

West Bengal State Council of Technical &
Vocational Education and Skill
Development
(Technical Education Division)



Syllabus
of

Diploma in Civil Engineering [CE]

Part-II (3rd Semester)

Revised 2022

CURRICULAR STRUCTURE FOR PART – II FIRST SEMESTER (THIRD SEMESTER) OF THE FULL-TIME DIPLOMA COURSE IN CIVIL ENGINEERING

SL. No	SUBJECT CODE	SUBJECT OF STUDY	HOURS PER WEEK			CREDITS	Marks
			LECTURE	TUTORIAL	PRACTICAL		
1	CEPC301	Construction Materials	2	0	0	2	100
2	CEPC302	Basic Surveying	3	0	0	3	100
3	CEPC303	Mechanics of Materials	3	0	0	3	100
4	CEPC304	Building Construction	2	0	0	2	100
5	CEPC305	Concrete Technology	2	0	0	2	100
6	CEPC306	Civil Engineering Planning and Drawing	1	0	0	1	100
7	CEPC307	Transportation Engineering	2	0	0	2	100
		LABORATORY/SESSIONAL PAPERS					
8	CEPC308S	Civil Engineering Planning and Drawing Practices	0	0	4	2	100
	CEPC309S : Civil Engineering Lab- I (consisting of following four Modules with 8 Practical Classes and 4 Credits)						
9	CEPC309S/I	Module-I: Construction Material Lab	0	0	2	1	100
10	CEPC309S/II	Module-II: Mechanics of Materials Lab	0	0	2	1	100
11	CEPC309S/II I	Module-III: Concrete Technology Lab	0	0	2	1	100
12	CEPC309S/IV	Module-IV: Transportation Engineering Lab	0	0	2	1	100
		INTERNSHIP					
13	CEI310S	Internship-I after 2 nd Semester	0	0	0	1	100
		TOTAL	15	0	12	22	1300

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Construction Materials	Course Code	CEPC301
Subject offered in Semester	Third	Number of Credits	2(L:2, T:0, P: 0)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

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 Content:

Module	Distribution of unit
Module A	Unit 1 and 2
Module B	Unit 3 and 4
Module C	Unit 5

Unit – I: Overview of Construction Materials

- Scope of construction materials in Building Construction, Transportation Engineering, environmental Engineering, Irrigation Engineering (applications only).
- Selection of materials for different civil engineering structures on the basis of strength, durability, Eco friendly and economy.
- Broad classification of materials – Natural, Artificial, special, finishing and recycled

Unit – II: Natural Construction Materials

- Requirements of good building stone; general characteristics of stone; quarrying and dressing methods and tools for stone.
- Structure of timber, general properties and uses of good timber, different methods of seasoning for preservation of timber, defects in timber, use of bamboo in construction.
- Asphalt, bitumen and tar used in construction, properties and uses.
- Properties of lime, its types and uses.
- Properties of sand and uses
- Classification of coarse aggregate according to size and its use

Unit- III: Artificial Construction Materials

- Constituents of brick earth, Conventional / Traditional bricks, Modular and Standard bricks, Special bricks –fly ash bricks, Characteristics of good brick, Field tests on Bricks, Classification of burnt clay bricks and their suitability, Manufacturing process of burnt clay brick, fly ash bricks, Aerated concrete blocks.
- Flooring tiles – Types, uses
- Manufacturing process of Cement - dry and wet (only flow chart), types of cement and its uses. Field tests on cement.
- Precast concrete blocks- hollow, solid, pavement blocks, and their use.
- Plywood, particle board, Veneers, laminated board and their uses.
- Types of glass: soda lime glass, lead glass and borosilicate glass and their uses
- Ferrous and non-ferrous metals and their uses.

Unit- IV: Special Construction Materials

- Types of material and suitability in construction works of following materials: Waterproofing, Termite proofing; Thermal and sound insulating materials.
- Fibers – Types –Jute, Glass, Plastic Asbestos Fibers (only uses).
- Geopolymer cement: Geo-cement: properties, uses.

Unit- V: Processed Construction Materials

- Constituents and uses of POP (Plaster of Paris), POP finishing boards, sizes and uses.
- Paints- whitewash, cement paint, Distemper, Oil Paints and Varnishes with their uses. (Situations where used).
- Industrial waste materials- Fly ash, Blast furnace slag, Granite and marble polishing waste and their uses.
- Agro waste materials - Rice husk, Bagasse, coir fibres and their uses.
- Special processed construction materials; Geosynthetic, Ferro Crete, Artificial timber, Artificial sand 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, 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.
10. Singh, Parveen, Civil Engineering Materials, S.K. Kataria & sons
11. Soni, S.K., Building Materials and Constructions, S.K. Kataria & sons
12. Singh, Gurucharan, Building Construction & Materials, Standard Book House, New Delhi.
13. Gambhir, M.L, Jamwal Neha, Lab Manual Building & Construction Materials, Tata McGraw Hill, New Delhi.
14. Subramanian, N., Building Materials, Oxford University Press.

Course outcomes: After completing this course, student will be able to:

- Identify relevant construction materials.
- Identify relevant natural construction materials.
- Select relevant artificial construction materials.
- Select relevant special type of construction materials.
- Identify and use of processed construction materials.

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Basic Surveying	Course Code	CEPC302
Subject offered in Semester	Third	Number of Credits	3 (L:3, T: 0, P: 0)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

Objective:- Following are the objectives of this course:

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

Contents:

Module	Distribution of unit
Module A	Unit 1 and 2
Module B	Unit 3 and 4
Module C	Unit 5

Unit – I Overview and Classification of Survey

- Survey-Definition, Purpose and Use.
- Types of surveying- Primary and Secondary, Classification: Primary-Plane & Geodetic, Secondary Classification-Based on Instrument, Based on Method, Based on Purpose, Based on Nature of Field.
- Principles of Surveying.
- Scales: Engineer's scale, Representative Fraction (RF), Plain, Diagonal, Vernier and Chord Scale.

