

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR
SEMESTER SCHEME-2020-21



III SEMESTER
(SESSION 2021-2022 & ONWARDS)

CONSTRUCTION MATERIAL

Course Code	CE 3001 (Same as CC 3001)
Course Title	Construction Material
Number of Credits	3(L:3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

1. To learn about various construction materials, and understand their relevant characteristics.
2. To be able to identify suitability of various materials for different construction purposes.
3. To know about natural, artificial, and processed materials available for various purposes of construction activities.

Course outcomes:

After competing this course, student will be able to:

1. Identify relevant construction materials.
2. Identify relevant natural construction materials.
3. Select relevant artificial construction materials.
4. Select relevant special type of construction materials.

Identify and use of processed construction materials.

Course Content:**1. Overview of Construction Materials**

- 1.1 Scope of construction materials in Building Construction, Transportation Engineering, Environmental Engineering, Irrigation Engineering (applications only).
- 1.2 Selection of materials for different Civil Engineering structures on the basis of strength, durability, eco-friendly and economy.
- 1.3 Broad classification of materials – Natural, Artificial, special, finishing and recycled.

2. Natural Construction Materials**2.1 Stones**

- 2.1.1 Requirements of good building stone
- 2.1.2 General characteristics of stone
- 2.1.3 Quarrying and dressing methods and tools for stone

2.2 Timber

- 2.2.1 Structure of timber
- 2.2.2 General properties and uses of good timber
- 2.2.3 Different methods of seasoning for preservation of timber
- 2.2.4 Defects in timber
- 2.2.5 Use of bamboo in construction

2.3 Asphalt, bitumen and tar used in construction, their properties and uses**2.4 Properties of lime, its types and uses****2.5 Properties of sand and uses****2.6 Classification of coarse aggregate according to size****3. Artificial Construction Materials****3.1 Bricks**

- 3.1.1 Constituents of brick earth
- 3.1.2 Conventional / Traditional bricks
- 3.1.3 Modular and Standard bricks
- 3.1.4 Special bricks – fly ash bricks
- 3.1.5 Characteristics of good brick
- 3.1.6 Field tests on Bricks

- 3.1.7 Classification of burnt clay bricks and their suitability
- 3.1.8 Manufacturing process of burnt clay brick, fly ash bricks, Aerated concrete blocks
- 3.2 Flooring tiles – types and uses
- 3.3 Cement
 - 3.3.1 Manufacturing process of Cement - dry and wet (only flow chart)
 - 3.3.2 Types of cement and its uses
 - 3.3.3 Field tests on cement
- 3.4 Precast concrete blocks- hollow, solid, pavement blocks, and their uses
- 3.5 Plywood, Particle board, Veneers, laminated board and their uses
- 3.6 Types of glass: Soda lime glass, lead glass and borosilicate glass and their uses
- 3.7 Ferrous and non-ferrous metals and their uses
- 4. Special Construction Materials**
 - 4.1 Types of material and suitability in construction works of following materials:
 - 4.1.1 Water proofing
 - 4.1.2 Termite proofing
 - 4.1.3 Thermal and sound insulating materials
 - 4.2 Fibers – Types – Jute, Glass, Plastic Asbestos Fibers, (only uses)
- 5. Processed Construction Materials**
 - 5.1 Constituents and uses of POP (Plaster of Paris), POP finishing boards, sizes and uses
 - 5.2 Wall Putty
 - 5.3 Paints:
 - 5.3.1 Whitewash
 - 5.3.2 Cement paint
 - 5.3.3 Distempers
 - 5.3.4 Oil Paints and Varnishes with their uses (Situations where used)
 - 5.4 Industrial waste materials- Fly ash, Blast furnace slag, Granite and marble polishing waste and their uses

References:

1. Ghose, D. N., Construction Materials, Tata McGraw Hill, New Delhi.
2. S.K. Sharma, Civil Engineering Construction Materials, Khanna Publishing House, Delhi
3. Varghese, P.C. , Building Materials, PHI learning, New Delhi.
4. Rangwala, S.C., Engineering Materials, Charator publisher, Ahmedabad.
5. Somayaji, Shan, Civil Engineering Materials, Pearson education, New Delhi.
6. Rajput, R.K, Engineering Materials, S. Chand and Co., New Delhi.
7. Sood H., Laboratory Manual on Testing of Engineering Materials, New Age Publishers, New Delhi.
8. Sharma C. P., Engineering Materials, PHI Learning, New Delhi.
9. Duggal, S. K., Building Materials, New International, New Delhi.

BASIC SURVEYING

Course Code	CE 3002 (Same as CC 3002)
Course Title	Basic Surveying
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To understand types of surveying works required
- To know the types of method and equipments to be used for different surveys
- To know the use and operational details of various surveying equipments

Course outcomes:

After completing this course, student will be able to:

- Select the type of survey required for given situation
- Compute area of open field using chain, tape and cross staff
- Conduct traversing in the field using chain and compass
- Use levelling instruments to determine reduced level for preparation of contour maps
- Use digital planimeter to calculate the areas

Course Content:**1. Overview and Classification of Survey**

- 1.1 Survey – Principles, purpose and use
- 1.2 Types of surveying: Primary and Secondary
- 1.3 Classification of surveying
 - 1.3.1 Plane
 - 1.3.2 Geodetic
 - 1.3.3 Cadastral
 - 1.3.4 Hydrographic
 - 1.3.5 Photogrammetry
 - 1.3.6 Aerial
- 1.4 Scales
 - 1.4.1 Engineer's scale
 - 1.4.2 Representative Fraction (RF) and
 - 1.4.3 Diagonal scale

