

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1501707	PJ	Advanced Foundation Engineering	03	01	00	30	70	03

Course Objectives:

- To explain how the earth pressure acting on sheet pile
- To explain the concepts of braced cuts and how to calculate the lateral pressure at different locations
- To explain the concepts of Terzaghi and IRC Methods and individual components
- To explain the concepts of collapsible and expansive soils and design of foundations
- To explain different methods of ground improvement techniques

Course Outcomes: Upon completion of this course, student will be able to,

- Design the depth of embedment for sheet pile and forces in the anchor.
- Determine the loads / forces on the struts and bending moment in wales, sheet piles and design of coffer dam
- Determine the pressures and to design the well foundation
- Determine the swell, uplift capacity and factor of safety
- Importance and difficulties in stabilization

Unit - 1 Bulkheads

Types of Sheet Pile Walls – Free Cantilever Sheet Pile – Cantilever Sheet Pile in Cohesionless and Cohesive Soils – Anchored Sheet Pile with Free Earth Support – Rowe’s Moment Reduction Curves – Anchored Sheet Pile with Fixed Earth Support – Design of Anchors.

Unit - 2 Braced Cuts and Cofferdams

Braced Cuts – Introduction – Lateral Earth Pressure on Sheetings – Different Types of Sheeting and Bracing Systems – Design of Various Components of Bracings.

Cofferdams – Types of Cofferdams – Design of Circular Cofferdams on Rock – Design of Cellular Cofferdams on Soil.

Unit - 3 Well Foundations

Introduction – Different Shapes of Wells – Grip Length – Forces Acting on the Well Foundation – Terzaghi’s Analysis – Banerjee and Gangopadhyay’s Analysis – Simplified Analysis for Heavy Wells – IRC Method – Individual Components of the Well – Sinking of Wells – Measures for rectification of Tilts and Shifts.

Unit - 4 Foundations on Collapsible and Expansive Soils

Collapsible Soils – General Considerations and observations – Computation of Collapse Potential and Settlement – Foundation Design – Treatment Methods.

Expansive Soils – Distribution of Expansive Soils – General Characteristics – Clay Mineralogy and Mechanism of Swelling – Definition of Some Parameters – Evaluation of Swelling Potential of Expansive Soils – Classification of Swelling Soils by Indirect Measurement – Swelling Pressure by Direct Measurements – Effect of Initial Moisture Content and initial Dry Density on Swelling Pressure – Estimating the Magnitude of Swelling – Design of Foundations in Swelling Soils – Elimination of Swelling.

Unit - 5 Soil Stabilization

Introduction – Mechanical Stabilization – Cement Stabilization – Lime Stabilization – Bituminous Stabilization – Chemical Stabilization – Thermal Stabilization – Electrical Stabilization – Stabilization by Grouting – Stabilization by Geo-Textile and Fabrics – Reinforced Earth.

TEXT BOOKS

1. Dr. K R Arora “Soil Mechanics & Foundation Engineering”, Standard Publishers Distributers, New Delhi.
2. V N S Murthy “Advanced Foundation Engineering”, C B S Publishers & Distributors, New Delhi.
3. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain “Soil Mechanics & Foundation Engineering”, Lakshmi Publications, New Delhi.

REFERENCE BOOKS

1. Joseph E. Bowles “Foundation analysis & Design”, Tata McGraw-Hill Companies, Inc. New York.
2. Braja M Das “Principles of Foundation Engineering”, Thomson Publishers, United States.
3. N N Som & S C Das “Theory and Practice of Foundation Design”, Prentice-Hall of India (P) Limited, New Delhi.
4. P Purushothama Raj “Soil Mechanics and Foundation Engineering”, Pearson Education India, New Delhi.
5. Dr. P Purushothama Raj “Ground Improvement Techniques”, Lakshmi Publications, New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1501702	PJ	Design and Detailing of Reinforced Concrete Structures – 2	03	01	00	30	70	03

Course Objectives:

