Transportation Engg.-I

Sem -VI

General Course Information:

Course Code: PCC-CVE302-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments and quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Quantify the specifications of various road construction materials required	**L2(Understanding)**
CO2	Perform geometric design of highways and expressways	**L3(Applying)**
CO3	Perform analysis and design of flexible and rigid pavements	**L4(Analyzing)**
CO4	Evaluate highway maintenance, drainage and economic issues	**L5(Evaluating)**
CO5	Perform the traffic studies necessary before making changes to or designing new road	**L6(Creating)**

Course Content

UNIT I

General: Different modes of transport, Development of Transport System, Phased development of Roads in India.

Planning of Highways: Planning & Management of Highways, Various road plans developed in India, Road patterns, Highway Surveys & Alignment, Design, Drawings, Estimates & Project Report.

Geometric Design of Highways: Introduction, Highways Classification, Right of way, Land width, width of formation, Thickness of pavement, Sight Distances, Stopping site distance, overtaking sight distance, overtaking zones, camber, Road Curves, Transition Curves, Super elevation. Widening at curves, IRC-recommendations for various geometric design parameters.

UNIT II

Construction of Roads: Various types of bituminous constructions and their selection, Construction of earth, gravel, water bound macadam, surface dressing, premixed carpet, bituminous macadam, bituminous concrete, mastic asphalt, cement concrete pavements.

Types of bituminous binders and properties: Manufacturing of bitumen, Paving bitumen specifications as per IS 73: 2013, comparison between bitumen, tar, cut back & emulsion, Modified binders and its rheology.

UNIT III

Pavements: Factors affecting design of pavements. Structure of Flexible pavement and its design procedure as per IRC 37:2001, 2012 and IRC72: 2007, Construction of Cement Concrete Roads & its layer specifications, Design of PQC pavements as per IRC 58 & SP 062.

Failures of flexible and rigid pavements: Causes of Failures and Remedial Measures, Maintenance of flexible and rigid pavements, pavement evaluation and its strengthening.

Traffic Studies: Definition of Traffic Engineering, Various faces of Traffic Engineering, Road user characteristics, Importance of traffic studies, spot speed, speed and delay and origin and destination studies. Traffic accident studies, Causes of accidents and Remedial Measures, Parking studies

UNIT IV

Drainage: Introduction, Importance & Principles of Highway Drainage, Surface Drainage, Sub Surface drainage.

Highway Maintenance: Introduction, Maintenance of Earth, gravel, WBM Roads, Bituminous Roads, Cement Concrete pavements.

Highway Economics: Economics of Pavement types, Economic Evaluation of Highway Schemes, Life Cycle Costing

REFERENCE BOOKS:

1. Khanna S.K. and C.E.G. Justo,HighwayEngineerin, Nemchand Bros(2012)
2. Kadyali L. R.; Highway Engineering, Nem Chand & Brothers, Roorkee (2004).
3. Sharma & Sharma; Principle and Practice of Highway Engineering, Asia Publishing House, New Delhi (2010)
4. Rao G. V.; Transportation Engineering, Tata McGraw Hill Publisher, New Delhi (1999)
5. Yoder E. J.; Principles of Pavement Design, John Wiley & Sons (1975).

Course Articulation Matrix:

Course Outcomes	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	-	-	-	-	-	-	-	-	3	1	2	-
CO2	1	2	3	1	-	-	-	-	1	-	1	3	1	2	3
CO3	1	2	3	-	1	-	-	-	-	-	1	3	2	3	3
CO4	2	3	2	1	1	-	-	-	-	-	2	3	1	2	3
CO5	1	2	3	3	1	-	-	-	1	-	2	3	1	2	3

Sewerage & Sewage Treatment
Sem -VI

General Course Information

Course Code: PCC-CVE304-T Course Credits: 2 Mode: Lecture (L) Type: PCC Contact Hours: 2 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments and quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand the concepts of sewage and sewage treatment	L2 (Understanding)
CO2	Apply environmental treatment technologies for sewage treatment	L3 (Applying)
CO3	Characterization of sewage using various parameters and methods	L4 (Analyzing)
CO4	Assess appropriate methods for sewage treatment	L5 (Evaluating)
CO5	Plan, design and operations of sewerage system and sewage treatment plant	L6 (Creating)

*Revised Bloom's Taxonomy

Course Content

UNIT-I

Collection of sewage: Importance of sanitation, Systems of sewerage – separate, combined and partially separate. Quantity of sanitary sewage and variations. Shapes of sewer – circular and egg shaped. Design of sewers, self-cleansing velocity and slopes, Construction and testing of sewer lines. Sewer materials. joints and appurtenances.

