4	2	Highway planning in India- Highway alignment - Engineering Surveys for alignment – Highway Project- Important
5	2	Highway planning in India- Highway alignment - Engineering Surveys for alignment – Highway Project- Important
6	2	Transport/Highway related agencies in India. PMGSY project. Introduction about IRC, NRRDA
7	3	The highway crosses sectional elements- Camber-Sight Distance.
8	3	Types of sight distances- Discuss and Derivation on Stopping Sight Distance.
9	3	Discuss and Derivation on Overtaking Sight Distance.
10	3	Design of horizontal alignments - Super elevation.
11	3	Widening of Pavements on horizontal curves.
12	3	Transition Curves- Design of Vertical alignments – Gradients.
13	3	Summit and Valley Curves- Recommendations of IRC Codes of

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		Practice.
14	4	Highway Materials: Desirable Properties.
15	4	Highway Materials: Testing Procedures.
16	4	Standards and standard values relating to Soil.
17	4	Discuss Properties on Stone Aggregates, Bitumen and Tar, fly-ash/pond-ash.
18	4	Role of filler in Bituminous mix, materials of filler.
19	4	Specifications of DLC and PQC for rigid pavement.
20	5	Methods of constructing different types of roads viz. Earth roads.
21	5	Methods of constructing different types of roads viz Stabilized roads, WBM.
22	5	Methods of constructing different types of roads viz WMM roads, earthen embankments.
23	5	DLC and embankments with fly ash. Bituminous roads and Concrete roads. Berms and Shoulders.
24	5	Features of rural roads including those in PMGSY. Hot mix plant for Bituminous roads-components, layout, control panel, quality assurance.
25	5	Highway construction of rigid and flexible pavements including types of road rollers.
26	5	Specifications of compaction of different layers of bituminous roads.
27	5	Modern pavers for CC roads. Roller compacted concrete road construction.
28	6	Design of Flexible Pavement.
29	6	Design of Flexible Pavement.
30	6	Design of Rigid Pavement.
31	6	Design of Rigid Pavement.
32	6	Numerical based on Rigid and Flexible Pavements.
33	7	Railway Engineering: Types and Selection of Gauges, Selection of Alignment, Ideal Permanent Ways.
34	7	Cross- sections in different conditions, Drainage, Salient Features and types of Components viz. Rails.
35	7	Discuss to Sleepers, Ballast, and Rail Fastenings.
36	8	Airport Engineering: - Introduction: Requirements to Airport Planning
37	8	Airport Classifications, Factors in Airport Site Selection, Airport Size
38	8	Planning of Airport: Requirements of Airport- Terminal Area,

		Runway Length etc.
39	8	Harbours: history of water transportation, modern trends in water transportation
40	8	Components of harbour, classification of harbours. Ports and docks.

TEXT/REFERENCE BOOKS

1. Railway Engineering by Sexena S.C. and Arora S.P, Dahnpat Rai Publishers, Delhi.
2. Airport Engineering by Rangwala, Charotar Publishing House.
3. Transportation Engineering by A.K. Upadhyay, S.K. Kataria and Sons.
4. Railway Engineering by Satish Chandra and M.M Agarwal, Oxford University Press, Delhi.



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TECHNO INDIA INSTITUTE OF TECHNOLOGY

I MID TERM ONLINE EXAMINATION (VII Semester)

SUB. Transportation Engineering

Time: 2 Hours

Max Marks: 82

PART -A

(Answer Should be given up to 25 words only) [5X2=10]

(All questions are compulsory)

1. What are the significant recommendation of Jaykar committee report?
2. Highway Related Agencies in India. (Only Name)
3. Compare mode of transportation (ONLY FLOW CHART)
4. What do you know about Highway Alignment?
5. Discuss about Minimum Travel Pattern.

PART-B

(Attempt any FOUR questions) [4x10=40]

1. Discuss about Transportation Engineering and its Importance
2. Derive Expression about Overtaking Sight Distance (OSD) .
3. Calculate the length of Transition Curve and the shift using following data:
Design speed 70kmph, radius of circular curve 200m, allowable rate of change acceleration 0.5 to 0.8 m/s² , allowable rate of introduction of super elevation is 1In120, pavement Width =7.5m.
4. The speed of overtaking and overtaken vehicles are 70 &40 kmph respectively on a two way traffic on road. If the acceleration of overtaking vehicle is 0.99 m/s² .
 - I. Calculate safe overtaking sight distance
 - II. find minimum length of overtaking Zone.
 - III. Draw a neat sketch of overtaking zone and show the position of Sign posts
5. The radius of the horizontal curve is 100m . the design speed is 50Kmph and the design Coefficient is 0.15, then
 - I. Calculate the Super elevation req. if full Lateral friction is assumed to develop.
 - II. Calculate the Coefficient of friction needed if no Superelevation is provided
 - III. Calculate the req. Superelevation if the pressure on inner wheel and outer wheel should be equal.

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PART-C

(All questions are Compulsory) [2x16=32]

1 The Following data was Collected for Planning the road development Program of a backward district.

- I. Total Area= 9600 km²
- II. Agriculture & developed Area= 3200 km²
- III. Existing Railway track Length= 105 km
- IV. Existing length of metalled Road= 322 km
- V. Existing Length of Unmetalled Road(ODR&VR)=450 km
- VI. No. of town or Village with diff. Population Ranges are as below.