- The primary objective of the course is to extend student's knowledge and proficiency in reinforced concrete structural design, analysis, and special detailing.
- Structural member modeling and analysis will be emphasized by developing small computer programs and/or by using available computer software.
- Structural member and system design will be implemented using the current code standards and specifications.
- To enable the student design more complex structural elements of reinforced concrete and model their behavior using computer applications.
- Students will build on their knowledge of basic reinforced concrete design and learn to:
 - ✓ Model and predict the response of reinforced concrete members under axial, flexure and shear loads, and
 - ✓ Design typical reinforced concrete components such as beams, slabs, footings, retaining walls, slender columns and pre-stressed beams

Course Outcomes: Upon completion of this course, student will be able to,

- Distinguish the different types of slabs
- Design of columns following IS code specifications
- Design footings
- Design of cantilever retaining walls
- Design of water storage tanks

Unit - 1 Design of Slabs

Design of One Way Continuous Slab – Design of T-Beam Roof Slab Simply Supported on Four Edges, With Corners Not Held Down and Carrying U.D.L – Slab Simply Supported on the Four Edges With Corners Held Down and Carrying U.D.L. – Indian Standard Code Method – Design of Continuous Slabs – Design of Circular Slabs.

Unit - 2 Design of Slender Column

Behaviour of Slender Columns – Braced and Unbraced Slender Columns – Second Order Structural Analysis of Slender Column Structures – IS Code Provisions for Slender Columns – Strength Reduction Coefficient Method – Additional Moment Method – Design of Columns with Axial Tension and Uniaxial Bending.

Unit - 3 Design of Footings

Isolated Footings: Allowable Soil Pressure – Distribution of Base Pressure – Concentrically Loaded Footings – Eccentrically Loaded Footings – Overturning and Sliding – General Design Considerations and Code Requirements – Design of Plain Concrete Footing – Design of Rectangular Reinforced Concrete Footing.

Combined Footings: Distribution of Soil Pressure – Geometry of Two-Column Combined Footings – Design Considerations in Two-Column Footings – Design of Two-Column Combined Footings: Rectangular and Trapezoidal Footings.

Unit - 4 Design of Cantilever Retaining Walls

Types of Retaining Walls – Behaviour – Lateral Earth Pressure – Effect of Surcharge – Effect of Water Table – Proportioning Cantilever Retaining Walls – Stability Requirements – Soil Bearing Pressure Requirement – Design of Cantilever Retaining Wall with Horizontal and Inclined Backfill.

Unit - 5 Design of Water Storage Tanks

Analysis Using IS-3370 – Underground and Over the Ground Supported Tanks – Design of Rectangular and Circular Water Tanks with Flexible and Rigid Joints between Floor and Wall.

TEXT BOOKS

1. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain “Limit State Design of Reinforced Concrete (As per IS 456-2000)”, Lakshmi Publications, New Delhi.
2. S Unnikrishna Pillai and Devdas Menon “Reinforced Concrete Design”, Tata McGraw-Hill Companies, Inc. New York.

REFERENCE BOOKS / IS CODES

1. M L Gambhir “Fundamentals of Reinforced Concrete Design”, P H I Learning Pvt. Limited, New Delhi.
2. P C Varghese “Limit State Design of Reinforced Concrete”, P H I Learning Pvt. Limited, New Delhi.
3. IS 456-2000 “Indian Standard Code of Plain and Reinforced Concrete – Code of Practice”, Bureau of Indian Standards, New Delhi.
4. IS 3370-2009 “Indian Standard Code of Concrete Structures for Storage of Liquids – Code of Practice”, Bureau of Indian Standards, New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1501703	PJ	Design and Detailing of Steel Structures	03	01	00	30	70	03

Course Objectives:

- Steel structures and structural elements are analyzed and designed by elastic & plastic methods. These methods based on experimental investigations. The structural design in a limited sense also deals with the design of various parts or members of structures.

Course Outcomes: Upon completion of this course, student will be able to,

- Design the different types of structural steel sections.
- Design different types of compression and tension members which are used in different types of steel constructions.
- Able to differentiate and design different types of Beams, column bases and welded connections.