Unit- II Chain Surveying

- Instruments used in chain survey: Chain, Tapes, Arrow, Ranging rod, Line ranger, Pegs, Offset rod, cross staff, Optical square, Plumb Bob.
- Methods of Chaining, obstacles in chaining.
- Principles of chain survey.
- Well and ill Conditioned Triangle.
- Errors in length: Instrumental error, personal error, error due to natural cause, random error.
- Calculation of Chain and Tape Correction.
- Types of offsets: Perpendicular and Oblique.
- Chain survey Station, Base line, Check line, Tie line, Tie station.
- Ranging: Direct and Indirect Ranging.
- Conventional Signs, Recording of measurements in a field book.
- area calculation from field book entry
- Simple numerical problems.

Unit- III Compass Traverse Survey

- Compass Traversing- open and closed.
- Technical Terms: Meridians and Bearings of a Line-True, Magnetic, Arbitrary
- Whole Circle Bearing system and Reduced Bearing system and examples on conversion of given bearing to another bearing (from one form to another), Fore Bearing and Back Bearing, Calculation of internal and external angles from bearings at a station and Vice-versa, Dip of Magnetic needle, Magnetic Declination and It's variation, Isogonic and Agonic line.
- Principles of Compass Traversing.
- Components of Prismatic Compass and their Functions, Difference between Prismatic and Surveyor compass. Methods of using Prismatic Compass - Temporary adjustments and observing bearings.
- Local attraction, different methods of correction of observed bearings - Correction at station and correction to included angles including cases when all stations in a traverse are affected with local attraction
- Methods of plotting a traverse and closing error, Graphical adjustment of closing error.
- Errors in Compass Surveying-Instrumental, Personal and Natural.
- Simple numerical problems.

Unit- IV Levelling and Contouring

- Levelling-Definition, Object and Uses.
- Basic terminologies: Level, Horizontal and vertical surfaces & Lines, Datum surface or Line, Bench Marks- GTS, Permanent, Arbitrary and Temporary, Reduced Level, Rise, Fall, Line of collimation, Axis of the Telescope, Axis of Bubble Tube, Station,

Back sight, Fore sight, Intermediate sight, Change point, Height of instruments, Focussing and Parallax.

- Types of levels: Dumpy, Tilting, Auto level, Digital level, Components of Dumpy Level and its fundamental axes, Temporary adjustments of Level.
- Types of Levelling Staff: Self-reading staff and Target staff.
- Curvature and Refraction correction.
- Reduction of level by Line of collimation or Height of Instrument and Rise and Fall Method.
- Levelling Types: Simple, Differential, Fly, Profile, Cross sectional, Check and Reciprocal Levelling.
- Entry in level book and arithmetical check and accuracy check of level work
- Errors in Levelling-Instrumental, Personal and Natural, Permissible limits of Error in Levelling.
- Contour, contour intervals, horizontal equivalent. Contour gradient.
- Uses of contour maps, Characteristics of contours, Methods of Contouring: Direct and indirect.
- Simple numerical problems

Unit – V Plane Table Surveying

- Principles of plane table survey.
- Accessories of plane table survey and their uses,
- Setting of plane table- Leveling, Centering, Orientation.
- Orientation of plane table - Back sighting and Magnetic needle method.
- Methods of Plane table survey- Radiation, Intersection, Traversing, and Resection (No Two-Point and Three-Point Problem).
- Merits and demerits of plane table survey
- Errors in Plane table Surveying- Instrumental, Personal and Plotting.
- No numerical problems

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.
10. C.L. Kochher, Surveying, Dhanpat Rai Publication, New Delhi.
11. Dr. N.R. Chandak and Prof. H.R. Kumavat, Surveying, SK Kataria & Sons, New Delhi
12. Saurabh Kumar Soni, Surveying-I, SK Kataria & Sons, New Delhi
13. Agor, R., A Text Book of Surveying & Levelling, Khanna Publishers.
14. Chandra A.M., Plane Surveying, New Age International Publishers.

Course outcomes: After completing this course, student will be able to:

- Measure linear, angular, horizontal & vertical distances in field , adopting precautions and standard data recording methods.
- Conduct traversing in the field using chain and compass.
- Use levelling instruments to determine reduced level for preparation of contour maps
- Prepare plans using Plane Table Surveys.
- Select the type of survey required for given situation.

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Mechanics of Materials	Course Code	CEPC303
Subject offered in Semester	Third	Number of Credits	3 (L:3, T: 0, P: 0)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

Objective:- Following are the objectives of this course:

- To learn properties of structural sections and structural materials.
- To understand the concept of stress and strain.
- To calculate shear force, bending moment for different structural elements and corresponding stresses.
- To understand different methods of finding axial forces in trusses.

Contents:

Module	Distribution of unit
Module A	Unit 1 and 2
Module B	Unit 3 and 4
Module C	Unit 5

Unit – I Moment of Inertia

- Moment of inertia (M.I.): Definition, M.I. of plane lamina, Radius of gyration, section modulus, Parallel and Perpendicular axes theorems, M.I. of rectangle, square, circle, semi-circle, quarter circle and triangle section
- M.I. of symmetrical and unsymmetrical sections: I-section, Channel section, T-section, Angle section, Hollow sections and built up sections about centroidal axes and any other reference axis.

- Polar Moment of Inertia of solid circular sections.
- Simple numerical problems.

Unit- II Simple Stresses and Strains

- Definition of rigid, elastic and plastic bodies, deformation of elastic body under various forces, Definition of stress, strain, elasticity, Hooke's law, Elastic limit, Modulus of elasticity.
- Types of Stresses- Tensile and Compressive stresses, Shear and Bending stresses.
- Standard stress strain curve for Mild steel and HYSD bar under tension: Yield stress, Proof stress, Ultimate stress, Strain at various critical points, strain hardening, Percentage elongation and Factor of safety.
- Deformation of body due to axial force, forces applied at intermediate sections, maximum and minimum stress induced, Composite section under axial loading.
- Concept of temperature stresses and strain, Stress and strain developed due to temperature variation in homogeneous simple bar (no composite section, without yielding).
- Longitudinal and lateral strain, Modulus of Rigidity, Poisson's ratio, Biaxial and tri-axial stresses [concept only], volumetric strain, change in volume, Bulk modulus (Introduction only).
- Relation between modulus of elasticity, modulus of rigidity and bulk modulus
- Simple numerical problems.

