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Fourth Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
BS	BS-202	Probability, Statistics and Linear Programming	4		4
HS/MS	HS-204	Technical Writing*	2		2
PC	CEC-206	Soil Mechanics	4		4
PC	CEC-208	Hydraulics and Hydrology	4		4
PC	CEC-210	Environmental Engineering - I	4		4
PC	CEC-212	Transportation Engineering	4		4
Practical / Viva Voce					
BS	BS-252	Probability, Statistics and Linear Programming Lab		2	1
PC	CEC-254	Soil Mechanics Lab		2	1
PC	CEC-256	Hydraulics Lab		2	1
PC	CEC-258	Transportation Engineering Lab		2	1
Total			**22**	**8**	**26**

***NUES:** All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

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Paper Code(s): BS-202	L	P	C
Paper: Probability, Statistics and Linear Programming	4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1^{st}) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To understand probability and probability distributions.
2:	To understand methods of summarization of data.
3:	To understand and use test for hypothesis.
4:	To understand methods for solving linear programming problems.

Course Outcomes (CO):

CO1:	Ability to solve probability problems and describe probability distributions.
CO2:	Ability to describe and summarize data.
CO3:	Ability to use test for hypothesis.
CO4:	Ability to formulate and solve linear programming problems.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	-	3	1	1	1	-	-	-	-	-	1	2
CO2	-	3	1	1	1	-	-	-	-	-	1	2
CO3	-	3	2	2	1	-	-	-	-	-	2	2
CO4	-	3	3	3	1	-	-	-	-	-	2	2

Unit I

Basics: Probability and Statistical models, Sample Spaces and Events, Counting Techniques, Interpretations and Axioms of Probability, Unions of Events and Addition Rules, Conditional Probability, Intersections of Events and Multiplication and Total Probability Rules, Independence, Bayes' Theorem, Random Variables.

Discrete and Continuous Random Variables and Distributions: Probability Distributions and Probability Mass / density Functions, Cumulative Distribution Functions, Mean and Variance of a Random Variable, Discrete and continuous Uniform Distribution, Binomial Distribution, Geometric and Negative Binomial Distributions, Hypergeometric Distribution, Poisson Distribution. Normal Distribution, Normal Approximation to the Binomial, and Poisson Distributions; Exponential Distribution, Erlang and Gamma Distributions, Weibull Distribution, Lognormal Distribution, Beta Distribution.

Unit II

Joint Probability Distributions for Two Random Variables, Conditional Probability Distributions and Independence, Joint Probability Distributions for Two Random Variables, Covariance and Correlation, Common Joint Distributions, Linear Functions of RandomVariables, General Functions of Random Variables, Moment-Generating Functions.

Numerical Summaries of Data, Stem-and-Leaf Diagrams, Frequency Distributions and Histograms, Box Plots, Time Sequence Plots, Scatter Diagrams, Probability Plots. Point Estimation, Sampling Distributions and the

Central Limit Theorem without proof, General Concepts of Point Estimation, Methods of Point Estimation, Statistical Intervals for a Single Sample.

Unit III

Hypotheses Testing for a SingleSample: Tests on the Mean of a Normal Distribution with Variance Known / Unknown, Tests on the Variance and Standard Deviationof a Normal Distribution, Tests on a Population Proportion, Testing for Goodness of Fit, Nonparametric tests (Signed, Wilcoxon), Similarly Statistical Inference forTwo Samples.
Regression and Correlation: Linear Regression, Least Squares Estimators, Hypotheses testing for simple linear regression, Confidence Intervals, Adequacy of model, Correlation, Transformed Variables, Logistic Regression. Similarly, for multiple linear regression including aspects of MLR.

Unit IV

Linear Programming: Introduction, formulation of problem, Graphical method, Canonical and Standard form of LPP, Simplex method, Duality concept, Dual simplex method, Transportation and Assignment problem.

Textbooks:

1. *Applied Statistics and Probability for Engineers* by Douglas G. Montgomery and Runger, Wiley, 2018
2. *Linear Programming* by G. Hadley, Narosa, 2002

References:

1. *Miller and Freund's Probability and Statistics for Engineers* by Richard A. Johnson, Pearson, 10th Ed., 2018.
2. *Probability & Statistics for Engineers & Scientists* by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Pearson, 2016.
3. *Statistics and probability with applications for engineers and scientists using Minitab, R and JMP*, C. Gupta, Irwin Guttman, and Kalanka P. Jayalath, Wiley, 2020.
4. *Probability and Statistics for Engineering and the Sciences*, Jay Devore, Cengage Learning, 2014.
5. *Probability and Statistics in Emgineering*, William W. Hines, Douglas C. Montgomery, David M. Goldman, and Connie M. Borror, Wiley, 2003.
6. *Operations Research: An Introduction* by Hamdy A. Taha, Pearson, 10th Edition, 2016

Paper Code(s): CEC-206	L	P	C
Paper: Soil Mechanics	4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To explain the methods of classifying the soils
2.	To analyze the flow of water through soils and to estimate the stress distribution in the soil mass
3.	To estimate the compaction characteristics, compressibility characteristics, settlements
4.	To assess the shear strength of the soils.