Unit - 1 Plastic Analysis and Welded Connections

Plastic Analysis: Introduction – Idealized Stress – Strain Diagram – Shape Factors for Various Sections – Moment Curvature Relationship – Ultimate Moment – Plastic Hinge – Lower and Upper Bound Theorems – Ultimate Strength Fixed and Continuous Beams – Frames.

Welded Connections: Introduction – Advantages and Disadvantages of Welding – Strength of Welds – Butt and Fillet Welds – Permissible Stresses – IS Code Requirements – Design of Welds Subjected to Moment Acting in the Plane and at Right Angles to the Plane of the Joints – Beam to Beam and Beam to Column Connections.

Unit - 2 Design of Tension and Compression Members

Tension Members: Types of Sections – Net Effective Section for Angles and Tees in Tensions – Lug Angles – Tension Splices

Compression Members: Plain and Built Up Compression Members – Assumptions Regarding End Conditions – Design of Built Up Columns with Battens and Lacings – Splicing of Column.

Unit - 3 Beams

Allowable Stresses – Design Requirements as per IS Code – Design of Simple and Compound Beams- Curtailment of Flange Plates – Beam to Beam Connections – Check for Deflections – Shear – Buckling – Check for Bearing – Laterally Unsupported Beams.

Unit - 4 Design of Beam to Column Connections

Introduction – Design of Beam to Column Connections – Framed, Stiffened, Un-Stiffened and Seated Bracket Connections.

Unit - 5 Design of Column Bases

Design of Slab Base and Gusseted Bases – Column Bases subjected to Moment.

TEXT BOOKS

1. S K Duggal “Limit State Design of Steel Structures”, Tata McGraw-Hill Companies, Inc. New York.

2. S SBhavikatti “Design of Steel Structures”, I K International Publishing House Pvt. Limited, New Delhi.

REFERENCE BOOKS / IS CODES / TABLES

1. IS 800-2007 “Indian Standard Code of Practice for General Construction in Steel”, Bureau of Indian Standards, New Delhi.
2. IS 875 – Part – 3 “Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Building and Structures – Wind Loads”, Bureau of Indian Standards, New Delhi.
3. K L V Ramu and SubhashChander “Steel Tables – SI Units”, Jain Brothers, New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1501701	PJ	Structural Analysis – 2	03	01	00	30	70	03

Course Objectives:

- To understand application of Castigliano's theorem 1 and 2 for beams and trusses
- To study the behavior of arches and their methods of analysis
- To have basic knowledge of I.L for reaction, bending moment and shear force in simply supported beam.
- To learn and analyze continuous beams by flexibility and stiffness method
- To understand the methods of analysis of indeterminate trusses for external loads, lack of fit and thermal effect.

Course Outcomes: Upon completion of this course, student will be able to,

- Differentiate Determinate and Indeterminate Structures
- Analyze the arches with different end conditions
- Draw the influence lines and construct the ILD diagram for the moving loads.
- Analyze the loads in Pratt and Warren trusses, design of bridge structures
- Use the concepts of matrix method for analysis of beams, frames and trusses.

Unit - 1 Indeterminate Structural Analysis

Indeterminate Structural Analysis – Determination of Static and Kinematic Indeterminacies – Solution of Trusses with up to Two Degrees of Internal and External Indeterminacies – Castiglioni's Theorem.

Unit - 2 Arches

Three Hinged Arches: Elastic Theory of Arches – Eddy's Theorem – Determination of Horizontal Thrust – Bending Moment – Normal Thrust and Radial Shear – Effect of Temperature.

Two Hinged Arches: Determination of Horizontal Thrust Bending Moment – Normal Thrust and Radial Shear – Rib Shortening and Temperature Stresses – Tied Arches – Fixed Arches – (No Analytical Question).

Unit - 3 Moving Loads

Introduction – Maximum SF and BM at a Given Section and Absolute Maximum S.F. and B.M Due to Single Concentrated Load U. D Load Longer than the Span – U. D Load Shorter than the Span – Two-Point Loads with Fixed Distance between them and Several Point Loads – Equivalent Uniformly Distributed Load – Focal Length.

Unit - 4 Influence Lines

Definition of Influence Line for SF – Influence Line for BM – Load Position for Maximum SF at a Section – Load Position for Maximum BM at a Section Point Loads – U.D. Load Longer than the Span – U.D. Load Shorter than the Span – Influence Lines for Forces in Members of Pratt and Warren Trusses.