2. Chain Surveying

- 2.1 Instruments used in chain survey:
 - 2.1.1 Chains
 - 2.1.2 Tapes
 - 2.1.3 Arrow
 - 2.1.4 Ranging rod
 - 2.1.5 Line ranger
 - 2.1.6 Offset rod
 - 2.1.7 Open cross staff
 - 2.1.8 Optical square
- 2.2 Chain survey Station, Base line, Check line, Tie line, Offset, Tie station
- 2.3 Ranging: Direct and Indirect Ranging
- 2.4 Methods of Chaining, obstacles in chaining.
- 2.5 Errors in length:
 - 2.5.1 Instrumental error
 - 2.5.2 Personal error
 - 2.5.3 Error due to natural cause
 - 2.5.4 Random error
- 2.6 Principles of triangulation
- 2.7 Types of offsets: Perpendicular and Oblique
- 2.8 Conventional Signs, Recording of measurements in a field book

3. Compass Traverse Survey

- 3.1 Compass Traversing- open, closed

3.2 Technical terms:

- 3.2.1** Geographic/ True Magnetic Meridians and Bearings,
- 3.2.2** Whole Circle Bearing system and Reduced Bearing system and examples on conversion of given bearing to another bearing (from one form to another),
- 3.2.3** Fore Bearing and Back Bearing
- 3.2.4** Calculation of internal and external angles from bearings at a station
- 3.2.5** Dip of Magnetic needle
- 3.2.6** Magnetic Declination

3.3 Types of Compass

- 3.3.1** Components of Prismatic Compass and their Functions
- 3.3.2** Introduction of Surveyor Compass

3.4 Methods of using Prismatic Compass- Temporary adjustments and observing bearings (With Numerical)**3.5 Local attraction, Methods of correction of observed bearings - Correction at station and correction to included angles.****3.6 Methods of plotting a traverse and closing error****3.7 Graphical adjustment of closing error****4. Levelling and Contouring****4.1 Basic terminologies:****4.1.1** Level surfaces**4.1.2** Horizontal and vertical surfaces**4.1.3** Datum**4.1.4** Bench Marks- GTS, Permanent, Arbitrary and Temporary**4.1.5** Reduced Level**4.1.6** Rise and Fall method**4.1.7** Line of collimation**4.1.8** Station**4.1.9** Back sight, Fore sight, Intermediate sight**4.1.10** Change point**4.1.11** Height of instruments**4.2 Types of levels:****4.2.1** Dumpy level**4.2.2** Tilting level**4.2.3** Auto level**4.2.4** Digital level**4.3 Components of Dumpy Level and its fundamental axes****4.4** Temporary adjustments of Level**4.5** Types of Levelling Staff: Self-reading staff and Target staff**4.6** Reduce level by Line of collimation and Rise and Fall Method.**4.7** Types of levelling:**4.7.1** Simple levelling**4.7.2** Differential levelling**4.7.3** Fly levelling**4.7.4** Profile levelling**4.7.5** Reciprocal Levelling**4.8** Contour, contour intervals, horizontal equivalent**4.9** Use of contour maps**4.10** Characteristics of contours**4.11** Methods of Contouring: Direct and indirect**5. Measurement of Area and Volume****5.1** Components and use of Digital planimeter**5.2** Measurement of area using digital planimeter**5.3** Measurement of volume of reservoir from contour map

Suggested learning resources

1. Punmia, B.C.; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying I, Laxmi Publications, New Delhi.
2. Basak, N. N., Surveying and Levelling, McGraw Hill Education, New Delhi.
3. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling volume I, Pune Vidyarthi Gruh Prakashan.
4. Duggal, S. K., Survey I, McGraw Hill Education, New Delhi.
5. Saikia, M.D.; Das. B.M.; Das. M.M., Surveying, PHI Learning, New Delhi.
6. Subramanian, R., Fundamentals of Surveying and Levelling, Oxford University Press. New Delhi.
7. Rao, P.Venugopala Akella, Vijayalakshmi, Textbook of Surveying, PHI Learning New Delhi.
8. Bhavikatti, S. S., Surveying and Levelling, Volume 1, I. K. International, New Delhi.
9. Arora K R , Surveying Vol. I, Standard Book House.

SEMESTER SCHEME 2020-21

MECHANICS OF MATERIALS

Course Code	CE 3003 (Same as CC/CV 3003)
Course Title	Mechanics of Materials
Number of Credits	3 (L:3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To learn properties of area and structural material properties.
- To understand the concept of stress and strain.
- To calculate shear force, bending moment for different shapes of structural elements and corresponding stresses.
- To understand the concept of buckling loads for short and long columns.

Course outcomes:

After competing this course, student will be able to:

- Articulate practical applications of moment of inertia of symmetrical and unsymmetrical structural sections.
- Analyse structural behaviour of materials under various loading conditions.
- Interpret shear force and bending moment diagrams for various types of beams and loading conditions.
- Determine the bending and shear stresses in beams under different loading conditions.
- Analyse the column for various loading and end conditions.

Course Content**1. Moment of Inertia****1.1** Moment of inertia (M.I.):**1.1.1** Definition**1.1.2** M.I. of plane lamina**1.1.3** Radius of gyration**1.1.4** Section modulus**1.1.5** Parallel and Perpendicular axes theorems (without derivations)**1.1.6** M.I. of rectangle, square, circle, semi-circle, quarter circle and triangle section (with derivations)**1.2** Moment of inertia of :**1.2.1** Symmetrical and unsymmetrical I-section**1.2.2** Channel section**1.2.3** T-section**1.2.4** Angle section**1.2.5** Hollow sections**1.2.6** Built up sections about centroidal axes and any other reference axis**1.3** Polar Moment of Inertia of solid circular sections**2. Simple Stresses and Strains****2.1** Definition of rigid, elastic and plastic bodies**2.2** Deformation of elastic body under various forces**2.3** Definitions of :**2.3.1** Stress**2.3.2** Strain**2.3.3** Elasticity**2.3.4** Hook's law**2.3.5** Elastic limit**2.3.6** Modulus of elasticity**2.4** Type of Stresses-Normal, Direct, Bending and Shear**2.5** Nature of stresses i.e. Tensile and Compressive stresses.

