Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1801602	PCC	Concrete Technology	02	00	00	30	70	02

Course Objective:

1. Lot of advances is taking place in the concrete technology as par with development taking place in the engineering.
2. The present day industry needs the knowledge of concrete technology thoroughly.
3. The subject is designed to give the basic knowledge as well as latest developments in concrete technology.

Course Outcomes: After completion of the course, students will be able to

1. Know the basics of cement, its composition, different properties.
2. Get familiarize with aggregates used in concrete and the properties of fresh concrete.
3. Know about elasticity, shrinkage creep and durability of concrete.
4. Carry out the testing on hardened concrete.
5. Design the mix of concrete proportions by ACI and IS methods

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1															
CO 2															
CO 3															
CO 4															
CO 5															

Unit – 1 Cements and Admixtures

Portland cement – Chemical composition – Hydration, Setting of cement – Types of cements - Tests on physical properties – Different grades of cement – Introduction to Mineral and chemical admixtures.

Unit – 2 Aggregates & Fresh Concrete

Concrete aggregates: Classifications – Strength and other mechanical properties – Moisture content and its effects – Deleterious substances – Alkali-Aggregate reaction – Grading curves and grading requirements – Gap-graded aggregate – Maximum aggregate size.

Fresh concrete: Workability – Factors affecting workability – Measurements of workability – Effect of time and temperature – Segregation – Bleeding – Mixing of concrete – vibration of concrete – Ready mixed concrete – Pumped concrete.

Unit – 3 Durable Properties of Concrete

Elasticity, Shrinkage and Creep: Modulus of elasticity – Dynamic modulus – Poisson's ratio – Shrinkage and its effects – Creep of concrete – Factors affecting creep.

Durability: Permeability – Chemical attack of Concrete – Efflorescence – Air entrained concrete – Thermal properties – Resistance of concrete to fire.

Unit – 4 Hardened Concrete

Curing of concrete: Methods of curing – Maturity - Influence of temperature – Steam curing at atmospheric pressure – High pressure steam curing

Hardened concrete: Compression tests – Flexure test – Splitting test – Rebound Hammer test – Ultrasonic pulse velocity test

Unit – 5 Mix Design of Concrete

Concrete Mix Design and Quality Control: Basic consideration – Factors in the choice of properties– ACI & IS methods of mix design - Simple example of mix design

TEXTBOOKS

1. M S Shetty "Concrete Technology", S. Chand Publishers, New Delhi.
2. A M Neville "Properties of Concrete", Pearson Publications, England.

REFERENCES BOOKS

1. M L Gambhir "Concrete Technology", Tata McGraw-Hill Companies, Inc. New York.
2. P K Mehta and J M Monteiro "Concrete: Micro structure, Properties and Materials", Tata McGraw-Hill Companies, Inc. New York.
3. Krishna Raju "Design of Concrete Mix", CBS Publishers, New Delhi.
4. J Prasad and C G K Nair "Non-Destructive Test and Evaluation of Materials", Tata McGraw-Hill Companies, Inc. New York.
5. A R Santha Kumar "Concrete Technology", Oxford University Press, New Delhi.

Subject Code	Subject Category		L	T	P	IM	EM	Credits
1801603	PCC		02	01	00	30	70	03

Course Outcomes: At the end of the course the student will able to

1. Identify, formulate and determine stability of structure, external reactions, and internal forces and differentiate determinacy and indeterminacy up to two degree for indeterminate structures.
2. Able to apply slope deflection, moment distribution, to analyse indeterminate structures.)
3. Determine reactions, bending moments, shear force, absolute maximum shear force and bending moment in beams subjected to moving loads.
4. Analyze indeterminate beams by using stiffness and flexibility matrix methods.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1															
CO 2															
CO 3															
CO 4															

Unit – 1 Analysis of Indeterminate Structures

Indeterminate Structural Analysis – Determination of static and kinematic indeterminacies – Solution of trusses up to two degrees of internal and external indeterminacy – Castigliano's second theorem.

Unit – 2 Slope Deflection and Moment Distribution Methods

Slope Deflection Method: Analysis of single bay, single storey, portal frame including side sway.

Moment Distribution Method: Analysis of Single Bay Single Storey Portal Frames including side Sway

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.