Unit - 5 Flexibility and Stiffness Methods

Flexibility Method: Introduction – Application to Continuous Beams Including Support Settlements.

Stiffness Method: Introduction to Stiffness Method and its Application to Continuous Beams including Support Settlements.

TEXT BOOKS

1. Dr. C S Reddy “Structural Analysis”, Tata McGraw-Hill Companies, Inc. New York.
2. S Ramamrutham and R Narayan “Theory of Structures”, DhanpatRai Publishing Company (P) Limited, New Delhi.
3. G S Pandit and S P Gupta “Structural Analysis – A Matrix Approach”, Tata McGraw-Hill Companies, Inc. New York.

REFERENCE BOOKS

1. DevdasMenon “Structural Analysis”, Narosa Publishing House, New Delhi.
2. V N Vazirani, M MRatwani and S K Duggal “Analysis of Structures”, Khanna Publishers, New Delhi.
3. S SBhavikatti “Structural Analysis – 1 & 2”, Vikas Publishing House Pvt. Limited, New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1501704	PJ	Transportation Engineering – 2	03	01	00	30	70	03

Course Objectives:

- To understand the various components of railway Engineering.
- To know various component involved in the track design concept of railway Engineering.
- To understand the techniques involved in harbor Layout.

Course Outcomes: Upon completion of this course, student will be able to,

- List the components of railway Engineering and their functions.
- Design railway track geometrics.
- List the requirement of airport site selection
- List the requirement of a harbor
- List suitable harbor maintenance methods.

Unit - 1 Introduction to Railway Engineering

Permanent Way Components – Cross Section of Permanent Way – Functions of Various Components Like Rails, Sleepers and Ballast – Rail Fastenings – Creep of Rails – Theories Related to Creep – Adzing of Sleepers Sleeper Density – Geometric Design of Rail Way Track – Gradients – Grade Compensation – Degree of Curve Cant and Negative Super Elevation – Cant Deficiency.

Unit - 2 Geometric Design of Railway Track

Gradients – Grade Compensation – Cant and Negative Super Elevation – Cant Deficiency – Degree of Curve Crossings and Turn Outs – Stations and Yards – Introduction – Purposes of Rail Way Stations – Selection of a Site for a Railway Station – Types of Railway Stations – Definition of a Yard – Types of Yards – Tunnelling Definition – Types of Tunnelling – Drainage in Tunnels – Ventilation of Tunnels – Lining of Tunnels – Underground Railways – Tube Railways – Maintenance of Railway Tunnels.

Unit - 3 Airport Engineering

Airport Site Selection – Factors affecting Site Selection and Surveys – Runway Orientation – Wind Rose Diagram – Basic Runway Length – Correction for Runway Length – Terminal Area – Layout and Functions – Concepts of Terminal Buildings – Simple Building, Linear Concept, Pier Concept and Satellite Concept – Typical Layouts – Runway and Taxiway Lighting.

Unit – 4 Harbours, Docks and Break Water

Introduction – Natural Harbours – Artificial Harbours – Size of Harbours – Open Berths – Docks – Shape of Docks and Basins – Design and Construction of Basin or Dock Walls – Dock Entrances and Entrance Locks Classification of Breakwaters – Upright Wall Breakwater – Mound with Super Structure Water Breaker – Mound Breakwaters.

Unit – 5 Dredging and Maintenance

Introduction – Types of Dredgers – Bucket or Ladder Dredger – Sand Pump or Hydraulic Dredger or Cutter Dredger – Grab Dredger – Rock Dredger – Dipper Dredger – Hopper Barge – Maintenance of Buildings – Protection of Timber Piles – Maintenance of Lock Gates and Caissons – Maintenance Fresh Water – Hydraulic and Electric Mains – Soundings – Organization of Maintenance.

TEXT BOOKS

1. S C Saxena and S P Arora “A Text Book of Railway Engineering”, DhanpatRai Publishing Company (P) Limited, New Delhi.
2. V N Vazirani and S P Chandola “Transportation Engineering – Vol-2”, Khanna Publishers, New Delhi.