Course Outcomes (CO)

CO 1	Classify the soil and determine its Index properties.
CO 2	Evaluate permeability and seepage properties of soil, determine the vertical stress under different loading conditions, phenomenon of soil liquefaction
CO 3	Interpret the compaction and consolidation characteristics & effective stress concept of soil.
CO 4	Determine the shear stress under different loading conditions.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	2	-	-	-	-	-	-	-	-	-	-
CO 4	-	2	-	-	-	-	-	-	-	-	-	-

UNIT-I

Soil Origin and classification: Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Weight volume relationships, Clay minerals, Soil structure, Index properties, sensitivity and thixotropy, Particle size analysis, Unified and Indian standard soil classification system.

UNIT-II

Soil Hydraulics: Stress conditions in soil-total, effective and neutral stresses and relationships. Permeability - Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil. Seepage, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, capillarity, critical hydraulic gradient and quick sand condition, uplift pressure, piping.

Stress Distribution in soil: Elastic constants of soils and their determination, Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under loaded areas, Concept of pressure bulb, contact pressure.

UNIT-III

Soil compaction, water content: dry unit weight relationships. Factors controlling compaction. Field compaction equipment; field compaction control; Proctor needle method.
Consolidation: Primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Consolidation test, Normal and Over Consolidated soils, Over Consolidation Ratio, determination of coefficient of consolidation.

UNIT – IV

Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test; unconfined compression test; pore pressure, Skempton's pore water pressure coefficients and Soil liquefaction.

Textbook(s):
1. Gopal Ranjan and A. S. R. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers; 4th Edition (2022).
2. Dr B.C. Punmia, Er A.K. JAIN, & Dr A.K. Jain, "Soil Mechanics and Foundations", Laxmi Publications; 17th Edition (2017).

Reference Books:
1. Dr K.R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Dist., (2020)
2. Venkataramaiah, "Geotechnical Engineering" New Age International Publishers.
3. V.N.S. Murthy, "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", (2016).
4. P. Purushothama Raj, "Soil Mechanics and Foundation Engineering", Pearson Education India, (2013).
5. Geotechnical Engineering [Principles and Practices] P.Donald,Coduto,PHI Publications
6. Soil mechanics in engineering practice by Karl Terzaghi, Ralph Brazelton Peck, Gholamreza Mesri,Wiley.
7. Soil mechanics by Lambe and Whitman Wiley edition
8. Geotechnical Engg, Gulati and Dutta, McGrawHill Education (I) Pvt. Ltd1. E. Ward Cheney & David R. Kincaid

Paper Code(s): CEC-208	L	P	C
Paper: Hydraulics and Hydrology	4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	Define different types of flow and their conditions with limitations.
2.	Develop an expression for types of flows and their characteristics. To know about the hydrological cycle process.
3.	To Assess the Storage capacity of the reservoir and the process of mitigating floods.
4.	To determine flow characteristics.

Course Outcomes (CO)

CO 1	Able to understand and explain the flows in hydraulic structures.
CO 2	Able to determine various components of the hydrologic cycle affecting the movement of water in the earth and various Stream flow measurements technique
CO 3	Able to evaluate the hydrologic parameters
CO 4	Able to determine and analyze groundwater hydraulics.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	2	-	-	-	-	-	-	-	-	-	-
CO 4	-	2	-	-	-	-	-	-	-	-	-	-

UNIT-I

Channel Hydraulics: - Energy and Momentum Principles: Critical depth, the concept of specific energy and specific force, application of specific energy principle for the interpretation of open channel phenomenon, flow through vertical and horizontal contractions. Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical, and numerical methods, flow in a curved channel.

UNIT-II

Hydraulic Jump, Surges, Water Waves: Classical hydraulic Jump, evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, equation of motion for unsteady flow, open channel surge, celerity of the gravity wave, deep and shallow water waves.