TEXTBOOKS

1. C. S. Reddy "Basic Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New York.
2. S. Ramamurtham, "Theory of Structures", Dhanpat Rai Publishing Company (p) Ltd, New Delhi.

REFERENCE BOOKS

1. R. C. Hibbeler "Structural Analysis", Pearson Education, London, United Kingdom.
2. Devdas Menon "Structural Analysis", Narosa Publishing House, New Delhi.
3. A.K. Jain "Advanced Structural Analysis", Nem Chand & Bros, Roorkee.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1801604	PCC	Design of Reinforced Concrete Structures – 1	02	01	00	30	70	03

Course Objectives: A student can able to know

1. The different structural elements and its behavior by imposing of loads,
2. Analysis and design of different structural elements like beams.
3. The usage of IS Codes in the process of analysis.

Course Outcomes: After completion of this course, students will expertise on

1. Identify the different loading combinations and its variations
2. Analysis and design of beams
3. Designofshearreinforcementandknowtheimportanceofdevelopmentlength
4. Structural detailing of different slabs
5. Importance of serviceability

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1															
CO 2															
CO 3															
CO 4															
CO 5															

Unit – 1 General Concepts of RC Design

Introduction to working stress method - Ultimate load and limit state method-characteristic sand design values & partial safety factors, Stress-strain curves for concrete & steel.

Unit – 2 Limit State of Collapse in Flexure

Assumptions-Analysis & design of stress block parameters, Modes of failure, types of sections, Design of singly & double reinforced rectangular beams , Design of Flanged beams.

Unit – 3 Design for Shear, Torsion and Bond

Design of simply supported beams for shear and torsion – Anchorage bond stress, Design bond stress and development length of bars.

Unit – 4 Design of Slabs

Design of one way and two way slabs (IS Code Method)

Unit – 5 Limit State of Collapse in Compression

Axially Loaded Columns, Columns with Axial Load and Uniaxial Bending.

TEXTBOOKS

1. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain "Comprehensive RCC Design", Laxmi Publications, New Delhi.

REFERENCE BOOKS

1. Ashok. K Jain "Reinforced Concrete: Limit State Design", Nem Chand & Bros, Roorkee.
2. N Krishna Raju and R N Pranesh "Reinforced Concrete Design: IS: 456-2000 Principles and Practice", New Age International (P) Limited, Publishers, New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1801605	PCC	Foundation Engineering	02	00	00	30	70	02

Course Objectives:

1. To emphasize the importance of soil investigations including destructive and non-destructive methods,
2. To explain how earth pressure theory is important in retaining structure design,
3. To explain the concept of bearing capacity and how to estimate the safe bearing capacity for various foundation systems including settlement consideration,
4. To explain in what circumstances pile is needed and how do analysis the pile and pile group under various soil conditions,
5. To study the types of slopes for different conditions.

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

1. Carry out soil investigation for any civil engineering construction,
2. Analyze earth retaining structures for any kind of soil medium,
3. Estimate bearing capacity using IS code methods, design proper foundations for any kind of shallow foundation system,
4. Estimate pile and pile group capacity for any kind of soil including group efficiency and negative friction,
5. Design of slopes for any type of soil conditions.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1															
CO 2															
CO 3															
CO 4															
CO 5															

Unit – 1 Site Investigation & Sub-Soil Exploration

Site reconnaissance – Depth of exploration – Lateral extent of exploration – Test pits – Auger borings – Wash borings – Soil samplers – Penetration test – Standard penetration test (SPT) – Geophysical methods – Seismic refraction and electrical resistivity methods – Sub soil investigation reports - Plate load test – Pressure meter.

Unit – 2 Earth Pressure Theories and Retaining Walls

Active and passive earth pressures in cohesionless and cohesive soils (with and without surcharge, horizontal and inclined surfaces) - Rankine's theory of earth pressure – Earth pressures in layered soils – Coulomb's earth pressure theory – Culmann's and Rebhann's graphical method. Types of retaining walls – Stability of gravity and cantilever retaining walls – Drainage in retaining walls.