REFERENCE BOOKS

1. Satish Chandra and M MAgarwal “Railway Engineering”, Oxford & IBH Publishing Company (P) Limited, New Delhi.
2. R Srinivasan “Harbour, Dock and Tunnel Engineering”, Charotar Publishing House Pvt. Limited, Anand.
3. Hasmukh P Oza and GautamOza “Dock and Harbour Engineering”, Charotar Publishing House Pvt. Limited, Anand.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1501705	PJ	Water Resources Engineering – 2	03	01	00	30	70	03

Course Objectives:

- To study the various factors considering for construction of different head works i.e., canal head works, cross drainage works etc.,
- To study the different components and their applications
- To study the various design procedures and their engineering significances
- To study the different tools required for knowing performance of water resources projects.

Course Outcomes: Upon completion of this course, student will be able to,

- Distinguish of irrigation systems, various water resources and storage works.
- List the principles of mathematics in finding the irrigation requirements.
- Know the responsibility of a civil engineer for constructions of canal outlets, canal escapes; cross drainage works in reducing the floods.
- Design hydraulic structures and regulatory works using different methods.
- Predict the cost benefit analysis and give insights for the benefit of society.

Unit - 1 Spillways

Types of Spillways – Necessity and Components of Spillways – Applications of Spillways –Design Principles of Ogee Spillways – Types of Spillway Gates – Energy Dissipation Methods.

Unit - 2 Canal Structures – 1

Types of Falls and Their Location – Design Principles of Sarda type Fall – Trapezoidal Notch Fall and Straight Glacis Fall.

Unit - 3 Canal Structures – 2

Canal Regulation Works – Principles of Design of Distribution and the Head Regulator – Canal Outlets – Types of Canal Modules – Proportionality Sensitivity and Flexibility.

Unit - 4 Cross Drainage Works

Types of Selection of Site – Design Principles of Aqueduct – Siphon Aqueduct and Super Passage.

Unit - 5 Water Resources Planning

Introduction to Indian Water Resources – Scenario of Water Use – Purpose of Water Resource Development – Classification of Water Resources – Development Projects – Simulation – Process of Project Formulation – Project Evaluation – Strategies for Future – Planning Strategies – Management Strategies.

TEXT BOOKS

1. G L Asawa “Irrigation and Water Resources Engineering”, New Age International (P) Limited, Publishers, New Delhi.
2. R S Varshney, S C Gupta and R L Gupta “Theory and Design of Irrigation Structures”, Nem Chand & Bros Publishers, Roorkee, Uttarakhand.

REFERENCE BOOKS

1. SatyaNarayanaMurtyChalla “Water Resources Engineering – Principles and Practice”, New Age International (P) Limited, Publishers, New Delhi.
2. B C Punmia, Pande B BLal, Ashok Kumar Jain &Arun Kumar Jain “Irrigation and Water power Engineering”, Lakshmi Publications, New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1501802	PJ	Design and Drawing of Irrigation Structures	03	01	00	30	70	03

Course Objectives:

- To study the preliminary and secondary investigations required for hydraulic structures
- To study the different methods for estimating of peak flow
- To study in detail design procedures and their site specific criteria
- To study the different safety measures required for during operations of irrigation structures.

Course Outcomes: Upon completion of this course, student will be able to,

- Understand the factors which are used for selecting in constructing various hydraulic structures.
 - To estimate the peak flood and their importance in the design of hydraulic structures and components in the structures.
- Understand how to develop an irrigation structure as per the suitability of a site.
- To design the various components of hydraulic structures.
- Understand various protective works used in hydraulic structures for the safety of Submerged.

Unit - 1 Design of surplus weir

Introduction – Estimation of Flood Discharge – Selection of type of Work – Length of Surplus Weir – Crest Width Base Width – Abutments – Wings Returns – Aprons.

Unit - 2 Canal Drop (Notch Type)

Trapezoidal Notch Length of Drop Wall Between Abutments – Profile of Drop Wall – Notch Pier – Protective Works.