Unit- III Shear Force and Bending Moment

- Types of supports, beams and loads.
- Concept and definition of shear force and bending moment, Relation between load, shear force and bending moment.
- Shear force and bending moment diagram for cantilever, simply supported and over hang on one or both side beams subjected to point loads, uniformly distributed loads or combination of these two types of loading (for udl - over full span or partial span), point of contra flexure.
- Simple numerical problems.

Unit- IV Bending and Shear Stresses in beams

- Concept and theory of pure bending, assumptions, flexural equation, bending stresses and their nature, concept of neutral plane and neutral axis, bending stress distribution diagram for square, rectangular, circle, I-section, T- section.
- Concept of moment of resistance and simple numerical problems using flexural equation
- Shear stress equation (without derivation), relation between maximum and averages shear stress for rectangular and circular section, shear stress distribution diagram for square, rectangular, circle, I-section, T- section. Simple numerical problems based on shear equation.
- Simple numerical problems.

Unit- V Simple Trusses

- Types of trusses (Simple, Fink, compound fink, French truss, Pratt truss, Howe truss, North light truss, King post and Queen post truss)
- Calculate support reactions for trusses subjected to point loads at joints
- Calculate forces in members of truss using Method of joints and Method of sections.

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.
9. Ramamrutham.S, Theory of structures, Dhanpatrai & Sons.
10. Khurmi, R. S. , Theory of Structures S. Chand and Co., New Delhi.
11. Bhavikatti, S S , Structural Analysis Vol-1, Vikas Publishing House Pvt Ltd. New Delhi.
12. Bhattachariya, B., Engineering Mechanics, Oxford University Press.
13. Chakraborty, M., Strength of Materials, Kolkata.
14. Adarsh, Swaroop, Mechanics of Materials, New Age International Publishers.

Course outcomes: After completing 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.
- Evaluate axial forces in the members of simple truss.

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Building Construction	Course Code	CEPC304
Subject offered in Semester	Third	Number of Credits	2 (L:2, T: 0, P: 0)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

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.

Course Content:

Module	Distribution of unit
Module A	Unit 1 and 2
Module B	Unit 3 and 4
Module C	Unit 5

Unit – I: Overview of Building Components

- Classification of Buildings as per National Building Code Group A to I, As per Types of constructions- Load Bearing Structure, Framed Structure, Composite Structure.
- Building Components - Functions of Building Components, Substructure – Foundation, Plinth.

- Superstructure – Walls, Partition wall, Cavity wall, Sill, Lintel, Stair, Doors and Windows, Floor, Mezzanine floor, Roof, Columns, Beams, Parapet.

Unit – II: Construction of Substructure

- Job Layout: Site Clearance, Layout for Load Bearing Structure and Framed Structure by Center Line and Face Line Method, Precautions.
- Earthwork: Excavation for Foundation, Timbering and Strutting, Earthwork for embankment, Material for plinth Filling, Tools and plants used for earthwork.
- Foundation: Functions of foundation, Types of foundation – Shallow Foundation: Stepped Footing, Wall Footing, Column Footing, Isolated and Combined Column Footing, Raft Foundation, Grillage Foundation. Deep Foundation: Pile Foundation, Well foundation and Caissons, Pumping Methods of Dewatering, Deep wells, Well points, Cofferdams (Introduction only).

Unit- III: Construction of Superstructure

- **Stone Masonry:** Terms used in stone masonry- facing, backing, hearting, Through stone, corner stone, cornice. Types of stone masonry: Rubble masonry, Ashlar Masonry and their types. Joints in stone masonry and their purpose. Selection of Stone Masonry, Precautions to be taken in Stone Masonry Construction.
- **Brick masonry:** Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat, bonding, joints, lap, frog, level and plumb and other related important terms, Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond. Requirements of good brick masonry. Junctions in brick masonry and their purpose and procedure. Precautions to be observed in Brick Masonry Construction. Comparison between stone and Brick Masonry. Tools and plants required for construction of stone and brick masonry. Hollow concrete block masonry and composite masonry.
- **Scaffolding, Shoring and formwork:** Purpose, Types of Scaffolding, Process of Erection and Dismantling. Purpose and Types of Shoring, purpose and types of Underpinning. Formwork: Definition of Formwork, Requirements of Formwork, Materials used in Formwork, Types of Formwork, Removal of formwork as per BIS.

Unit- IV: Building Communication and Ventilation

- **Horizontal Communication: Doors** –Components of Doors, Full Panelled Doors, Partly panelled and Glazed Doors, Flush Doors, Collapsible Doors, Rolling Shutters, Revolving Doors, Fully glazed Doors. Sizes of Door recommended by BIS.
- **Windows:** Component of windows, Types of Windows - Full Panelled, Partly Panelled and Glazed, wooden, Steel, Aluminum windows, Sliding Windows, Louvered Window, Bay window, Corner window, clear-storey window, Gable and Dormer window, Skylight. Size of Windows recommended by BIS. Ventilators. Fixtures and fastenings for doors and windows- material used; Functions of Window Sill , Lintels, Shed / Chajja.
- **Vertical Communication:** Means of Vertical Communication- Stair Case, Ramps, Lift, Elevators and Escalators. Terms used in staircase - steps, tread, riser, nosing, soffit, waist slab, baluster, balustrade, scotia, hand rails, newel post, landing, headroom, winder, stringer beam, going, rising. Types of staircase (On the basis of shape): Straight, dog-legged, open well, Spiral, quarter turn, bifurcated, Three quarter turn and Half turn, (On the basis of Material): Stone, Brick, R.C.C., wooden and Metal.

Unit- V: Building Finishes

- **Floors and Roofs:** Types of Floor Finishes and its suitability- Kota, Marble, Granite, Ceramic Tiles, Vitrified, Chequered Tiles, Paver Blocks, Concrete Floors, wooden Flooring, Skirting and Dado. Process of Laying and Construction, Finishing and Polishing of Floors, Roofing Materials- RCC, Mangalore Tiles, AC Sheets, G.I. sheets, Corrugated G.I. Sheets, Plastic and Fibre Sheets. Types of Roof: Flat roof, Pitched Roof-King Post truss, queen Post Truss, terms used in roofs.
- **Wall Finishes:** Plastering – Necessity of Plastering, Procedure of Plastering, Single Coat Plaster, Double Coat Plaster, Rough finish, Neeru Finishing and Plaster of Paris (POP). Special Plasters- Stucco plaster, sponge finish, pebble finish. Plaster Board and Wall Claddings. Precautions to be taken in plastering, defects in plastering. Pointing – Necessity, Types of pointing and procedure of Pointing. Painting – Necessity, Surface Preparation for painting, Methods of Application, Whitewashing and colour washing, distempering.