Population	>5000	2001-5000	1001-2000	501-1000	<500
No. of Vill.& Town	8	40	130	280	590

Calculate the additional length of metalled & unmetalled road for System based on Nagpur road Plan formula for the District..

2. Short Notes: (any four)..

- Transition curve (with expression)
- SSD. (with expression)
- Width of road, Horizontal Curve.(with expression)
- Shoulder, footpath, Guard rail.
- Road Pattern (any two)

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Civil Engineering Department

Tutorial-I/VII Sem.(IV Year)

(Subject Code: 3CE3-04): Transportation Engineering

Tutorial-1

- 1) Explain the various road patterns along with their advantages and disadvantages.
- 2) Calculate O.S.D. for a design speed of 76 kmph. Assume all other data as per IRC.

OR

A two lane road with a design speed of 80 kmph has radius of a horizontal curve is 480m. Design the rate of superelvation for mixed traffic. By how much should be the outer edge of pavement raised w.r.t. the inner edge if the pavement is 7.5m wide at the horizontal curve?

- 3) A Vertical summit curve is to be designed when two grades 1 in 50 (ascending) and 1 in 80 (descending) meets on a highway. Calculate the length of summit curve to have an overtaking sight distance at a design speed of 96 kmph.
- 4) Write a short note on- **(any 4)**
 - a. Horizontal curve
 - b. Kerb
 - c. Road margins
 - d. Camber
 - e. Jaykaar committee
- 5) Explain Nagpur Road Plan in brief.

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Civil Engineering Department

Tutorial-II/VII Sem.(IV Year)

(Subject Code: 3CE3-04): Transportation Engineering

Transportation-II

- 1) A two lane road with a design speed of 80 kmph has radius of a horizontal curve is 480m. Design the rate of superelvation for mixed traffic. By how much should be the outer edge of pavement raised w.r.t. the inner edge if the pavement is 7.5m wide at the horizontal curve?
- 2) Calculate O.S.D. for a design speed of 86 kmph. Assume all other data as per IRC.
- 3) A Vertical summit curve is to be designed when two grades 1 in 60 (ascending) and 1 in 90 (descending) meets on a highway. Calculate the length of summit curve to have an overtaking sight distance at a design speed of 86 kmph.
- 4) Write a short note on- **(any 4)**
 - f. Horizontal curve
 - g. Kerb
 - h. Road margins
 - i. Camber
 - j. Jaykaar committee
- 5) Explain Bombay Road Plan in brief.

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Civil Engineering Department

Tutorial-III/VII Sem.(IV Year)

(Subject Code: 3CE3-04): Transportation Engineering

- 1) Explain Lucknow Road Plan in brief.
- 2) Calculate O.S.D. for a design speed of 50 kmph. Assume all other data as per IRC.

OR

A two lane road with a design speed of 70 kmph has radius of a horizontal curve is 680m. Design the rate of superelvation for mixed traffic. By how much should be the outer edge of pavement raised w.r.t. the inner edge if the pavement is 5.5m wide at the horizontal curve?

- 3) A Vertical summit curve is to be designed when two grades 1 in 50 (ascending) and 1 in 80 (descending) meets on a highway. Calculate the length of summit curve to have an overtaking sight distance at a design speed of 76 kmph.
- 4) Write a short note on- **(any 4)**
 - a. Horizontal curve
 - b. Carriage way
 - c. Road margins
 - d. Camber
 - e. Jaykaar committee.

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Civil Engineering Department

VII Sem.(IV Year)

(Subject Code: 3CE3-04): Transportation Engineering

Important Question Bank

- 1) Explain Lucknow Road Plan in brief.
- 2) A Vertical summit curve is to be designed when two grades 1 in 50 (ascending) and 1 in 80 (descending) meets on a highway. Calculate the length of summit curve to have an overtaking sight distance at a design speed of 76 kmph.
- 3) Calculate O.S.D. for a design speed of 46 kmph. Assume all other data as per IRC.
- 4) Explain Bombay Road Plan in brief.
- 5) Explain the various road patterns along with their advantages and disadvantages.
- 6) Explain Nagpur Road Plan in brief. Write a short note on- **(any 4)**
 - f. Horizontal curve
 - g. Kerb
 - h. Road margins
 - i. Camber
 - j. Jaykaar committee
- 7) A two lane road with a design speed of 80 kmph has radius of a horizontal curve is 480m. Design the rate of superelvation for mixed traffic. By how much should be the outer edge of pavement raised w.r.t. the inner edge if the pavement is 7.5m wide at the horizontal curve?

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Civil Engineering Department

VII Sem.(IV Year)

(Subject Code: 3CE3-04): Transportation Engineering

Open Book Test

- 1) Explain Nagpur Road Plan in brief. Write a short note on- **(any 4)**
 - k. Horizontal curve
 - l. Kerb
 - m. Road margins
 - n. Camber
 - o. Jaykaar committee
- 2) A two lane road with a design speed of 80 kmph has radius of a horizontal curve is 480m. Design the rate of superelvation for mixed traffic. By how much should be the outer edge of pavement raised w.r.t. the inner edge if the pavement is 7.5m wide at the horizontal curve?
- 3) Calculate O.S.D. for a design speed of 86 kmph. Assume all other data as per IRC.

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