Unit - 3 Tank Sluice with Tower Head

Vent Way Design – Sluice Barrel Tower Head – R.C Slab – Earth Pressure – Stability Analysis – Tower Head Design – Cistern.

Unit - 4 Canal Regulator Cum Road Bridge

Vent Way Design – Drowning Ratio Method – Roadway – Piers Shutters, Abutments – Wing Walls – Return Walls – Return Walls – Solid Apron for Regulator – Revetments – Energy Dissipation.

Unit - 5 Under Tunnel

Design of Barrel Roof – Abutments Pressure Under Pier – Fixing Maximum Flood Levels Rail Channel – Afflux over Drop Wall – Loss of Head Calculation – Depth of Foundation Return Walls – Wing Walls and Return – Uplift – Creep Lost in Percolation.

TEXT BOOKS

1. C SatyanarayanaMurty “Water Resources Engineering – Principles and Practice”, New Age International (P) Limited, Publishers, New Delhi.

REFERENCE BOOKS

1. Santosh Kumar Garg “Irrigation Engineering and Hydraulic Structures”, Khanna Publishers, New Delhi.
2. N Balasubramanya “Hydraulic Structures and Irrigation Design Drawing”, Sapna Book House and Publishers, Bangalore.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1501806	PJ	Bridge Engineering	03	01	00	30	70	03

Course Objectives:

- Bridges and its components- different types of loadings and irc classification of loadings and its importance
- Bridges and box culverts and its design procedure.
- Bridge bearings and its importance and plate girder bridges and its design procedure.

Course Outcomes: Upon completion of this course, student will be able to,

- Students are effectively learned the bridges and various loads are acting on the bridges.
- Students understand the deck slab and its various loadings
- Students understood the t-beam bridge and its components and various loads acting on the t-beam bridges effectively
- Composite bridges and its design and shear connectors are designed by the students
- All of the components of the bridges and loads are learned by the students effectively.

Unit - 1 Introduction

Importance of Site Investigation in Bridge Design – Highway Bridge Loading Standards – Impact Factor – Railway Bridge Loading Standards (B.G & M G Bridges) – Various Loads in Bridges.

Unit - 2 Box Culvert

Box Culvert: General Aspects – Design Loads – Design of Box Culvert Subjected to R C Class AA Tracked Vehicles only.

Unit - 3 Design of Deck Slab Bridge

General Features – Effective Width Method of Analysis Design of Deck Slab Bridge (Simply Supported) subjected to Class AA Tracked Vehicles only.

Unit - 4 Design of T-Beam Bridge

General Features – Design of Interior Panel of Slab – Pigeauds Method – Design of a T- Beam Bridge Subjected to Class AA Tracked Vehicles only.

Unit - 5 Piers, Abutments and Bridge Bearings

General Features – Bed Block – Material Piers & Abutments – Types of Piers – Forces Acting on the Piers – Stability Analysis of Piers – General Features of Abutments – Forces Acting on Abutments – Stability Analysis of Abutments – Types of Wing Walls – Approaches – Types of Bridge Foundations (Excluding Design)

Bridge Bearings: General Features – Types of Bearings – Design Principles of Rocker & Roller Bearings – Design of Steel Rocker Bearings – Design of Elastomeric Pad Bearings

TEXT BOOKS

1. S Ponnuswamy “Bridge Engineering”, Tata McGraw-Hill Companies, Inc. New York.
2. N Krishna Raju “Design of Bridges”, Oxford & IBH Publishing Company (P) Limited, New Delhi.
3. D Johnson Victor “Essentials of Bridge Engineering”, Oxford & IBH Publishing Company (P) Limited, New Delhi.