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. Janardan Zha , Building Construction, Khanna Publication.
7. Bhavikatti S. S., Building Construction, Vikas Publication House Pvt. Ltd., Delhi.
8. Mantri S., A to Z Building Construction, Satya Prakashan, New Delhi.
9. Neelam Sharma, Building Construction, S.K.Kataria and Sons
10. Singh, Gurucharan, Building Construction & Materials, Standard Book House, New Delhi.
11. Gambhir, M.L. and JAMWAL, NEHA, Lab Manual Building & Construction Materials, Tata McGraw Hill, New Delhi.

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.

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Concrete Technology	Course Code	CEPC305
Subject offered in Semester	Third	Number of Credits	2 (L:2, T: 0, P: 0)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

Course Objectives: Following are the objectives of this course:

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

Course Content:

Module	Distribution of unit
Module A	Unit 1 and 2
Module B	Unit 3 and 4
Module C	Unit 5

Unit – I Cement, Aggregates, Water and Admixture

- Physical properties of OPC and PPC: fineness, standard consistency, setting time, soundness, compressive strength. Different grades of OPC and relevant BIS codes
- Testing of cement: Field test and Laboratory tests -fineness, standard consistency, setting time, soundness, compressive strength. Storage of cement and effect of storage on properties of cement.
- 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.
- Aggregates: Requirements of good aggregate, Classification according to size and shape.

- 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. Concept of crushed Sand.
- 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.
- Water: Quality of water, impurities in mixing water and permissible limits for solids as per IS: 456.
- 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.

Unit– II Concrete

- Concrete: Different grades of concrete, provisions of IS 456.
- 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.
- Properties of fresh concrete: Workability: Factors affecting workability of concrete. Determination of workability of concrete by slump cone, compaction factor, Vee-Bee Consistometer. Value of workability requirement for different types of concrete works. Segregation, bleeding and preventive measures.
- Properties of Hardened concrete: Strength, Durability, Impermeability.

Unit– III Concrete Mix Design and Testing of Concrete

- Concrete mix design: Objectives, ordinary concrete and controlled concrete, methods of mix design, study of mix design as per IS 10262 (only procedural steps), factors affecting concrete mix design
- Testing of concrete, determination of compressive strength of concrete cubes and cylinder at different ages, interpretation and co-relation of test results.
- 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.

Unit– IV Quality Control of Concrete

- Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete.
- Forms for concreting: Different types of form works for different structural members, requirement of good form work. Stripping time for removal of form works per IS 456.
- Waterproofing: Importance and need of waterproofing, methods of waterproofing and materials used for waterproofing.
- Joints in concrete construction: Types of joints, methods for joining old and new concrete, materials used for filling joints.

Unit– V Special Concrete and Extreme Weather concreting

- Special Concrete: Properties, advantages and limitation of following types of Special concrete: Ready mix Concrete, Fiber Reinforced Concrete, High performance Concrete Self-compacting concrete and light weight concrete.
- Cold weather concreting: effect of cold weather on concrete, precautions to be taken while concreting in cold weather condition.
- 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.
7. IS 456 : 2000
8. IS 10262: 2009
9. SP 23: 1982
10. Kulkarni, P. D., Ghosh, R. K. & Phull V. R., New Age International Publishers.
11. Vazirani, V. N. & CHANDOLA, S.P., Concrete Technology, Khanna Publishers.
12. Laskar, Aminul Islam, Concrete Technology, Laxmi Publication Pvt. Ltd.

Course outcomes: *After completing this course, student will be able to:*

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

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Civil Engineering Planning and Drawing	Course Code	CEPC306
Subject offered in Semester	Third	Number of Credits	1 (L:1, T: 0, P: 0)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

Course Objectives:

Following are the objectives of this course:

- To learn basic principles Civil Engineering drawing.
- To know graphical representation of various components of Civil Engineering structure mainly building
- To draw complete plan and elevation of a building.
- To learn basics of Computer Aided Drawings.

Course Content:

Module	Distribution of unit
Module A	Unit 1 and 2
Module B	Unit 3 and 4
Module C	Unit 5

Unit – I Conventions and Symbols

- Conventions as per IS 962, symbols for different materials such as earthwork, brickwork, stonework, concrete, woodwork and glass.
- Graphical symbols for doors and windows, Abbreviations, symbols for sanitary and electrical installations.

- Types of lines-visible lines, centre line, hidden line, section line, dimension line, extension line, pointers, arrow head or dots. Appropriate size of lettering and numerals for titles, sub-titles, notes and dimensions.
- Types of scale- Monumental, Intimate, criteria for Proper Selection of scale for various types of drawing.
- Sizes of various standard papers/sheets.
- Reading and interpreting readymade Architectural building drawing (To be procured from Architect, Planning Consultants, Planning Engineer).

Unit- II Planning of Building

- Principles of planning for Residential and Public building- Aspect, Prospect, Orientation, Grouping, Privacy, Elegance, Flexibility, Circulation, Furniture requirements, Sanitation, Economy.
- Space requirement and norms for minimum dimension of different units in the residential and public buildings as per IS 962.
- Rules and bye-laws of sanctioning authorities for construction work.
- Plot area, built up area, super built up area, plinth area, carpet area, floor area and FAR (Floor Area Ratio).
- Line plans for residential building of minimum three rooms including water closet (WC), bath, kitchen and staircase as per principles of planning.
- Line plans for public building, school building & primary health centre,

Unit- III Drawing of Load Bearing Structure

- Drawing of Single storey Load Bearing residential building (2 BHK) with staircase.
- Data drawing –plan, elevation, section, site plan, schedule of openings, construction notes with specifications, area statement, Planning and design of staircase- Rise and Tread for residential and public building.
- Working drawing – developed plan, elevation, sections passing through staircase, and/or WC and bath.
- Foundation plan of Load bearing structure.
- Drawing with CAD - Draw commands, modify commands, layer commands.
- Area statement of building.