- 2.6 Standard stress strain curve for tor steel bar under tension, Yield stress, Proof stress, Ultimate stress, Strain at various critical points, Percentage elongation and Factor of safety
- 2.7 Deformation of body due to axial force, forces applied at intermediate sections, Maximum and minimum stress induced
- 2.8 Composite section under axial loading
- 2.9 Concept of temperature stresses and strain, Stress and strain developed due to temperature variation in homogeneous simple bar (no composite section)
- 2.10 Longitudinal and lateral strain
- 2.11 Modulus of Rigidity, Poisson's ratio, Biaxial and tri-axial stresses, volumetric strain, change in volume, Bulk modulus (Introduction only)
- 2.12 Relation between modulus of elasticity, modulus of rigidity and bulk modulus (without derivation)

3. Shear Force and Bending Moment

- 3.1 Types of supports, beams and loads
- 3.2 Concept and definition of shear force and bending moment
- 3.3 Relation between load, shear force and bending moment (with derivation)
- 3.4 Shear force and bending moment diagram for cantilever and simply supported beams subjected to point loads, uniformly distributed loads and couple (combination of any two types of loading), point of contra flexure

4. Bending and Shear Stresses in beams

- 4.1 Concept and theory of pure bending, assumptions, flexural equation (with derivation), bending stresses and their nature, bending stress distribution diagram
- 4.2 Concept of moment of resistance and simple numerical problems using flexural equation
- 4.3 Shear stress equation (without derivation)
- 4.4 Relation between maximum and average shear stress for rectangular and circular section
- 4.5 Shear stress distribution diagram
- 4.6 Shear stress distribution for square, rectangular, circle, hollow, square, rectangular, circular, angle sections, channel section, I-section, T section
- 4.7 Simple numerical problems based on shear equation

5. Columns

- 5.1 Concept of compression member, short and long column, Effective length, Radius of gyration, Slenderness ratio, Types of end condition for columns, Buckling of axially loaded columns
- 5.2 Euler's theory, assumptions made in Euler's theory and its limitations, Application of Euler's equation to calculate buckling load
- 5.3 Rankine's formula and its application to calculate crippling load
- 5.4 Concept of working load/safe load, design load and factor of safety

Suggested learning resources:

1. Bedi D.S., Strength of Materials, Khanna Publishing House, Delhi, Ed. 2018
2. Timoshenko, S., Strength of Materials, Vol. I, CBS, New Delhi.
3. Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd. New Delhi.
4. Ramamurtham, S, Strength of Materials, Dhanpat Rai and sons, New Delhi.
5. Punmia B.C, Strength of Materials, Laxmi Publications (p) Ltd. New Delhi.
6. Rattan S.S., Strength of Materials, McGraw Hill Education; New Delhi.
7. Bansal R K, Strength of Materials, Laxmi Publications.
8. Subramaniam R, Strength of Materials, Oxford University Press.

BUILDING CONSTRUCTION

Course Code	CE 3004 (Same as CC 3004)
Course Title	Building Construction
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To identify different components of building.
- To understand different types of foundation and their significance.
- To know different types of masonry and their construction.
- To highlight the importance of communications in building planning.

Course outcomes:

After completing this course, student will be able to:

- Identify components of building structures.
- Propose suitable type of foundation for building structures.
- Select suitable type of masonry for building structures.
- Propose relevant means of communications for different types of buildings.
- Select relevant material for finishing works.

Course Content**1. Overview of Building Components****1.1. Classification of Buildings**

1.1.1 As per National Building Code Group A to I

1.1.2 As per Types of Constructions- Load Bearing Structure, Framed Structure, Composite Structure

1.2. Building Components - Functions of Building Components, Substructure – Foundation, Plinth**1.3. Superstructure:**

1.3.1 Walls

1.3.2 Partition wall

1.3.3 Cavity wall

1.3.4 Sill and Lintel

1.3.5 Doors and Windows

1.3.6 Floors

1.3.7 Roof

1.3.8 Columns

1.3.9 Beams

1.3.10 Parapet

1.3.11 Balcony

2. Construction of Substructure**2.1 Job Layout:**

2.1.1 Site Clearance

2.1.2 Layout for Load Bearing Structure and Framed Structure by Center Line and Face Line Method

2.1.3 Precautions

2.2 Earthwork:

2.2.1 Excavation for Foundation

2.2.2 Timbering and Strutting

2.2.3 Earthwork for embankment

2.2.4 Material for plinth Filling

2.2.5 Tools and plants used for earthwork

2.3 Foundation:

- 2.3.1 Functions of foundation,
- 2.3.2 Types of foundation
 - 2.3.2.1 Shallow Foundation
 - 2.3.2.2 Stepped Footing
 - 2.3.2.3 Wall Footing
 - 2.3.2.4 Column Footing
 - 2.3.2.5 Isolated and Combined Column Footing
 - 2.3.2.6 Raft Foundation
 - 2.3.2.7 Grillage Foundation. (Introduction Only)
 - 2.3.2.8 Deep Foundation - Pile Foundation, Well foundation and Caissons
- 2.3.3 Pumping Methods of Dewatering, Deep wells, Well points, Cofferdams (Introduction only)