REFERENCE BOOKS / IS CODES / IRC CODES

1. IS 800-2007 “Indian Standard Code of Practice for General Construction in Steel”, Bureau of Indian Standards, New Delhi.
2. IS 456-2000 “Indian Standard Plain and Reinforced Concrete – Code of Practice”, Bureau of Indian Standards, New Delhi.
3. IRC 6-2000 “Standard Specifications and Code of Practice for Different Types of Loadings Acting on the Bridge Structure”, The Indian Roads Congress, New Delhi.
4. IRC 22-2000 “Standard Specifications and Code of Practice for Road Bridges and Different Materials used in Bridge Structures and Reinforcement Details”, The Indian Road Congress, New Delhi.
5. IRC 24-2000 “Standard Specifications and Code of Practice for Permissible Bending Stresses in Steel and its Properties”, The Indian Road Congress, New Delhi.
6. IRC 83-2000 “Standard Specifications and Code of Practice for Different Types of Bridge Bearings used in the Bridges and its Detailed Specifications”, The Indian Road Congress, New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1501803	PJ	Quantity Surveying and Valuation	03	01	00	30	70	03

Course Objectives:

- To know the qualitative of different item of works and workman ships. Understand the types and methods of Estimations. Be aware of the influence of specifications on estimation.
- To understand how to prepare the rate of all items of works involved in construction and what are factors influencing the rate analysis.
- To emphasizes on preparation quantities of item of works with different methods.
- To expertise how to prepare bar bending schedule for structural elements

To study the importance of contractual system and how to evaluate the valuation of any structure after completion of certain age.

Course Outcomes: Upon completion of this course, student will be able to,

- Known about the quality implementation during the construction with follow of specifications.
- Expertise to prepare the rates of all possible items of works involved in construction.
- Erudite the different methods of estimation of various item of work and expertise to prepare bar bending schedule.
- Known about the basics to prepare the quantities of irrigation and road structures.
- Studied how to prepare tender schedule and how to finalize the tender. Know-how to prepare the valuation of the given structure.

Unit - 1 Specifications and Introduction to the Estimation of Structures

Specifications: Specification of Different Items of Works: Types - Standard Specifications for Different Items of Building Construction – Earth Work for Foundations, Mortars, Foundation Concrete, Reinforced Concrete, Brick Work, Stone Masonry, Mosaic Flooring, Terrazo Flooring, RCC Roof and AC Roof and GI Sheets, Plastering, Painting, Pointing and Wood Works.

Introduction to the Estimation of Structures: Introduction, Different Item of Works – Units of Item of Works – Types of Estimates – Methods of Estimates

Unit - 2 Rate Analysis

Rate Analysis of Different Item of Works: Earthwork Excavation – Mortars of Various Proportions (Cement and Lime) – Concrete with Various Proportions (Lime and Cement) – Brick Masonry – Stone Masonry – Pointing – Painting – Plastering – Aluminum Partitions – Wooden Partitions – Cement Concrete Flooring With 1:2:4 Mix – Ceramic and Vitrified Tile Flooring and Mosaic Flooring.

Unit - 3 Quantity Estimation of Buildings and Bar Bending Schedule

Estimation of Quantities in Buildings: Load Bearing Wall Structure of Single Room, Double Room and Multi Room.

Unit - 4 Estimation of Bar Bending Schedule

Beams - Slabs – Staircases – Sun Shade – Lintels – Portico

Unit - 5 Contracts and Valuation

Contracts: Types of Contracts, Contract Document, Conditions of Contracts, Contract Procedure, Termination of Contracts, Specifications, Important Conditions of Contract, Arbitration and Tenders.

Valuation: Introduction, Technique of Valuation, Elements of Valuation and Factors Affecting Valuation, Methods of Valuation to the Land Property and Building Property, Mortgage.

TEXT BOOKS

1. B N Dutta “Estimating and Costing in Civil Engineering”, U B S Publishers Distributers Pvt. Limited, Noida.
2. “Standard Data Book – Vol.2”, Andhra Pradesh Department of Standard Specifications, Amaravathi.

REFERENCE BOOKS

1. Dr. Roshan H Namavati “Professional Practice”, TheLakhani Book Depot, Mumbai.
2. S C Rangwala “Estimating Costing and Valuation”, Charotar Publishing House Pvt. Limited, Anand.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1501801	PJ	Sanitary Engineering	03	01	00	30	70	03

Course Objectives:

- To estimate sewage and storm water from cities and towns for arriving design flows for use in the design of sewage and sewage treatment process units.
- To focus in planning, design and operation of sewerage and sewage treatment units.
- To illustrate different practices in the management of sewage sludges and treated sewage effluent.
- To illustrate different practices in solid waste management.
- To illustrate air and noise pollutions and environmental impact assessment.