Unit – IV Culverts

- Introduction to culvert & its different components and types and specific use along with demonstration of a model
- Half sectional plan and half sectional elevation and side view of a single span slab culvert
- Half sectional elevation of a single span two hume-pipe culvert

Unit – V Steel connections & Steel Roof truss

- Plan elevation and side view of stanchion connected with base plate with gusset plate in concrete foundation
- Connection of main beam with secondary beam in one side
- Connection of beam with column
- Unequal column splicing
- Equal beam splicing
- Column bracket
- Introduction to truss – wooden (king post and queen post), steel (with angles and tubular truss) along with demonstration of model
- Details of a fink truss with welded/riveted joints and details of column connection
- drawing of a wooden king post and queen post truss of the building drawing in sheet

Suggested learning resources:

1. Shah. M.G. Kale, CM, Patki, S.Y., Building Drawing, Mcgraw Hill Publishing company Ltd. New Delhi.
2. Malik and Mayo, Civil Engineering Drawing, Computech Publication Ltd New Asian Publish- ers, New Delhi.
3. M. G. Shah and C. M. Kale, Principles of Perspective Drawing, Mcgraw Hill Publishing compa- ny Ltd. New Delhi.
4. Swamy, Kumara; Rao, N, Kameshwara, A ., Building Planning and Drawing, Charotar Publica- tion, Anand.
5. Bhavikatti, S. S., Building Construction, Vikas Publication House Pvt. Ltd., New Delhi.
6. Mantri, Sandip, A to Z Building Construction, Satya Prakashan, New Delhi.
7. Singh, Ajit, Working with Auto CAD 2000, Mcgraw Hill Publishing company Ltd. New Delhi.
8. Sane, Y.S., Planning and design of Building, Allied Publishers, New Delhi.
9. Venugopal, K. & Prabhu, Raja V., Engineering Drawing & AUTO-CAD, New Age International Publishers.
10. Jeyapooan, T., Engineering Graphics using AUTO-CAD, Vikas Publication House Pvt. Ltd., New Delhi.
11. Jolhe, Engineering Drawing with an introduction to CAD, Tata McGraw Hill, New Delhi.

Course outcomes: After completing this course, student will be able to:

1. Interpret the symbols, signs and conventions from the given drawing.
2. Prepare line plans of residential and public buildings using principles of planning.
3. Prepare submission and working drawing for the given requirement of civil engineering structure (CAD may be used in addition to conventional drawing).

Assignment to be produced in Sketch Book [compulsory]

1	Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962.
2	Study of a working drawing on Two BHK accommodation obtained from professional persons (Group activity) and make a report on this
3	a) Measure the units of existing building (Load Bearing / Frame structure/his or her own dwelling unit: home or house or flat).
	b) Draw line plan of measured existing building at serial no 3a to the suitable scale.
4	Draw line plan to suitable scale (Minimum 2BHK, flat roof, staircase, 2 nos WC and Bathroom(one attached), venrandah) [the same may be used in the drawing practical classes also]
	a) Residential single storied building (two plans)
	b) Apartment (two plans)
5	Draw line plans to suitable scale for any three Public Buildings from the following (School Building, Primary Health Centre, Bank, Post Office, Hostel, Restaurant, Community Hall and Library).
6	Draw three principal views of a channel section, I section, H section and angle section

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Transportation Engineering	Course Code	CEPC307
Subject offered in Semester	Third	Number of Credits	2 (L:2, T: 0, P: 0)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

Course Objectives: Following are the objectives of this course:

- To identify the types of roads as per IRC recommendations.
- To understand the geometrical design features of different highways.
- To perform different tests on road materials.
- To identify the components of railway tracks

Course Content:

Module	Distribution of unit
Module A	Unit 1 and 2
Module B	Unit 3 and 4
Module C	Unit 5

Unit – I Overview of Highway Engineering

- Role of transportation in the development of nation, Scope and Importance of roads in India and its' Characteristics.
- Different modes of transportation – land way, waterway, airway. Merits and demerits of roadway and railway;
- General classification of roads.
- Selection and factors affecting road alignment.

Unit- II Geometric Design of Highway

- Design speed, design vehicle, PCU, volume of traffic, terrain classification
- Camber: Definition, purpose, types as per IRC – recommendations.
- Kerbs, Road margin, road formation, right of way as per IRC – recommendations..
- Design speed and various factors affecting design speed as per IRC – recommendations.
- Gradient: Definition, types as per IRC – Recommendations, grade compensation at curve
- Sight distance: Definition, types IRC – recommendations, simple numerical.
- Curves: Necessity, types: Horizontal including transition curve, vertical curves [no design, no problems on curve design]
- Extra widening of roads: numerical examples.
- Super elevation: Definition, formula for calculating minimum and maximum Super elevation and method of providing super-elevation.
- Standards cross-sections of national highway in plain, embankment and cutting.

Unit- III Construction of Road Pavements

- **T**ypes of road materials and their Tests – Test on aggregates-Flakiness and Elongation Index tests, Angularity Number test, test on Bitumen- penetration, Ductility, Flash and Fire point test and Softening point test.
- Pavement – Definition, Types, Structural Components of pavement and their functions
- Construction of WBM road. Merits and demerits of WBM & WMM road.
- Construction of Flexible pavement / Bituminous Road, Types of Bitumen and its properties, emulsion, Cutback, Tar, Terms used in Bituminous Road - prime coat, tack coat, seal coat, premix carpet., penetration macadam, mastic asphalt, merits and Demerits of Bituminous Road.
- Cement concrete road - methods of construction, Alternate and Continuous Bay Method, joints in concrete pavement, filler and sealers, merits and demerits of concrete roads.

Unit- IV Basics of Railway Engineering

- Classification of Indian Railways, zones of Indian Railways
- Permanent way: Ideal requirement, Components; Rail Gauge, types, factors affecting selection of a gauge
- Rail, Rail Joints - requirements, types.
- Creep of rail: causes and prevention, wear in rail.
- Sleepers - functions and Requirement, types and sleeper density [numerical problems]
- Ballast - function and types, suitability.