UNIT-II

Sewage Characterization: Quality parameters- BOD, COD, Solids, D.O., Oil & Grease. Indian Standards for disposal of effluents into inland surface sources and on land.

UNIT-III

Sewage Treatment: Objectives, sequence and efficiencies of conventional treatment units. Preliminary treatment, screening and grit removal units. Theory and design aspects of primary treatment, secondary treatment- activated sludge process & its modifications, Tricking filter, sludge digestion and drying beds. Stabilization pond, aerated lagoon, UASB process , septic tank and Imhoff tank.

UNIT-IV

Disposal of Sewage: Disposal of sewage by dilution – self-purification of streams. Sewage disposal by irrigation (sewage treatment).

REFERENCE BOOKS:

1. Waste Water Engineering: Metcalf and Eddy.
2. Sewage and Sewage Treatment: S.K. Garg.
3. Sewage and Sewage Treatment: S.R. Krishansagar.
4. Waste Water Engineering: B.C. Punmia.
5. Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	1	1	-	-	1
CO2	3	2	1	1	1	-	-	-	-	-	1	2	-	1	2
CO3	3	2	1	1	2	-	-	-	-	-	1	2	1	1	2
CO4	3	3	1	3	2	-	-	-	-	-	2	2	1	2	2
CO5	2	2	3	2	1	-	-	-	-	-	3	2	3	3	3

Soil Mechanics

Sem -VI

General Course Information

Course Code: PCC-CVE306-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments and quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Describe and discuss basic concepts of soil properties and soil mechanics	L2 (Understanding)
CO2	Classify and determine the index and engineering properties of soil	L3 (Applying)
CO3	Apply the basic concepts of soil mechanics in civil engineering works	L3 (Applying)
CO4	Examine the permeability and compressibility characteristics of soils in engineering practices	L4 (Analyzing)
CO5	Evaluate earth pressures and apply to check external stability of retaining structures	L5 (Evaluating)

*Revised Bloom's Taxonomy

Unit-I

Soil Formation and Composition: Introduction, soil and rock, Soil Mechanics and Foundation Engineering, origin of soils, weathering, soil formation, major soil deposits of India, particle size, particle shape, inter particle forces, soil structure, principal clay minerals.

Basic Soil Properties: Introduction, three phase system, weight-volume relationships, soil grain properties, soil aggregate properties, grain size analysis, sieve analysis, sedimentation analysis, grain size distribution curves, consistency of soils, consistency limits and their determination, activity of clays, relative density of sands.

Classification of soils: Purpose of classification, classification on the basis of grain size, classification on the basis of plasticity, plasticity chart, Indian Standard Classification System.

Permeability of Soils: Introduction, Darcy's law and its validity, discharge velocity and seepage velocity, factors affecting permeability, laboratory determination of coefficient of permeability, determination of field permeability, permeability of stratified deposits.

Unit-II

Effective Stress Concept: Principle of effective stress, effective stress under hydrostatic conditions, capillary rise in soils, effective stress in the zone of capillary rise, effective stress under steady state hydro-dynamic conditions, seepage force, quick condition, critical hydraulic gradient, two dimensional flow, Laplace's equation, properties and utilities of flownet, graphical method of construction of flownets, piping, protective filter.

Compaction: Introduction, role of moisture and compactive effect in compaction, laboratory determination of optimum moisture content, moisture density relationship, compaction in field, compaction of cohesionless soils, moderately cohesive soils and clays, field control of compaction

Unit-III

Compressibility and Consolidation: Introduction, components of total settlement, consolidation process, one-dimensional consolidation test, typical void ratio-pressure relationships for sands and clays, normally consolidated and over consolidated clays, Casagrande's graphical method of estimating pre-consolidation pressure, Terzaghi's theory of one-dimensional primary consolidation, determination of coefficients of consolidation, consolidation settlement, Construction period settlement, secondary consolidation

Unit-IV

Shear Strength: Introduction, Mohr stress circle, Mohr-Coulomb failure-criterion, relationship between principal stresses at failure, shear tests, direct shear test, unconfined compression test, triaxial compression tests, drainage conditions and strength parameters, Vane shear test, shear strength characteristics of sands, normally consolidated clays, over-consolidated clays and partially saturated soils, sensitivity and thixotropy.

Earth Pressure: Introduction, earth pressure at rest, Rankine's active & passive states of plastic equilibrium, Rankine's earth pressure theory, Coulomb's earth pressure theory, Culmann's graphical construction, Rebhann's construction.