3. Construction of Superstructure

3.1 Stone Masonry:

- 3.1.1 Terms used in stone masonry- facing, backing, hearting, Through stone, corner stone, cornice
- 3.1.2 Types of stone masonry: Rubble masonry, Ashlar Masonry and their types
 - 3.1.3 Joints in stone masonry and their purpose
- 3.1.4 Selection of Stone Masonry
- 3.1.5 Precautions to be taken in Stone Masonry Construction

3.2 Brick masonry:

- 3.2.1 Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat bond, joints, lap, frog line, level and plumb
- 3.2.2 Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond
- 3.2.3 Requirements of good brick masonry
- 3.2.4 Junctions in brick masonry and their purpose and procedure
- 3.2.5 Precautions to be observed in Brick Masonry Construction
- 3.3 Comparison between stone and Brick Masonry
- 3.4 Tools and plants required for construction of stone and brick masonry
- 3.5 Hollow concrete block masonry and composite masonry

3.6 Scaffolding and Shoring:

- 3.6.1 Purpose
- 3.6.2 Types of Scaffolding
- 3.6.3 Process of Erection and Dismantling
- 3.6.4 Purpose and Types of Shoring, Underpinning

3.7 Formwork:

- 3.7.1 Definition of Formwork
- 3.7.2 Requirements of Formwork
- 3.7.3 Materials used in Formwork,
- 3.7.4 Types of Formwork
- 3.7.5 Removal of formwork

4. Building Communication and Ventilation

4.1 Horizontal Communication:

- 4.1.1 Doors –
 - 4.1.1.1 Components of Doors
 - 4.1.1.2 Full Paneled Doors
 - 4.1.1.3 Partly Paneled and Glazed Doors
 - 4.1.1.4 Flush Doors
 - 4.1.1.5 Collapsible Doors
 - 4.1.1.6 Rolling Shutters
 - 4.1.1.7 Revolving Doors
 - 4.1.1.8 Glazed Doors
 - 4.1.1.9 Sizes of Door recommended by BIS
- 4.1.2 Windows:
 - 4.1.2.1 Component of windows
 - 4.1.2.2 Types of Windows - Full Paneled, Partly Paneled and Glazed, wooden, Steel, Aluminum windows, Sliding

Windows, Louvered Window, Bay window, Corner window, clear-storey window, Gable and Dormer window, Skylight.

4.1.2.3 Sizes of Windows recommended by BIS

4.1.3 Ventilators

4.2 Fixtures and fastenings for doors and windows-Material used and functions of Window Sill and Lintels, Shed / Chajja

4.3 Vertical Communication:

4.3.1 Means of Vertical Communication- Stair Case, Ramps, Lift, Elevators and Escalators

4.4 Terms used in staircase-steps, tread, riser, nosing, soffit, waist slab, baluster, balustrade, scotia, hand rails, newel post, landing, headroom, winder

4.5 Types of staircase :

4.5.1 On the basis of shape:

4.5.1.1 Straight

4.5.1.2 Dog-legged

4.5.1.3 Open well

4.5.1.4 Spiral

4.5.1.5 Quarter turn

4.5.1.6 Bifurcated

4.5.1.7 Three quarter turn and

4.5.1.8 Half turn

4.5.2 On the basis of Material:

4.5.2.1 Stone

4.5.2.2 Brick

4.5.2.3 R.C.C.

4.5.2.4 Wooden

4.5.2.5 Metal

5. Building Finishes

5.1 Floors and Roofs:

5.1.1 Types of Floor Finishes and its suitability- Kota, Marble, Granite, Ceramic Tiles, Vitrified, Chequered Tiles, Paver Blocks, Concrete Floors, wooden Flooring, Skirting and Dado.

5.1.2 Process of Laying and Construction

5.1.3 Finishing and Polishing of Floors

5.1.4 Roofing Materials- RCC, Mangalore Tiles, AC Sheets, G.I. sheets, Corrugated G.I. Sheets, Plastic and Fibre Sheets

5.1.5 Types of Roof: Flat roof, Pitched Roof-King Post truss, Queen Post Truss, terms used in roofs

5.2 Wall Finishes:

5.2.1 Plastering – Necessity of Plastering

5.2.2 Procedure of Plastering

5.2.3 Single Coat Plaster, Double Coat Plaster

5.2.4 Rough finish, Neeru Finishing

5.2.5 Plaster of Paris (POP)

5.2.6 Special Plasters- Stucco plaster, sponge finish, pebble finish

5.2.7 Plaster Board and Wall Claddings

5.2.8 Precautions to be taken in plastering

5.2.9 Defects in plastering

5.2.10 Pointing – Necessity, Types of pointing and procedure of Pointing

5.2.11 Painting –Necessity, Surface Preparation for painting, Methods of Application

Suggested learning resources:

1. S. P. Arora and Bindra., Building Construction, Dhanpat Rai Publication, Delhi.
2. Sushil Kumar., Building Construction, Standard Publication.
3. Rangawala, S. C., Building Construction, Charotar Publication, Anand.
4. Punmia B. C., and Jain A. K., Building Construction ,Firewall Media.
5. Sharma S. K., Building Construction, S. Chand and Co. Pvt. Ltd., New Delhi.
6. JanardanZha , Building Construction, Khanna Publication.
7. Bhavikatti S. S., Building Construction, Vikas Publication House Pvt. Ltd., Delhi.
8. Mantri S., A to Z Building Construction, SatyaPrakashan, New Delhi.

SEMESTER SCHEME 2020-21

CONCRETE TECHNOLOGY

Course Code	CE 3005 (Same as CC /CV3005)
Course Title	Concrete Technology
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To know properties of cement, aggregate and water used in concrete.
- To understand different characteristics of concrete.
- To learn about role of admixtures in concrete.