Unit – 3 Bearing capacity of shallow foundations

Types of foundations – Depth of foundation – Terzaghi's bearing capacity equation – Bearing capacity of strip, square, circular, rectangular footings – Meyerhof's theory – Skempton's method – Brinch Hansen's method – Effect of ground water table on bearing capacity – Bearing capacity from building codes – Tolerable settlements – Settlement analysis.

Unit – 4 Pile Foundations

Types of piles – Load carrying capacity of piles based on Static pile formulae – Dynamic pile formulae – Pile Load tests - Load carrying capacity of pile groups in sands and clays – Settlement of pile groups - Negative skin friction.

Unit – 5 Earth Slope Stability

Infinite and finite earth slopes – Types and causes of failures – Factor of safety of infinite slopes – Stability analysis by Swedish arc method, Standard method of slices, Bishop's simplified method – Taylor's stability number- Stability of slopes of earth dams under different conditions.

TEXTBOOKS

1. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain "Soil Mechanics & Foundation Engineering", Laxmi Publications, New Delhi.
2. Dr. K R Arora "Soil Mechanics & Foundation Engineering", Standard Publishers Distributers, New Delhi.

REFERENCE BOOKS

1. Joseph E. Bowles "Foundation analysis & Design", Tata McGraw-Hill Companies, Inc. New York.
2. C Venkatramaiah "Geotechnical Engineering", New Age International (P) Limited, Publishers, New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1801606	PCC	Water Resources Engineering – 1	02	01	00	30	70	03

Course Objectives:

1. Introduce the types of irrigation systems, Introduce the concept of planning and design of irrigation systems, Understand design method of erodible and non-erodible, Know the principles of design of hydraulic structures on permeable foundations, Learn design principles of canal structures.

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

1. Estimate irrigation water requirements,
2. Design irrigation canals and canal network,
3. Plan an irrigation system, Plan and design diversion head work,
4. Analyze stability of gravity dam and earth dam
5. To know how to dissipate the energy, different structures and to know scour problems in downstream.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1															
CO 2															
CO 3															
CO 4															
CO 5															

Unit – 1 Irrigation

Necessity and importance principal crops and crop seasons – Types - Methods of application - Soil-water-plant relationship - Soil moisture constants - Consumptive use - Estimation of consumptives use - Crop water requirement - Duty and delta - Factor affecting duty - Depth and frequency of irrigation - Irrigation efficiencies - Water logging and drainage - Standard of quality for irrigation - Crop rotation - Soil-water-plant relationship - Vertical distribution of soil moisture - Soil moisture constants - Soil moisture tension

Unit – 2 Classification of Canals

Classification of canals - Design of Irrigation canals by Kennedy's and Lacey's theories - Balancing depth of cutting - Canal lining.

Unit – 3 Diversion Head works

Types of Diversion head works - Diversion and storage head works - Weirs and barrages - Layout of diversion head works – Components - Causes and failure of hydraulic structures on permeable foundations – Bligh's creep theory – Khosla's.

Unit – 4 Dams and Reservoirs

Types of dams - Merits and demerits - Factors affecting selection of type of dam - Factors governing selecting site for dam - Types of reservoirs - Selection of site for reservoir - Zones of storage of a reservoir - Reservoir yield - Estimation of capacity of reservoir using mass curve.

Unit – 5 Gravity and Earth Dams

Gravity dams: Forces acting on gravity dam - Causes of failure of a gravity dam - Elementary profile and practical profile of a gravity dam - Limiting height of a low gravity dam - Stability analysis - Drainage galleries.

Types of Earth dams: Causes of failure of earth dam - Criteria for safe design of earth dam - Seepage through earth dam - Graphical method - Measures for control of seepage.