REFERENCE BOOK:

1 Basic and Applied Soil Mechanics by Gopal Ranjan, ASR Rao, New Age Intetrnational(P)Ltd.Pub.N.Delhi.

2 Soil Mechanics and foundation engineering by Dr. K. R. Arora.

3. Soil Engg. in Theory and Practice, Vol .I, Fundamentals and General Principles by Alam Singh, CBS Pub.,N.Delhi.

4. Engg.Properties of Soils by S.K.Gulati, Tata-Mcgraw Hill,N.Delhi.

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Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	-	-	-	-	-	1	1	1	1	2
CO2	2	2	1	1	1	-	-	-	-	-	1	2	1	1	2
CO3	2	2	1	1	1	-	-	-	-	-	1	2	1	1	2
CO4	2	2	2	3	-	-	-	-	-	-	1	2	1	1	2
CO5	2	3	3	3	-	-	-	-	-	-	1	2	1	1	2

Design of Steel Structures-I
Sem -VI

General Course Information:

Course Code: PEC-CVE308-T Course Credits: **3** Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks- class performance measured through percentage of lecture attended (4 marks)- assignments and quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination- nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understandvarious aspects of the designs of steel structures	L2 (Understanding)
CO2	Apply the IS codes of practice for the design of steel structural elements.	L3 (Applying)
CO3	Analyze and design the behavior of various connections for both axial and eccentric forces.	L4 (Analyzing)
CO4	Examine and differentiate between gantry and plate girders	L4 (Analyzing)
CO5	Design of compression and flexural members using simple and built-up sections.	L6(Creating)

*Revised Bloom's Taxonomy

Course Contents

UNIT-I

Introduction: Properties of structural steel. I.S.Rolled sections and I.S. specification.

Connections: Importance- various types of connections- simple and moment resistant- riveted- bolted and welded connections.

Design of Tension Members: Introduction- types of tension members- net sectional areas- design of tension members- lug angles and splices.

UNIT-II

Design of Compression Members: Introduction- effective length and slenderness ratio- various types of sections used for columns- built up columns- necessity- design of built up columns- laced and battened columns including the design of lacing and battens- design of eccentrically loaded compression members.

Column Bases and Footings: Introduction- types of column bases- design of slab base and gusseted base- design of gusseted base subjected to eccentrically loading- design of grillage foundations.

UNIT-III

Design of Beams: Introduction- types of sections- general design criteria for beams- design of laterally supported and unsupported beams- design of built up beams- web buckling- web crippling and diagonal buckling.

UNIT-IV

Gantry Girders: Introduction- various loads- specifications- design of gantry girder.

Plate Girder: Introduction- elements of plate girder- design steps of a plate girder- necessity of stiffeners in plate girder- various types of stiffeners- web and flange splices (brief introduction)- Curtailment of flange plates- design beam to column connections: Introduction- design of framed and seat connection.

REFERENCE BOOKS:

1. Duggal- S.K. Limit State Design of Steel structures- McGraw Hill (2009.)
2. Ajmani- A. L. and Arya- A. S.- Design of Steel Structures- Nem Chand and Brothers (2000).
3. Subramanya- N- Design of Steel Structures- N. Subramanian- Oxford University Press(2008).
4. Design of steel structures, A.S.Arya & J.L.Ajmani, Nem chand & Bros., Roorkee.
5. Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
6. Design of steel structures, S.M.A.Kazmi & S.K.Jindal, Prentice Hall, New Delhi.
7. Design of steel structures, S.K.Duggal, TMH Pub., New Delhi.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	-	-	-	-	-	1	2	-	1	2
CO2	2	2	2	2	1	-	-	-	-	-	1	2	1	2	2
CO3	2	2	3	3	1	-	-	-	-	-	2	2	3	3	3
CO4	2	2	3	3	1	-	-	-	-	-	1	2	3	3	3
CO5	2	2	3	3	1	-	-	-	-	-	1	2	3	3	3

Transportation Engg.-I Lab

Sem -VI

General Course Information

Course Code: PCC-CVE302-P Course Credits: 1 Mode: Practical Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments and quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Estimate earth work from longitudinal and cross-section details	L2 (Understanding)
CO2	Demonstrate quality control tests on pavements and pavement materials	L3 (Applying)
CO3	Conduct traffic studies for estimating traffic flow characteristics	L4 (Analyzing
CO4	Evaluate the pavement materials	L5(Evaluating)
CO5	Design grade intersections	L6 (Creating

*Revised Bloom's Taxonomy

List of Experiment

1. Flakiness and Elongation Index of aggregates.
2. Specific gravity and water absorption test on aggregates.
3. Specific gravity of bitumen.
4. Proportioning of aggregates.
5. Marshall's stability test.
6. Stripping test on aggregates.
7. Determination of bitumen content.
8. CBR lab test on soil.
9. Traffic volume study using videography technique.
10. Traffic speed study using videography technique.