- Rail fixtures and fastenings – fish plate, spikes, bolts, keys, bearing plates, chairs- types of anchors and anti-creepers.

Unit- V Track geometrics, Construction and Maintenance

- Alignment- Factors governing rail alignment.
- Track Cross sections – standard cross section of single and double line in cutting and embankment. Important terms - formation width, side drains, etc
- Railway Track Geometrics: Gradient, curves - types and factors affecting, grade compensation, super elevation, limits of Super elevation on curves, cant deficiency, negative cant, coning of wheel, tilting of rail.
- Branching of Tracks, Points and crossings, Turn out- types, components, functions and inspection. Track junctions: crossovers, scissor cross over, diamond crossing, track triangle.
- Station - Purpose, requirement of railway station, important technical terms, types of railway station, factors affecting site selection for railway station.
- Station yard: Classification- Passenger, goods, locomotive and marshalling yards. Function & drawbacks of marshalling yards.
- Track Maintenance- Necessity, Classification, Tools required for track maintenance with their functions, Organisation of track maintenance, Duties of permanent way inspector, gangmate and key man.

Suggested learning resources:

1. L.R. Kadiyali, Transportation Engineering, Khanna Book Publishing Co., Delhi (ISBN: 978-93- 82609-858) Edition 2018
2. Khanna S.K., Justo, C E G and Veeraragavan, A., Highway Engineering, Nem Chand and Brothers, Roorkee.
3. Arora, N. L., Transportation Engineering, Khanna Publishers, Delhi.
4. Saxena S C and Arora S P, A Textbook of Railway Engineering, Dhanpat Rai Publication.
5. Birdi, Ahuja, Road, Railways, Bridge and Tunnel Engg , Standard Book House, New Delhi.
6. Sharma, S.K., Principles, Practice and Design of Highway Engineering,, S. Chand Publication, New Delhi.
7. Duggal, Ajay K. and Puri, V. P., Laboratory Manual in Highway Engineering, New Age international (P) Limited, Publishers, New Delhi.
8. Subramanian, K.P., Highway, Railway, Airport and Harbour Engineering, Scitech Publications, Hyderabad.
9. Chandola, S.P., A Text Book of Transportation Engineering, S. Chand Publication.
10. Vazirani, V. N. & Chandola, S.P., Transportation Engineering Vol.-I, Khanna Publishers.
11. Upadhyaya, A. K., Transportation Engineering, S. K. Kataria & Son, New Delhi.

Course outcomes: After completing this course, student will be able to:

- Identify the types of roads as per IRC recommendations.
- Implement the geometrical design features of different highways.
- knowledge on different tests on road materials.
- Preliminary knowledge on different type of highway construction
- Identify the components of railway tracks.
- Identify the defects in railway tracks.

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Civil Engineering Planning and Drawing Practices	Course Code	CEPC308S
Subject offered in Semester	Third	Number of Credits	2 (L:0, T: 0, P: 4)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

Course Objectives:

Following are the objectives of this course:

- To learn the basic principles of Civil Engineering Drawing.
- To make graphical representation of various components of Civil Engineering structure.
- To draw complete plan and elevation of a building.
- To learn basics of Computer Aided Drawings.

List of Practicals/Drawings to be completed:

Drawing to be produced in Full Imperial Size Sheet (A1)	
1	Draw submission drawing to the scale 1:100 of a single storey load bearing residential building (2BHK) with flat Roof, staircase, 2 nos WC and Bathroom(min. one attached), one Varandah showing
	a) Developed plan, Front elevation, one side elevation
	b) Section passing through Stair , W.C. and Bath
	c) Foundation plan and schedule of openings.
	d) Site plan (1:200), area statement, construction notes.
2	Draw working drawing for above mentioned drawing at serial number 1 showing:
	a) excavation trench plan

	b) Foundation plan to the scale 1:50
	c) Detailed enlarged section of Lintel and Chajjas including standard reinforcement.
	d) Detailed enlarged section of RCC staircase and landing slab including standard reinforcement
	e) Plan of Roof slab showing ridge line, drainage, position of rain water pipe, etc.
3	Culverts (problems to be supplied by the subject teacher(s))
	a) Introduction to culvert & its different components and types and specific use along with demonstration of a model
	b) Half sectional plan and half sectional elevation and side view of a single span slab culvert
	c) Half sectional elevation of a single span two hume-pipe culvert
4	Steel connections [bolted or welded] (problems to be supplied by the subject teacher(s))
	a. Plan elevation and side view of stanchion connected with base plate with gusset plate in concrete foundation
	b. Connection of main beam with secondary beam in one side
	c. Connection of beam with column
	d. Unequal column splicing
	e. Equal beam splicing
	f. Column bracket
5	Steel Roof truss (problems to be supplied by the subject teacher(s))
	Study of different trusses used in construction and draw a welded fink truss [angle or tubular] having standard dimension and minute detailing

NOTE: In addition to conventional approach to Civil Engineering Drawing, student may also take the help of CAD in preparing their sessional works if he/she desires so.

Suggested learning resources:

1. Shah. M.G. Kale, CM, Patki, S.Y., Building Drawing, Mcgraw Hill Publishing
2. Malik and Mayo, Civil Engineering Drawing, Computech Publication Ltd
3. M. G. Shah and C. M. Kale, Principles of Perspective Drawing, Mcgraw Hill
4. Swamy, Kumara; Rao, N, Kameshwara, A ., Building Planning and Drawing, Charotar Publica- tion, Anand.
5. Bhavikatti, S. S., Building Construction, Vikas Publication House Pvt. Ltd., Delhi.
6. Mantri, Sandip, A to Z Building Construction, Satya Prakashan, New Delhi.
7. Singh, Ajit, Working with Auto CAD 2000, Mcgraw Hill Publishing company Ltd.

8. Sane, Y.S., Planning and design of Building, Allied Publishers, New Delhi.
9. Venugopal, K. & Prabhu, RAJA V., Engineering Drawing & AUTO-CAD, New Age International Publishers.
10. Jeyapoovan, T., Engineering Graphics using AUTO-CAD, Vikas Publication House Pvt. Ltd., New Delhi.
11. Jolhe, Engineering Drawing with an introduction to CAD, Tata McGraw Hill, New Delhi.

