Techno India NJR Institute of Technology

Transportation Engineering

(Subject Code: 7CE4-01)

Bharat K Suthar

(Assistant Professor)

Department of CE

For Techno India NJR Institute of Technology

पंकज पोरवाल

Dr. Pankaj Kumar Porwal

(Principal)

RAJASTHAN TECHNICAL UNIVERSITY, KOTA
Syllabus
IV Year- VII & VIII Semester: B. Tech. (Civil Engineering)
7CE4-01: Transportation Engineering

Credit 3
3L+0T+0P

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

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

Syllabus of 4thYear B. Tech. (CE) for students admitted in Session 2017-18 onwards   Page 1

2

Course Overview:

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 Outcomes:

CO. NO.	Cognitive Level	Course Outcome
1	Analysis	To understand the principles of Highway geometrics design as per IRC standards. Perform geometric design for the Highway & Basic concept of Pavement design.
2	Application	To understand Types of pavements & Materials required for highway construction. Construction procedures for different types of pavements. Maintenance procedures for different types of pavements.
3	Design	To understand the Traffic engineering & different types of traffic control device.
4	Design	Analysing the strength required for pavement and designing flexible and rigid pavement by different methods.
5	Synthesis	Describe and understand the various components of railway track.

Prerequisites:

1. Basic knowledge of Indian Road Codes
2. Basic knowledge of planning
3. Knowledge of Surveying subject.
4. Knowledge of Horizontal and vertical curves.

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Course Outcome Mapping with Program Outcome:

Transportation Engineering															
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO471.1	3	2	2	2	2	1	1	1	2	1	1	2	2	2	2
CO471.2	2	2	1	1	1	2	1	1	2	2	2	1	1	2	2
CO471.3	3	2	2	2	2	1	1	1	2	1	1	2	2	2	2
CO471.4	3	3	3	2	2	1	2	1	2	1	1	1	2	2	1
CO471.5	3	3	3	2	2	1	2	1	2	1	1	1	2	2	1
CO471 (AVG)	2.8	2.4	2.2	1.8	1.8	1.2	1.4	1	2	1.2	1.2	1.4	1.8	2	1.6

Course Coverage Module Wise:

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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Assessment Methodology:

1. Practical exam in lab where they have to write Tests Related to the Quality of road material and construction. (Once in a week)
2. Assignments one from each unit.
3. Midterm subjective paper where they have to write about concepts related to road materials.
4. Final paper at the end of the semester subjective.

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Teaching and Learning resources unit-wise:

Theory concepts

https://nptel.ac.in/courses/105101087

https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_TEI_Lecture_Notes.pdf

https://vssut.ac.in/doc/Transportation-1_Lecture-Note.pdf

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/s^2 , 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/s^2** .

    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 Cofficient is 0.15, then

    I.Calculate the Super elevation req. if full Lateral friction is assumed to develop.

    II.Calculate the Cofficient 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.

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, foothpath, 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.

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.