Introduction, Hydrologic cycle, Climate and water availability, Water balances, Precipitation: Forms, Classification, Variability, Measurement, Data Analysis, Evaporation, and its measurement, Evapotranspiration and its measurement, Penman-Monteith method. Infiltration: Factors affection infiltration, Horton's equation, and Infiltration indices.

UNIT-III

Runoff: drainage basin characteristics, Hydrograph concepts assumptions and limitations of unit hydrograph, Derivation of unit hydrograph S hydrograph, Flow duration curve. Site selection, Zones of storage, Safe yield, Reservoir capacity, Reservoir sedimentation, and control. Causes of flooding and flood control measures. Channel improvement, Flood damage analysis. Design flood, Flood estimation, Frequency analysis, Flood routing through reservoirs and open channels, and Storm drainage design.

UNIT – IV

Occurrence and movement of groundwater, Darcy's law, governing groundwater flow equations, Factors governing groundwater flow, Types of aquifers, porosity, specific yield, specific retention, storage coefficient, permeability, hydraulic conductivity, hydraulic transmissibility, Conjunctive use and its necessity.

Textbook(s):

1. Fluid Mechanics: Including Hydraulic Machines by A.K. Jain.
2.Subramanya, K., Engineering Hydrology, Tata McGraw Hill, New Delhi.
3. Raghunath, H.M., Groundwater, 1987, Wiley Eastern Ltd., New Delhi.
4. Fluid Mechanics by RK Bansal.

References:

1. Modi, P.N., Irrigation Water Resources, and Water Power Engineering, Standard Book House, New Delhi.
2. Todd, D.K., Groundwater Hydrology, 1993 John Wiley & Sons.
3. Raghunath, H.M., Hydrology – Principles, Analysis and Design, 1986, Wiley
4. Dr. P.Jaya Rami Reddy, A Textbook of Hydrology, University Science Press.
5.Garg S.K., Hydrology and Water Resources Engineering

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Paper Code(s): CEC-210	L	P	C
Paper: Environmental Engineering - I	4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To make the students conversant with sources and its demand of water
2.	To understand the basic characteristics of water and its determination
3.	To provide adequate knowledge about the water treatment processes and its design
4.	To have adequate knowledge on operation and maintenance of water supply

Course Outcomes (CO)

CO 1	Explain the unit process and operations for waste water treatment
CO 2	Construct the sewerage and plumbing system
CO 3	Examine the advanced wastewater treatment methods
CO 4	Design the suspended and attached growth waste water treatment systems

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	1	1	-	-	-	-	1	-	-	-	-	-
CO 2	2	2	2	-	-	-	2	-	-	-	-	-
CO 3	-	-	1	-	-	-	3	-	-	-	-	-
CO 4	3	2	3	-	-	-	-	-	-	-	-	-

UNIT-I

Sewerage systems and their components: Introduction to sewerage system, Estimation of sewerage and drainage discharge, Dry weather flow, capacity of sewers, self-cleansing and non-scouring velocities, calculations of sizes and grades, forms and cross sections of sewers, hydraulic characteristics of circular sewer sections, use of tables and monograms, egg shaped sewers, systems of drainage, separate, combined and partially combined systems.

Quality and characteristics of sewage: physical, chemical and biological characteristics of sewage, Aerobic and anaerobic decomposition of sewage, nitrogen, sulphur and carbon cycles, collection of sewage sample, bacteriological and virological testing.

Sewage disposal: Disposal of treated / untreated / partially treated effluents in natural water bodies, Standard for effluent disposal on land, Disposal by land treatment / sewage farming methods, sewage sickness and its preventive measures, Treatment standards for sewage effluents, Bangalore and Indore methods of disposal.

UNIT-II

Engineered systems for waste water treatment: Types of treatment units in preliminary, primary and secondary treatment, their functions and efficiencies, analysis and design of screening, grit chambers, detritus tanks, skimming tanks, design of septic tanks and Imhoff tanks.

Ponds and lagoons: Principle, operations, construction, design and detailing of Oxidation ponds, Aerated

lagoons, Facultative ponds, Oxidation ditches, anaerobic lagoons.
Attached culture systems: System microbiology, Contact beds, Principle, operations, Construction and design details of Trickling filters, Bio towers, Rotating biological contractors (RBC).

UNIT-III

Design of Suspended culture systems : Activated sludge, concept of completely mixed and Plug flow reactors, process variation and design considerations, Aeration of activated sludge, Air diffusers and mechanical aerators, activated sludge clarifiers, Secondary clarifier design based on limiting flux rate.
Advanced waste water treatment: Nutrient removal, Nitrification and Denitrification, Air stripping for ammonia removal, phosphorus removal, dissolved solids removal, Waste water reuse.
Sludge thickening and sludge digestion: Sludge characteristics, sludge volume and solids relationships, Aerobic and anaerobic digestion, Factors affecting sludge digestion and their control, disposal of digested sludge.