Course outcomes:

After completing this course, student will be able to:

- Use different types of cement and aggregates in concrete
- Prepare concrete of desired compressive strength.
- Prepare concrete of required specification.
- Maintain quality of concrete under different conditions.
- Apply relevant admixtures for concreting.

Course Content:**1.Cement, Aggregates and Water**

- 1.1 Physical properties of OPC and PPC: fineness, standard consistency, setting time, soundness, compressive strength.
- 1.2 Different grades of OPC and relevant BIS codes
- 1.3 Testing of cement: Laboratory tests-fineness, standard consistency, setting time, soundness, compressive strength
- 1.4 Storage of cement and effect of storage on properties of cement
- 1.5 BIS Specifications and field applications of different types of cements: Rapid hardening, Low heat, Portland pozzolana, Sulphate resisting, Blast furnace slag, High Alumina and White cement
- 1.6 Aggregates: Requirements of good aggregate, Classification according to size and shape
- 1.7 Fine aggregates: Properties, size, specific gravity, bulk density, water absorption and bulking, fineness modulus and grading zone of sand, silt content and their specification as per IS 383.
- 1.8 Concept of crushed Sand
- 1.9 Coarse aggregates: Properties, size, shape, surface texture, water absorption, soundness, specific gravity and bulk density, fineness modulus of coarse aggregate, grading of coarse aggregates, crushing value, impact value and abrasion value of coarse aggregates with specifications.
- 1.10 Water: Quality of water, impurities in mixing water and permissible limits for solids as per IS: 456.

2. Concrete

- 2.1 Concrete: Different grades of concrete, provisions of IS 456.
- 2.2 Duff Abraham water cement (w/c) ratio law, significance of w/c ratio, selection of w/c ratio for different grades, maximum w/c ratio for different grades of concrete for different exposure conditions as per IS 456.
- 2.3 Properties of fresh concrete
 - 2.3.1 Workability: Factors affecting workability of concrete.
- 2.4 Determination of workability of concrete by slump cone, compaction factor, Vee-Bee Consistometer.

- 2.5 Value of workability requirement for different types of concrete works
- 2.6 Segregation, bleeding and preventive measures
- 2.7 Properties of Hardened concrete: Strength, Durability, Impermeability

3. Concrete Mix Design and Testing of Concrete

- 3.1 Concrete mix design: Objectives, methods of mix design,
- 3.2 Study of mix design as per IS 10262 (only procedural steps).
- 3.3 Testing of concrete, determination of compressive strength of concrete cubes at different ages, interpretation and co-relation of test results.
- 3.4 Non-destructive testing of concrete: Rebound hammer test, working principle of rebound hammer and factor affecting the rebound index, Ultrasonic pulse velocity test as per IS13311 (part 1 and 2), Importance of NDT tests

4. Quality Control of Concrete

- 4.1 Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete
- 4.2 Formwork for concreting: Different types of formwork for beams, slabs, columns, materials used for form work,
- 4.3 Requirement of good formwork
- 4.4 Stripping time for removal of formworks per IS 456.
- 4.5 Waterproofing: Importance and need of waterproofing
- 4.6 Methods of waterproofing and materials used for waterproofing
- 4.7 Joints in concrete construction: Types of joints, methods for joining old and new concrete
- 4.8 Introduction to water bars
- 4.9 Materials used for filling joints

5. Chemical Admixture, Special Concrete and Extreme Weather concreting

- 5.1 Admixtures in concrete: Purpose, properties and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixtures, air entraining admixtures and super plasticizers.
- 5.2 Special Concrete: Properties, advantages and limitation of following types of Special concrete:
 - 5.2.1 Ready mix concrete
 - 5.2.2 Fibre Reinforced concrete
 - 5.2.3 High performance concrete
 - 5.2.4 Self-compacting concrete
 - 5.2.5 Light weight concrete
- 5.3 Cold weather concreting: effect of cold weather on concrete, precautions to be taken while concreting in cold weather condition
- 5.4 Hot weather concreting: effect of hot weather on concrete, precautions to be taken while concreting in hot weather condition

Suggested learning resources:

1. Gambhir, M.L., Concrete Technology, Tata McGraw Hill Publishing Co. Ltd., Delhi.
2. Shetty, M.S., Concrete Technology, S. Chand and Co. Pvt. Ltd., Ram Nagar, Delhi.
3. Santhakumar, A. R., Concrete Technology, Oxford University Press, New Delhi.
4. Neville, A. M. and Brooks, J.J., Concrete Technology, Pearson Education Pvt. Ltd.
5. Neville, A. M., Concrete Technology, Pearson Education Pvt. Ltd., New Delhi.
6. Sood, H., Kulkarni P. D., Mittal L. N., Laboratory Manual in Concrete Technology, CBS Publishers, New Delhi.

GEOTECHNICAL ENGINEERING

Course Code	CE 3006 (Same as CC/CV 3006)
Course Title	Geotechnical Engineering
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To understand and determine physical and index properties and classification of soil
- To estimate permeability and shear strength of soil
- To know the load bearing capacity of soil
- To learn various soil stabilization and compaction methods

Course outcomes:

After completing this course, student will be able to:

- Identify types of rocks and sub soil strata of earth.
- Interpret the physical properties of soil related to given construction activities.
- Use the results of permeability and shear strength test for foundation analysis.
- Interpret soil bearing capacity results.
- Compute optimum values for moisture content for maximum dry density of soil through various tests.