Course Outcomes: Upon completion of this course, student will be able to,

- Gain skills in the estimation of sewage and storm water for arriving design flows.
- Become experts in planning, design, and operation and maintenance of sewerage and sewage treatment units.
- Gain knowledge in the management of treatment plant residues and effluent disposal practices.
- Gain knowledge in character, disposal of solid wastage managements.
- Gain knowledge in air and noise pollution and environmental impact assessment civil engineering projects.

Unit - 1 Estimation of Sewage and Storm Water, Collection of Sewage

Estimation of Sewage and Storm Water: Definition of Terms – Sewage, Sullage, Storm Water and Sludge – Objectives of Sewage and Storm Water Estimations and General Methods Available for Estimations in Urban Areas – Average, Peak and Minimum Sewage Flows and their Importance in Collection and Treatment Systems.

Collection of Sewage: Sewage Collection by Different Sewers and their Functions – Separate and Combined Sewers and their Merits and Demerits – Hydraulic Design of Sewers for Full and Partial Flow System – Self-Cleansing Velocity of Sewers – Sewer Appurtenances and their Location and Functions.

Unit - 2 Characterization of Sewage, Preliminary and Primary Treatment

Characterization of Sewage: Objectives of Sewage Characterization – Frequency of Sampling of Sewage for Different Parameters – Chemical Composition of Sewage – Solids, BOD and COD, Nutrients and Biological Impurities – Numerical Problems on BOD Equation – Population Equivalent – Carbon, Nitrogen and Sulphur Cycles.

Preliminary and Primary Treatment: Basic Concept of Sewage Treatment – Preliminary, Primary, Secondary and Tertiary Sewage Treatment Processes – Sewage Treatment Process – Design of Bar Screen, Grit Chamber and Primary Sedimentation Tanks.

Unit - 3 Secondary Treatment

Necessity of Secondary Treatment – Principles of Biological Treatment of Sewage – Suspended and Attached Growth of Biological System – Design of Conventional type of Activated Sludge Processes – Aerated Lagoons and Oxidation ponds – Design of Secondary Sedimentation Tanks – Operational Problems of Biological Treatment Process Units.

Unit - 4 Tertiary Treatment and Sludge Management

Tertiary Treatment: Objectives of Tertiary Treatment – Removal of Nitrogen, Phosphorus, and Refractory Organics from Secondary Treated Sewage – Standards for Disposal of Treated Sewage into Inland Surface Waters, Marine disposal and on Land for Invigation.

Sludge Management: Sludge Stabilization by Aerobic and Anaerobic Processes – Sludge Dewatering Practices – Sludge Drying Beds and Centrifugation. Sludge Disposal Practices – Design of Septic Tank and Soak Pits.

Unit - 5 Solid Waste Management, Air and Noise Pollution

Solid Waste Management: Sources, Characteristics and Generation of Solid Wastes – Collection and Disposal – Design and Management of Sanitary Landfills.

Air and Noise Pollution: Types of Air Pollutants – Sources and Effect of Air Pollution – Air Pollution Metrology – Air Pollution Control – Air Quality Standards and Limits – Sources and Effects of Noise Pollution – Measurement of Noise and Control of Noise Pollution – Permissible Limits of Noise Pollution.

TEXT BOOKS

1. G L Karia and R A Christian, “Waste Water Treatment: Concepts and Design Approach”, Prentice-Hall of India (P) Limited, New Delhi.
2. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain “Wastewater Engineering”, Lakshmi Publications, New Delhi.

REFERENCE BOOKS

1. Met Calf & Eddy “Waste Water Engineering – Treatment and Reuse”, Tata McGraw- Hill Companies, Inc. New York.
2. Arcadio P Sincero Sr., Gregoriaa Sincero, “Environmental Engineering - A Design Approach”, Prentice-Hall of India (P) Limited, New Delhi.
3. H S Peavy and D R Rowe “Environmental Engineering” Tata McGraw-Hill Companies, Inc. New York.