REFERENCE BOOKS:

1. Khanna S.K. and C.E.G. Justo,HighwayEngineerin, Nemchand Bros(2012)

2. Kadyali L. R.; Highway Engineering, Nem Chand & Brothers, Roorkee (2004).
3. Sharma & Sharma; Principle and Practice of Highway Engineering, Asia Publishing House, New Delhi (2010)
4. Rao G. V.; Transportation Engineering, Tata McGraw Hill Publisher, New Delhi (1999)
5. Yoder E. J.; Principles of Pavement Design, John Wiley & Sons (1975).
6. L.R. Kadiyali, Traffic Engineering and Transportation Planning, Khanna Publishers.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	-	-	-	-	-	-	-	-	1	1	1	1	2
CO2	-	-	3	-	-	-	-	-	-	-	1	2	1	1	2
CO3	-	3	-	-	-	-	-	-	-	-	1	2	1	1	2
CO4	-		3	-	-	-	-	-	-	-	1	2	1	1	2
CO5	-	-	3	-	-	-	-	-	-	-	1	2	1	1	2

Sewerage and Sewage Treatment Lab

Sem -VI

General Course Information

Course Code: PCC-CVE304-P Course Credits: 1 Mode: PRACTICAL(P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments and quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

*Revised Bloom's Taxonomy

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Identify physical, chemical and biological characteristics of sewage	L2(Understanding)
CO2	Solve optimum dosage of coagulant of sewage	L3(Applying)
CO3	Analyze a sewage treatment plant	L4(Analyzing)
CO4	Evaluate break - point chlorination	L5(Evaluating)
CO5	Formulate the quality of Sewage	L6(creating)

Detailed Syllabus:

1. Determination of pH.
2. Determination of Conductivity.
3. Determination of Acidity of sewage
4. Determination of Alkalinity of sewage
5. Determination of Chlorides in sewage
6. Determination of Hardness of sewage
7. Determination of Fluorides in sewage
8. Determination of Available Chlorine in bleaching powder.
9. Conducting Break Point Chlorination Test.
10. Determination of Residual Chlorine.
11. Determination of Dissolved Oxygen.
12. Determination of Chemical Oxygen Demand of sewage
13. Determination of Biochemical Oxygen Demand of sewage
14. Conducting Jar test for determining optimum dosage of coagulant.

15. Determination of Total Solids, Total Dissolved Solids & Settelable Solids.

REFERENCE BOOKS

Standard methods for the examination of water and wastewater. (2012). 21st Edition, Washington: APHA.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	-	-	1	2	-	-	-	1	2	1	1	2
CO2	1	2	3	1	-	1	2	-	-	-	1	2	1	-	2
CO3	1	3	2	1		1	2	-	-	-	1	2	3	1	3
CO4	1	2	3	1	-	1	2	-	-	-	1	2	1	-	3
CO5	1	2	3	1	-	1	2	-	-	-	1	2	1	2	3

Soil Mechanics Lab

Sem -VI

General Course Information

Course Code: PCC-CVE306-P Course Credits: 1 Mode: Lecture (P) Type: PCC Contact Hours: 2hours (P) Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments and quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Cite the soil conditions for design of structures	L1(Remembering)
CO2	Classify soils	L2(Understanding)
CO3	Interpret the soil after exploration from under ground samples	L3(Applying)
CO4	Determine index properties of soils	L4(Analyzing)
CO5	Determine engineering properties of soils	L5(Evaluating)

Detailed Syllabus:

1. Specific Gravity of soil particles.
2. Sieve Analysis.
3. Liquid Limit, Plastic Limit & Shrinkage Limit.
4. Proctor's Standard Compaction Test.
5. Determination of Field Density.
6. Constant Head Permeameter Test.
7. Variable Head Permeameter Test.
8. Unconfined Compression Test.
9. Triaxial Compression Test (U.U Test).
10. Consolidation Test.

REFERENCE BOOKS:

1.Soil Mechanics Laboratory Manual.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	1	-	-	-	2	2	2	1	3
CO2	1	2	-	-	-	-	1	-	-	-	2	2	2	1	3
CO3	1	2	-	-	-	-	1	-	-	-	2	2	2	1	3