Course Content:**1.Overview of Geology and Geotechnical Engineering**

- 1.1 Introduction of Geology, Branches of Geology
- 1.2 Importance of Geology for civil engineering structure and composition of earth
- 1.3 Definition of a rock: Classification based on their genesis (mode of origin), formation
- 1.4 Classification and engineering uses of igneous, sedimentary and metamorphic rocks
- 1.5 Importance of soil as construction material in Civil engineering structures and as foundation bed for structures
- 1.6 Field application of geotechnical engineering for foundation design, pavement design, design of earth retaining structures, design of earthen dam

2.Physical and Index Properties of Soil

- 2.1 Soil as a three-phase system
- 2.2 Water content
- 2.3 Determination of water content by oven drying method as per BIS code
- 2.4 Void ratio, porosity and degree of saturation, density index
- 2.5 Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight
- 2.6 Determination of bulk unit weight and dry unit weight by core cutter and sand replacement method
- 2.7 Determination of specific gravity and water content by pycnometer
- 2.8 Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit, Plasticity index
- 2.9 Particle size distribution test and plotting of curve, Determination of effective diameter of soil, well graded and uniformly graded soils
- 2.10 Plasticity chart
- 2.11 BIS classification of soil.

3.Permeability and Shear Strength of Soil

- 3.1 Definition of permeability
- 3.2 Darcy's law of permeability, coefficient of permeability, factors affecting permeability
- 3.3 Determination of coefficient of permeability by constant head and falling head tests
- 3.4 Simple problems to determine coefficient of permeability
- 3.5 Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, application of flow net, (No numerical problems)
- 3.6 Shear failure of soil
- 3.7 Concept of shear strength of soil

- 3.8 Components of shearing resistance of soil – cohesion, internal friction
- 3.9 Mohr-Coulomb failure theory
Strength envelope, strength equation for purely cohesive and cohesion less soils
- 3.10 Direct shear and vane shear test –laboratory methods

4. Bearing Capacity of Soil

- 4.1 Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure
- 4.2 Introduction to Terzaghi's analysis and assumptions
- 4.3 Effect of water table on bearing capacity
- 4.4 Field methods for determination of bearing capacity – Plate load and Standard Penetration Test. Test procedures as per IS:1888& IS:2131
- 4.5 Definition of earth pressure, Active and Passive earth pressure for no surcharge condition, coefficient of earth pressure
- 4.6 Rankine's theory and assumptions made for non-cohesive Soils

5. Compaction and stabilization of soil

- 5.1 Concept of compaction, Standard and Modified proctor test as per IS code
- 5.2 Plotting of Compaction curve for determining: Optimum moisture content (OMC), maximum dry density (MDD), Zero air voids line
- 5.3 Factors affecting compaction
- 5.4 Field methods of compaction – rolling, ramming and vibration
- 5.5 Suitability of various compaction equipments-smooth wheel roller, sheep foot roller, pneumatic tyred roller, Rammer and Vibrator
- 5.6 Difference between compaction and consolidation
- 5.7 Concept of soil stabilization, necessity of soil stabilization, different methods of soil stabilization
- 5.8 California bearing ratio (CBR) test - Meaning and Utilization in Pavement Construction
- 5.9 Necessity of site investigation and soil exploration: Types of exploration, criteria for deciding the location and number of test pits and bores
- 5.10 Field identification of soil – dry strength test, dilatancy test and toughness test.

Suggested learning resources:

1. Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication, Delhi.
2. Murthy, V.N.S., A text book of soil mechanics and foundation Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Ramamurthy, T.N. & Sitharam, T.G., Geotechnical Engineering (Soil Mechanics), S Chand and Company LTD., New Delhi.
4. Raj, P. Purushothama, Soil Mechanics and Foundation Engineering, Pearson India, New Delhi.
5. Kasamalkar, B. J., Geotechnical Engineering, Pune Vidyarthi Griha Prakashan, Pune.
6. Arora K R, Soil Mechanics and Foundation Engineering, Standard Publisher.

CONSTRUCTION MATERIAL LAB

Course Code	CE 3007 (Same as CC 3007)
Course Title	Construction Material Lab.
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To learn about various construction materials, and understand their relevant characteristics.
- To be able to identify suitability of various materials for different construction purposes.
- To know about natural, artificial, and processed materials available for various purposes of construction activities.

Course outcomes:

After competing this course, student will be able to:

- 1) Identify relevant construction materials.
- 2) Identify relevant natural construction materials.
- 3) Select relevant artificial construction materials.
- 4) Select relevant special type of construction materials.
- 5) Identify and use of processed construction materials.

List of practical to be performed:

1. Identify various sizes of available coarse aggregates from sample of 10 kg in laboratory and prepare report (60,40, 20,10 mm)
2. Identify the available construction materials in the laboratory on the basis of their sources.
3. Identify the grain distribution pattern in given sample of teak wood in the laboratory and draw the various patterns. (along and perpendicular to the grains)
4. Prepare the lime putty by mixing lime (1 kg) with water in appropriate proportion and prepare report on slaking of lime.
5. Identify various layers and types of soil in foundation pit by visiting at least 3 construction sites in different locations of city and prepare report consisting photographs and samples. Part I
6. Identify various layers and types of soil in foundation pit by visiting at least 3 construction sites in different locations of city and prepare report consisting photographs and samples. Part II
7. Select first class, second class and third-class bricks from the stake of bricks and prepare report on the basis of its properties.
8. Measure dimensions of 10 bricks and find average dimension and weight. Perform field tests - dropping, striking and scratching by nail and correlate the results obtained.
9. Identify different types of flooring tiles such as vitrified tiles, ceramic tiles, glazed tiles, mosaic tiles, anti-skid tiles, chequered tiles, paving blocks and prepare report about the specifications.
10. Apply the relevant termite chemical on given damaged sample of timber.
11. Identify the type of glasses from the given samples.
12. Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 1m x 1m using suitable brush/rollers adopting safe practices. Part I
13. Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 1m x 1m using suitable brush/rollers adopting safe practices. Part II
14. Prepare the cement mortar of proportion 1:3 or 1:6 using artificial sand as a special processed construction material.
15. Prepare mortar using cement and Fly ash or Granite/marble polishing waste in the proportion 1:6 or 1:3.