Course outcomes: After completing this course, student will be able to:

- Interpret the symbols, signs and conventions from the given drawing.
- Prepare line plans of residential and public buildings using principles of planning.
- Prepare working drawing for the given requirement of Civil engineering structure

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Civil Engineering Laboratory I Module-I: Construction Material Lab	Course Code	CEPC309S/I
Subject offered in Semester	Third	Number of Credits	1 (L:0, T: 0, P: 2)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

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.

List of practical to be performed: (At least 8 nos 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 a construction sites and prepare report consisting photographs and samples.
6. Select first class, second class and third-class bricks from the stack of bricks and prepare report on the basis of its properties.

7. 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.
8. 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.
9. Apply the relevant termite chemical on given damaged sample of timber.
10. Identify the type of glasses from the given samples.
11. 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.
12. Prepare the cement mortar of proportion 1:3 or 1:6 using sand and apply on 1 m X 1 m surface as plastering
13. Prepare mortar using cement and Fly ash or Granite/marble polishing waste in the proportion 1:6 or 1:3 and apply on 1 m X 1 m surface as plastering

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, 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.
10. Singh, Parveen, Civil Engineering Materials, S.K. Kataria & sons
11. Soni, S.K., Building Materials and Constructions, S.K. Kataria & sons
12. Singh, Gurucharan, Building Construction & Materials, Standard Book House, New Delhi.
13. Gambhir, M.L. and Jamwal, NEHA, Lab Manual Building & Construction Materials, Tata McGraw Hill, New Delhi.
14. Subramanian, N., Building Materials, Oxford University Press.

Course outcomes: After completing 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.

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Civil Engineering Laboratory I Module-II: Mechanics of Materials Lab	Course Code	CEPC309S/II
Subject offered in Semester	Third	Number of Credits	1 (L:0, T: 0, P: 2)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

Objective:- 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.

List of Practicals to be performed: (Practical 5 and 6 is compulsory) and perform at least 2 Nos Practical from the rest)

- Study and understand the use and components of Universal Testing Machine (UTM).
- Perform Tension test on mild steel as per IS:432(1).
- Perform tension test on Tor steel as per IS:1608, IS:1139.
- Conduct compression test on sample test piece using Compression Testing Machine.
- Plot Shear force and Bending Moment diagrams for cantilever, simply supported beams
- Plot Shear force and Bending Moment diagrams for overhanging beams for different types of loads including moment loading.

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, 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.
9. Ramamrutham.S, Theory of structures, Dhanpatrai & Sons.
10. Khurmi, R. S. , Theory of Structures S. Chand and Co., New Delhi.
11. Bhavikatti, S S , Structural Analysis Vol-1, Vikas Publishing House Pvt Ltd. New Delh
12. Bhattachariya, B., Engineering Mechanics, Oxford University Press.
13. Chakraborty, M., Strength of Materials, Kolkata.
14. Adarsh, Swaroop, Mechanics of Materials, New Age International Publishers.

Course outcomes: After completing 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.

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Civil Engineering Laboratory I Module-III: Concrete Technology Lab	Course Code	CEPC309S/III
Subject offered in Semester	Third	Number of Credits	1 (L:0, T: 0, P: 2)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

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.

List of Practical to be performed: (At least 10 experiments should be performed)

1	Determine fineness of cement by Blaine's air permeability apparatus Or by sieving.
2	Determine standard consistency of cement.
3	Determine initial and final setting times of cement.
4	Determine compressive strength of cement.
5	Determine silt content in sand.
6	Determine bulking of sand.
7	Determine bulk density of fine and coarse aggregates.
8	Determine water absorption of fine and coarse aggregates.
9	Determine surface moisture of fine and coarse aggregates.
10	Determine grading of fine aggregate and coarse aggregate by sieve analysis.

11	Determine workability of concrete by slump cone test.
12	Determine workability of concrete by compaction factor test.
13	To prepare concrete mix of a particular grade [nominal mix may be allowed] and determine compressive strength of concrete for 7 and 28 days.
14	Demonstration of NDT equipment .

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.
7. Kulkarni, P. D., Ghosh, R. K. & Phull, V. R., New Age International Publishers.
8. Vazirani, V. N. & CHANDOLA, S. P., Concrete Technology, Khanna Publishers.
9. Laskar, Aminul Islam, Concrete Technology, Laxmi Publication Pvt. Ltd.
10. IS 456 : 2000
11. IS 10262: 2009
12. **SP 23: 1982**

Course outcomes: After completing this course, student will be able to:

- **determine the engineering properties of cement and its suitability in using in different site condition.**
- **determine the engineering properties of coarse aggregate and fine aggregate and their suitability in using in preparing design mix of concrete**
- **determine the engineering properties of fresh and hardened concrete**
- **perform non-destructive testings of concrete**

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Civil Engineering Laboratory I Module-IV: Transportation Engineering Lab	Course Code	CEPC309S/IV
Subject offered in Semester	Third	Number of Credits	1 (L:0, T: 0, P: 2)
Prerequisites	NIL	Course Category	PC
Question distribution		Marks distribution	

Course Objectives: Following are the objectives of this course:

- To identify the types of roads as per IRC recommendations.
- To understand the geometrical design features of different highways.
- To perform different tests on road materials.
- To identify the components of railway tracks.

List of Practicals to be performed: [at least 10 nos]

1	Draw the sketches showing standard cross sections of Expressways, Freeways, NH/SH, MDR/ODR
2	Flakiness and Elongation Index of aggregates.
3	Aggregate impact value test
4	Los Angeles Abrasion test
5	Aggregate crushing value test
6	Softening point test of bitumen.

7	Penetration test of bitumen.
8	Flash and Fire Point test of bitumen.
9	Ductility test of Bitumen.
10	Visit the constructed road for visual inspection to identify defects and suggest remedial measures and Prepare the photographic report containing details
11	Visit the hill road constructed site to understand its components and prepare the photographic report containing details
12	Visit the road of any one type (flexible or rigid) to know the drainage condition and prepare a photographic report containing details.
13	Prepare the photographic report suggesting possible repairs and maintenance for a. flexible pavement and b. rigid pavement
14	Visit to railway track for visual inspection of fixtures, fasteners and yards and prepare a photographic report containing details.