UNIT - IV

Sewage collection from houses and buildings: General principles for design of sanitary plumbing system, Functions and types of traps, types of plumbing systems, one pipe / two pipe, single stack / partially ventilated single stack system.
Construction and maintenance of sewers: Forces acting on sewer pipes, materials used in construction, laying and testing of sewer pipes, sewer appurtenances such as manholes, street inlets, gullies, catch basins, grease and oil traps, storm water overflows, inverted siphons, flushing and ventilation of sewers, Pumps for lifting sewage.

Text Books:

1. S.K. Garg, "Water Supply Engineering", Khanna Publishers.
2. Davis and Cornwell, "Introduction to Environmental Engineering", McGraw Hill
3. Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw Hill

References:

1. Henry and Heinke, "Environmental Science and Engineering", Prentice Hall India
2. Venugopala Rao, "Principles of Environmental Science and Engineering", Prentice Hall India
3. Gilbert M. Masters, "Introduction to Environmental Engineering" Prentice Hall India.
4. Kiely, Gerardd "Environmental Engineering" Tata McGraw Hill
5. Hammer, Hammer "Water and Wastewater Technology" PHI Learning Pvt. Ltd
6. Qasim, Motley, Zhu "Water works engineering" PHI Learning Pvt. Ltd.
7. C.D.Gupta, V.K.Gupta "Water Supply Handbook" Jain Brothers

Paper Code(s): CEC-212	L	P	C
Paper: Transportation Engineering	4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1^{st}) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1.	To understand the principles and practices of transportation engineering
2.	To have the capability to identify and solve transportation problems within the context of data availability and limitations of analysis tools
3.	To understand the basics of highway planning and design, and workout problems in design of road geometrics
4.	To deal with the characteristics of aircrafts related to airport design; runway and taxiway design,

Course Outcomes (CO)

CO 1	Conduct various engineering studies and survey for the design of transportation facilities.
CO 2	Develop the skills of highway, railway & Airport planning.
CO 3	Geometric design of roadway, railway & airport.
CO 4	Recommend suitable transportation systems like metros, railways, and airways to provide a substantiated conclusion.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	-	2	-	-	-	-	-	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	-	2	-
CO 3	-	-	3	-	-	2	-	1	-	-	-	-
CO 4	-	1	-	-	-	-	-	-	-	-	-	-

UNIT-I

Highways development Planning: Introduction, Different modes of transport, Development of Transport System, Phased development of Roads in India. Highway Surveys & Alignment, Design, Drawings, Estimates & Project Report.

UNIT-II

Geometric Design of Highways: Introduction, Highways Classification, Right of way, Land width, width of formation, width of pavement, Sight Distances, camber, horizontal and vertical Road Curves, Transition Curves.

UNIT-III

Developments in Indian Railways , Different Modes of Transport , Organization of Indian Railways , Indian Railway Finances and their Control, Gauges on World Railways, Different Gauges on Indian Railways, Choice of Gauge, Problems Caused by Change of Gauge, Necessity for Geometric Design, Details of Geometric Design of Track, Gradients, Grade Compensation on Curves, Circular Curves, Superelevation, Safe Speed on Curves,

Transition Curve, Compound Curve, Reverse Curve, Extra Clearance on Curves, Widening of Gauge on Curves, Vertical Curves, Realignment of Curves, Cutting Rails on Curves, Check Rails on Curves.

UNIT – IV

Airport Engineering: Introduction to Air Transportation – Aircraft Characteristics – Factors Affecting Selection of site for Airport – Aprons – Taxiway – Hanger – Geometric design – Computation of Runway Length, Correction for Runway Length, Orientation of Runway, Wind Rose Diagram

Text Books

1. Highway Engineering by Khanna and Justo, Nem Chand & Brothers, Roorkee
2. Subhash C. Saxena (2008) Airport Engineering, Planning and Design, CBS Publishers and Distributors
3. Saxena SC and Arora S C (2010) A Text Book of Railway Engineering, Dhanpat Rai Publications

Reference Books

1. Highway Engineering by L.R. Kadiyali
2. Transportation Engineering by G.V. Rao, Tata McGraw Hill Publisher, New Delhi
3. Principles of Pavement Design by E.J. Yodder
4. Traffic Engineering by Matson,Smith&Hurd

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