Suggested learning resources:

1. Ghose, D. N., Construction Materials , Tata McGraw Hill, New Delhi.
2. S.K. Sharma, Civil Engineering Construction Materials, Khanna Publishing House, New Delhi
3. Varghese, P.C. , Building Materials, PHI learning, New Delhi.
4. Rangwala, S.C., Engineering Materials, Charator publisher, Ahemdabad.
5. Somayaji, Shan, Civil Engineering Materials, Pearson education, New Delhi.
6. Rajput, R.K, Engineering Materials, S. Chand and Co., New Delhi.
7. Sood H., Laboratory Manual on Testing of Engineering Materials, New Age Publishers, New Delhi.
8. Sharma C. P., Engineering Materials, PHI Learning, New Delhi.
9. Duggal, S. K, Building Materials, New International, New Delhi.

SEMESTER SCHEME 2020-21

BASIC SURVEYING LAB

Course Code	CE 3008 (Same as CC 3008)
Course Title	Basic Surveying Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To understand types of surveying works required
- To know the type of method and equipments to be used for different surveys
- To know the use and operational details of various surveying equipments.

Course outcomes:

After completing this course, student will be able to:

- Select the type of survey required for given situation.
- Compute area of open field using chain, tape and cross staff.
- Conduct traversing in the field using chain and compass.

List of Practicals to be performed

1. Measure distance between two survey stations using chain, tape and ranging rods when two stations are inter visible.
2. Undertake reciprocal ranging and measure the distance between two stations.
3. Determine area of open field using chain and cross staff survey.
4. Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass.
5. Measure Fore Bearing and back bearing of a closed traverse of 5 or 6 sides and correct the bearings and included angles for the local attraction.
6. Undertake Survey Project with chain and compass for closed traverse for minimum 5 sides around a building.
7. Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical **No.6.**
8. Undertake simple leveling using dumpy level/ Auto level and leveling staff.
9. Undertake differential leveling and determine Reduced Levels by Height of instrument method and Rise and fall method using dumpy level/Auto Level and leveling staff.
10. Undertake fly leveling with double check using dumpy level/ Auto level and leveling staff.
11. Undertake Survey Project with Leveling instrument for Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m interval.
12. Plot the L-section with minimum 3 cross-sections on A1 size imperial sheet for data collected in Survey Project mentioned at practical **No.11.**
13. Undertake Survey Project for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m.
14. Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical **No.13.**
15. Measure area of irregular figure using Digital planimeter.

Suggested learning resources:

1. Punmia, B.C.; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying I, Laxmi Publications., New Delhi.
2. Basak, N. N., Surveying and Levelling, McGraw Hill Education, New Delhi.
3. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling volume I, Pune VidyarthiGruhPrakashan.
4. Duggal, S. K., Survey I, McGraw Hill Education, New Delhi.
5. Saikia, M D.; Das. B.M.; Das. M.M., Surveying, PHI Learning, New Delhi.
6. Subramanian, R., Fundamentals of Surveying and Levelling, Oxford University Press. New Delhi.

7. Rao, P.VenugopalaAkella, Vijayalakshmi, Textbook of Surveying, PHI Learning
8. Bhavikatti, S. S., Surveying and Levelling, Volume 1, I. K. International, New Delhi.
9. Arora K R , Surveying Vol. I, Standard Book House

- level to prepare contour maps
- Use digital planimeter to calculate the areas.

SEMESTER SCHEME 2020-21

MECHANICS OF MATERIALS LAB

Course Code	CE 3009 (Same as CC/CV 3009)
Course Title	Mechanics of Materials Lab.
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To know the procedure for the conduct of tensile and compressive strength.
- To understand the concept of stress and strain through testing of different materials.
- To calculate shear force, bending moment and their corresponding stresses.
- To understand flexural strength and abrasive properties of floor tiles.

Course outcomes:

After competing this course, student will be able to:

- Test different Civil engineering materials on Universal Testing Machine.
- Analyse structural behaviour of materials under various loading conditions.
- Interpret shear force and bending moment diagrams for various types of beam sections and different loading conditions.
- Determine bending and shear stresses in beams under different loading conditions.
- Calculate flexural strength of different types of floor tiles.

List of Practicals to be performed:

1. Study and understand the use and components of Universal Testing Machine (UTM).
2. Perform Tension test on mild steel as per IS:432(1).
3. Perform tension test on Tor steel as per IS:1608, IS:1139.
4. Conduct compression test on sample test piece using Compression Testing Machine.
5. Conduct Izod Impact test on three metals. e.g. mild steel/ brass/aluminum/ copper /cast iron etc as per IS:1598.
6. Conduct Charpy Impact test on three metals. e.g. mild steel/ brass/aluminum/ copper /cast iron etc as per IS:1757.
7. Determine Water Absorption on bricks per IS:3495 (part II), IS:1077 or tile IS:1237.
8. Determine Compressive strength of dry and wet bricks as per IS:3495(part I), IS:1077.
9. Conduct Abrasion Test on flooring tiles (any one) e.g. Mosaic tiles, Ceramic Tiles as per IS: 13630 (part7), Cement Tile as per IS: 1237.
10. Perform Single Shear and double shear test on any two metals e.g. Mild steel/ brass/aluminium/copper / cast iron etc as per IS:5242.
11. Conduct Compression test on timber section along the grain and across the grain as per IS:2408.
12. Plot Shear force and Bending Moment diagrams for cantilever, simply supported beams.
13. Plot Shear force and Bending Moment diagrams for overhanging beams for different types of loads including moment loading.
14. Conduct Flexural test on timber beam on rectangular section in both orientation as per IS:1708, IS:2408.
15. Conduct Flexure test on floor tiles IS:1237,IS:13630 or roofing tiles as per IS:654,IS:2690.