Suggested learning resources:

1. L.R. Kadiyali, Transportation Engineering, Khanna Book Publishing Co., Delhi (ISBN: 978-93- 82609-858) Edition 2018
2. Khanna S.K., Justo, C E G and Veeraragavan, A., Highway Engineering, Nem Chand and Brothers, Roorkee.
3. Arora, N. L., Transportation Engineering, Khanna Publishers, Delhi.
4. Saxena S C and Arora S P, A Textbook of Railway Engineering, Dhanpat Rai Publication.
5. Birdi, Ahuja, Road, Railways, Bridge and Tunnel Engg , Standard Book House, New Delhi.
6. Sharma, S.K., Principles, Practice and Design of Highway Engineering,, S. Chand Publication, New Delhi.
7. Duggal, Ajay K. and Puri, V. P., Laboratory Manual in Highway Engineering, New Age international (P) Limited, Publishers, New Delhi.
8. Subramanian, K.P., Highway, Railway, Airport and Harbour Engineering, Scitech Publications, Hyderabad.
9. Chandola, S.P., A Text Book of Transportation Engineering, S. Chand Publication.
10. Vazirani, V. N. & Chandola, S. P.,Transportation Engineering Vol.-I, Khanna Publishers.
11. Upadhyaya. K., Transportation Engineering, S. K. Kataria & Son, New Delhi.

Course outcomes: After completing this course, student will be able to:

- Identify the types of roads as per IRC recommendations.
- Implement the geometrical design features of different highways.
- Perform different tests on road materials.
- Identify the components of railway tracks.
- Identify the defects in railway tracks

Name of the Course	Diploma in Civil Engineering	Course duration	6 semester
Course Title	Internship-I after II nd Sem	Course Code	CEI310S
Subject offered in Semester	Third	Number of Credits	1 (L:0, T: 0, P: 0)
Prerequisites	NIL	Course Category	I
Question distribution		Marks distribution	

Course Objectives: Following are the objectives of this course:

- To understand industrial environment and Civil Engineering activities.
- To get exposure to field level works.
- To get brief idea on drawings.
- To be accustomed with online courses.

NOTE: Activity(s) from the following has to be performed and prepare a report on the activity together with presentation before the subject teacher.

- **Activities may be arranged by the West Bengal State Council of Technical and Vocational Education & Skill Development.**
- **Board of Practical Studies, MSME or Department of Small Scale Industries or other engineering department of State Government may be involved. Initiative from the Department of Technical Education, Training and Skill Development is highly solicited.**
- **Activities centering Private organization in the arena of civil engineering construction/ planning and design/ supervision/marketing etc may also be considered.**
- **It may be arranged in-campus or off-campus; online or offline mode or blended mode.**
- **Activities may be conducted continuously for stipulated period of time or may be arranged in a staggered fashion – in the later case Saturday and Sunday may be utilized for the Internship Program and accordingly class schedule will have to be arranged.**

- **Activities may be performed by a group of students or may be done by individually under the guidance of subject teacher(s)**

After the 2nd Semester students are required to be involved in Inter/ Intra Institutional Activities viz: training and simulation program with different institute like workshop of ITI , other polytechnics, other technical institute, institutions; soft skill training organized by the Training and Placement Cell of the respective institute; contribution at innovation/entrepreneurship cell of the institute, participation in the workshop/competition etc; learning at departmental laboratory/institutional workshop. It may also cover subjects taught in 1st, 2nd and 3rd semester (on any one or combination of the following subjects)
a. science and humanities b. engineering mechanics c. computer application d. engineering graphics e. environmental science f. departmental subjects g. any other current topic on latest trend in civil engineering.

Activity(s) may include -

- Training / Skill Development from any institute [private/govt/govt aided] or from any individual expert on topics related to civil engineering field;
- Soft skill training organized by Training and Placement Cell of the respective institutions;
- Review study and preparation of report based on traditional library or digital library or internet ;
- Learning at Departmental Lab/ Institutional workshop;
- Working for consultancy job/project work within the institutes or outside the institute;
- Any training on open online learning (like internshala, Moocs etc) - **NOT Compulsory TO PRODUCE ANY CERTIFICATE from the training organisation or trainer;**
- Visit to construction site and prepare a report along with labeled photograph or drawing ;
- An industrial visit to a testing laboratory of civil engineering materials and prepare a report on visit
- Industrial visit to a manufacturing unit related to the civil engineering construction or any other engineering materials;
- Participation in a socio-economic survey on any current topics or like and know the methodology
- Conducting a market survey on determination/variation on rate of any civil engineering materials and preparation a report on the same

If a subject teacher or any other teachers from civil engineering department or any other department of respective polytechnic desires to involve students to study/review/visit/etc etc on any subject or topic not covered in the list produced above as per his/her convenience then he/she should be given authority to proceed with the same.

After completion of each internship, the student should prepare a comprehensive report to indicate what he/she has observed and learnt in the training period. The student may contact Industrial supervisor/Faculty member/TPO for assigning topics and problems and should prepare the final report on assigned topics. The training report should be signed by the Industrial supervisor/Internship Faculty member, TPO and HOD.

The internship report will be evaluated on the basis of following criteria (as applicable):

Sl no	Criteria for evaluation of Internship Report
1.	Originality
2.	Adequacy and purposeful writeup
3	Organization, format, drawing, sketches style language
4	Practical applications and relationship with basic theory
5	Concepts taught in the course outcomes
6	Attendance record, daily diary, quality of the internship report

Seminars must be arranged for the students based on his/her training report, before an internal committee constituted by the concerned department of the institute. The evaluation will be based on the following criteria:

Sl no	Criteria for evaluation of Internship Report
1	Quality of content presented
2	Proper planning for presentation
3	Effectiveness of presentation
4	Depth of knowledge and skills
5	Viva voce

Course outcomes: After completing this course, student will be able to:

- Understand the overall brief knowledge of industrial activities.
- Relate the industrial activities with his/her different courses of Diploma in Civil Engineering.