TEXTBOOKS

1. S K Garg "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.

REFERENCE BOOKS

1. GL Asawa "Irrigation and Water Resources Engineering", New Age International Publishers, New Delhi.
2. R S Varshney "Concrete Dams", Oxford & IBH Publishing Co., New Delhi,
3. Murthy Chall and N Satya "Water Resources Engineering", New Age International Publishers, New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1801610	PEC 2	Port and Harbour Engineering	02	01	00	30	70	03

Course Objectives:

1. To expose the students to planning, Design, construction and Maintenance of Harbour Engineering.

Course Outcomes: On completing the course, the students will have the ability to

1. Understand the various features in Harbours and ports, their Construction, Costal protection Works and Costal Regulations to be adopted.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1															

Unit – 1 Definition of Basic Terms

Harbor, port, satellite port, Docks, Waves and Tides - Coastal Structures: Piers, Break Waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating landing stage - Inland Water Transport

Unit – 2 Harbor Planning

Classification of Harbor, Natural Harbors, Artificial Harbors, Size of Harbors - Selection of Site and Planning of Harbor, Components, Ship Characteristics, Characteristics of good Harbor, Principles of Harbor planning, layouts of Harbor, Site Selection.

Unit – 3 Design of Harbor

Requirements, Classification, Location and Design, Principles, and Terminal facilities,

Unit – 4 Harbour Maintenance

Costal protection - Coastal Regulation Zone 2011, Purpose, Methods, Wave action on Costal Structures, Types, Suitability. Dredgers - Disposal of dredged materials, Mechanical and Hydraulic dredges.

Unit – 5 Coast Structures

Piers, Break waters, warehouses, spring fenders, Dolphins and floating landing Stage, wave action on coastal structure - Environment concern of port operations.

TEXTBOOKS

1. Bindra S P, "Railway Engineering – A Course in Docks and Harbour Engineering", Dhanpath Rai and Sons, New Delhi.
2. V.N. Vazirani and S P. Chandola, "Docks and Harbour Engineering - Text book of Transport Engineering", Khanna Publishers, New Delhi.

REFERENCE BOOKS

1. Hasmukh P. Oza and Gautam H. Oza, "Dock and Harbour Engineering", Charotar Publishing House Pvt. Ltd., Gujarat.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1801614	PCC	Concrete Technology Lab	00	00	02	50	50	01

Course Objectives:

1. To conduct laboratory tests to find suitability of materials for design of concrete mixes.

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

1. Conduct Quality Control tests on concrete making materials, fresh & hardened concrete
2. Design and test concrete mix.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1															
CO 2															

List of Experiments

1. Normal Consistency of cement
2. Fineness of cement.
3. Initial setting time and final setting time of cement.
4. Specific gravity and soundness of cement.
5. Compressive strength of cement.
6. Workability test on concrete by compaction factor, slump and Vee-bee.
7. Compressive strength of concrete.
8. Bulking of Fine aggregate.
9. Non-Destructive testing on concrete (for demonstration)

TEXTBOOKS

1. M S Shetty "Concrete Technology – Theory and Practice", S Chand & Company Limited, New Delhi.

REFERENCE BOOKS

1. Hemant Sood, L N Mittal and P D Kulkarni "Laboratory Manual on Concrete Technology", C B S Publishers and Distributors, New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	Credits
1801615	PCC	Foundation Engineering Lab	00	00	02	50	50	01

Course Objectives:

1. To estimate shear strength of soils by direct shear test and unconfined compressive test
2. To estimate the engineering properties of the soils by density test, CBR, permeability test

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

1. Classify soil based on estimated index and engineering characteristics of soils
2. Carry out interpolation among the estimated soil design parameters

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1															
CO 2															

LIST OF EXPERIMENTS

1. Proctor Compaction Test
   - Standard Proctor Compaction
   - Modified Proctor Compaction
2. Determination of Shear Strength Parameters
   - Direct Shear Test
   - Unconfined Compressive Strength Test
   - Triaxial Shear Test (Demo)
3. Determination of Permeability
   - Constant Head Method
   - Variable Head Method
4. California Bearing Ratio Test
5. North Dakota Penetration test
6. Determination of Consolidation Properties (Demo)

TEXTBOOKS

1. S Mittal and J P Shukla "Soil Testing for Engineers", Khanna Publishers, New Delhi.
2. T G Sitharam and T N Ramamurthy "Geo-Technical Engineering", S Chand Publishing, New Delhi.

REFERENCE BOOKS

1. Compendium of Indian Standards on Soil Engineering: Part – 1 & 2, Laboratory and Field Testing of Soils for Civil Engineering Purposes.
2. Dr. K R Arora "Soil Mechanics & Foundation Engineering", Standard Publishers Distributers, New Delhi.