Suggested learning resources:

1. Bedi D.S., Strength of Materials, Khanna Publishing House, New Delhi (Edition 2018)
2. Timoshenko, S., Strength of Materials, Vol. I, CBS, New Delhi.
3. Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd. New Delhi.
4. Ramamurtham, S, Strength of Materials, DhanpatRai and sons, New Delhi.
5. Punmia B C, Strength of Materials, Laxmi Publications (p) Ltd. New Delhi.
6. Rattan S.S., Strength of Materials, McGraw Hill Education; New Delhi.
7. Bansal R K, Strength of Materials, Laxmi Publications.
8. Subramaniam R, Strength of Materials, Oxford University Press.

SEMESTER SCHEME 2020-21

CONCRETE TECHNOLOGY LAB

Course Code	CE 3010 (Same as CC/CV 3010)
Course Title	Concrete Technology Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To know properties of cement, aggregate and water used in concrete.
- To understand different characteristics of concrete.
- To learn about role of admixtures in concrete.

Course outcomes:

After completing this course, student will be able to:

- Identify different types of cement by performing laboratory tests.
- Know the physical properties of fine and coarse aggregates.
- Prepare concrete of required specification.
- Maintain the quality of concrete applying scientific principles.
- Use relevant admixtures for improving the workability of concrete.

List of Practical to be performed:

1	Determine fineness of cement by Blaine's air permeability apparatus Or by sieving.
2	Determine specific gravity, standard consistency, initial and final setting times of cement.
3	Determine compressive strength of cement.
4	Determine silt content in sand.
5	Determine bulking of sand.
6	Determine bulk density of fine and coarse aggregates.
7	Determine water absorption of fine and coarse aggregates.
8	Determine Fineness modulus of fine aggregate by sieve analysis.
9	Determine elongation and flakiness index of coarse aggregates
10	Determine workability of concrete by slump cone test.
11	Determine workability of concrete by compaction factor test.
12	To prepare concrete mix of a particular grade and determine compressive strength of concrete for 7 and 28 days.
13	Demonstration of NDT equipments

Suggested learning resources:

1. Gambhir, M.L., Concrete Technology, Tata McGraw Hill Publishing Co. Ltd., Delhi.
2. Shetty, M.S., Concrete Technology, S. Chand and Co. Pvt. Ltd., Ram Nagar, Delhi.
3. Santhakumar, A. R., Concrete Technology, Oxford University Press, New Delhi.
4. Neville, A. M. and Brooks, J.J., Concrete Technology, Pearson Education Pvt. Ltd.
5. Neville, A. M., Concrete Technology, Pearson Education Pvt. Ltd., New Delhi.
6. Sood, H., Kulkarni P. D., Mittal L. N., Laboratory Manual in Concrete Technology, CBS Publishers, New Delhi.

GEOTECHNICAL ENGINEERING LAB

Course Code	CE 3011 (Same as CC/CV 3011)
Course Title	Geotechnical Engineering Lab.
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To understand and determine physical and index properties of soil.
- To estimate the permeability and shear strength of soil.
- To know the procedure for performing C.B.R test.
- To learn various compaction methods for soil stabilization.

Course outcomes:

After completing this course, student will be able to:

- Identify types of rocks and sub soil strata of earth.
- Interpret the physical properties of soil related to given construction activities.
- Use the results of permeability and shear strength test for foundation analysis.
- Interpret the soil bearing capacity results.
- Compute optimum moisture content values for maximum dry density of soil through various tests.

List of Practicals to be performed:

1. Identification of rocks from the given specimen.
2. Determine water content of given soil sample by oven drying method as per IS: 2720 (Part- II).
3. Determine specific gravity and water content of soil by pycnometer method as per IS 2720 (Part- III).
4. Determine dry unit weight of soil in field by core cutter method as per IS 2720 (Part- XXIX).
5. Determine dry unit weight of soil in field by sand replacement method as per IS 2720 (Part- XXVIII).
6. Determine Plastic and Liquid Limit along with Plasticity Index of given soil sample as per IS 2720 (Part- V).
7. Determine grain size distribution of given soil sample by mechanical sieve analysis as per IS 2720 (Part- IV).
8. Use different types of soil to identify and classify soil by conducting field tests-Through Visual inspection, Dry strength test, Dilatancy test and Toughness test.
9. Determine coefficient of permeability by constant head test as per IS 2720 (Part- XVII).
10. Determine coefficient of permeability by falling head test as per IS 2720 (Part- XVII).
11. Determine shear strength of soil by direct shear test as per IS 2720 (Part-XIII).
12. Determine shear strength of soil by vane shear test as per IS 2720 (Part-XXX).
13. Determine MDD and OMC by standard proctor test of given soil sample as per IS 2720 (Part- VII).

Suggested learning resources:

1. Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication
2. Murthy, V.N.S., A text book of soil mechanics and foundation Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Ramamurthy, T.N. &Sitharam,T.G., Geotechnical Engineering(Soil Mechanics), S Chand and Company LTD., New Delhi.
4. Raj, P. Purushothama, Soil Mechanics and Foundation Engineering, Pearson India
5. Kasamalkar, B. J., Geotechnical Engineering, Pune VidyarthiGrihaPrakashan, Pune.
6. Arora K R, Soil Mechanics and Foundation Engineering, Standard Publisher.
