Final

DIPLOMA CURRICULUM OF CIVIL ENGINEERING (SECOND YEAR) (3rd Semester)

(To be implemented from 2025-26)

Prepared by;

National Institute of Technical Teachers' Training & Research Kolkata
Block – FC, Sector – III, Salt Lake City, Kolkata – 700106

Vetted by:
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State Council for Technical Education & Vocational Training
Near Raj Bhawan, Unit-VIII, Bhubaneswar, Odisha

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PROGRAMME TITLE: CIVIL ENGINEERING

SEMESTER - III

SL. No	Category of Course	Code No	Course Title	Teaching Scheme				Evaluation Scheme				Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory		Practical			
					L	T	P	End Exam	Progressive Assessment	End Exam	Progressive Assessment		
1	**Programme core**	CEPC201 TH:1	Building Construction		3	0	0	70	30	-	- -	100	3
2		CEPC203 TH:2	Transportation Engineering		3	0	0	70	30	-	- -	100	3
3		CEPC205 TH:3	Mechanics of Materials		3	0	0	70	30	-	- -	100	3
4		CEPC207 TH:4	Geotechnical Engineering		3	0	0	70	30	-	- -	100	3
5		CEPC209 TH:5	Building Material & Concrete Technology		3	0	0	70	30	-	- -	100	3
6		CEPC211 PR:1	Transportation Engineering Lab		0	0	4	-		15	35	50	2
7		CEPC213 PR:2	Mechanics of Materials Lab.		0	0	4	-		15	35	50	2
8		CEPC215 PR:3	Geotechnical Engineering Lab..		0	0	4	-		15	35	50	2
9		CEPC217 PR:4	Building Materials & Construction Lab.		0	0	4	-		15	35	50	2
10	**Summer Internship**	SI201	Summer internship – I*		0	0	0	-		15	35	50	2
TOTAL					**15**	**0**	**16**	**350**	**150**	**75**	**175**	**750**	**25**

*4-weeks after 2nd Semester

SEMESTER - III COURSES

TH:1- BUILDING CONSTRUCTION

L	T	P		Course Code: CEPC 201	
3	0	0			
Total Contact Hours			**Total Marks: 100**	**Theory Assessment**	
Theory		: 45Hrs		End Term Exam	70
				Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PC	

RATIONALE

This course has been designed for the students to know the properties of different materials for use and quality control in construction works as per IS code of practice. Further, practical input has been given for augmenting the learning by the students.

LEARNING OUTCOMES

After completion of this course, the students will be able to

- Explain different components of building, types of foundation and their significance.
- Compare different types of masonry and their construction.
- Explain different construction technique
- Explain the importance of communications in building planning.

COURSE CONTENT DETAILS

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
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, Doors and Windows, Floor, Mezzanine floor, Roof, Columns, Beams, Parapet.	**4**
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.	**8**

	• 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 bond, joints, lap, frog line, level and plumb. 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 and Shoring:** Purpose, Types of Scaffolding, Process of Erection and Dismantling. Purpose and Types of Shoring, Underpinning. Formwork: Definition of Formwork, Requirements of Formwork, Materials used in Formwork, Types of Formwork, Removal offormwork.	**12**
UNIT-IV	**Building Communication and Ventilation** • **Horizontal Communication: Doors** –Components of Doors, Full Paneled Doors, Part ly Paneled and Glazed Doors, Flush Doors, Collapsible Doors, Rolling Shutters, Revolving Doors, Glazed Doors. Sizes of Door recommended by BIS. • **Windows:** Component of windows, Types of Windows – Full Paneled, Partly Paneled and Glazed, wooden, Steel, Aluminum windows, Sliding Windows, Louvered Window, Bay win- dow, Corner window, clear storey window, Gable and Dormer window, Skylight. Sizes of Windows recommended by BIS. Ventilators. • Fixtures and fastenings for doors and windows • Material used and functions of Window Sill and 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,	**8**

	newel post, landing, headroom, winder. 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 Ma terials- 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. Painting – Necessity, Types of painting and procedure of Painting. Painting –Necessity, Surface Preparation for painting, Methods of Application.	**13**
	Total	**45**

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, NewDelhi.
8. Sharma C. P., Engineering Materials, PHI Learning, New Delhi.
9. Duggal, S. K, Building Materials, New International, New Delhi.
10. S. P. Arora and Bindra., Building Construction, Dhanpat Rai Publication, Delhi.
11. Sushil Kumar., Building Construction, Standard Publication.
12. Rangawala, S. C., Building Construction, Charotar Publication, Anand.
13. Punmia B. C., and Jain A. K., Building Construction ,Firewall Media.

14. Sharma S. K., Building Construction, S. Chand and Co. Pvt. Ltd., New Delhi.
15. Janardan Zha , Building Construction, Khanna Publication.
16. Bhavikatti S. S., Building Construction, Vikas Publication House Pvt. Ltd., Delhi.
17. Mantri S., A to Z Building Construction, Satya Prakashan, New Delhi.

TH:2- TRANSPORTATION ENGINEERING

L	T	P		
3	0	0		**Course Code: CEPC 203**
Total Contact Hours				**Theory Assessment**
Theory		: 45 Hrs	**Total Marks: 100**	End Term Exam 70
				Progressive Assessment : 30
Pre Requisite		**: Nil**		
Credit		**3**		Category of Course : PC

RATIONALE

Airport Engineering and Railways, as specialized topics of Civil Engineering constitute important components of Transportation Engineering. Many–a-times diploma holders are involved in the construction and/or maintenance of airports, and railways. At the same time a state may not have many airports or the facility of railways. In such a case the subject may be offered as an elective to a student who plans carrier in line with the subject matter.

LEARNING OUTCOME

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.

COURSE CONTENT DETAILS

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
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 ofroadway and railway; • General classification of roads. • Selection and factors affecting road alignment.	**5**
UNIT –II	**Geometric Design of Highway** • Camber: Definition, purpose, types as per IRC – recommendations. • Kerbs: Road margin, road formation, right of way. • Design speed and various factors affecting design speed as per IRC – recommendations.	**10**

	• Gradient: Definition, types as per IRC – Recommendations. • Sight distance (SSD): Definition, types IRC – recommendations, simple numerical. • Curves: Necessity, types: Horizontal, vertical curves. • 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 embankment and cutting.	
UNIT –III	**Construction of Road Pavements** • Types of road materials and their Tests – Test on aggregates-Flakiness and Elongation In- dex 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 proper- ties, Emulsion, Cutback, Tar, Terms used in BR-prime coat, tack coat, seal coat, Merits andDemerits of BR. • Cement concrete road -methods of construction, Alternate and Continuous Bay Method, Construction joints, filler and sealers, merits and demerits of concrete roads. Types of joints.	**10**
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. • Sleepers - functions and Requirement, types - concrete sleepers and their density • Ballast - function and types, suitability. • Rail fixtures and fastenings – fish plate, spikes, bolts, keys, bearing plates, chairs-types of anchors and anti-creepers.	**10**
UNIT - V	**Track geometrics, Construction and Maintenance**	**10**

	• Alignment- Factors governing rail alignment. • Track Cross sections – standard cross section of single and double line in cutting and em- bankment. Important terms-permanent land, formation width, side drains, • Railway Track Geometrics: Gradient, curves- types and factors affecting, grade compensa- tion, super elevation, limits of Super elevation on curves, cant deficiency, negative cant, con- ing of wheel, tilting of rail. • Branching of Tracks, Points and crossings, Turn out- types, components, functions and in- spection. Track junctions: crossovers, scissor cross over, diamond crossing, track triangle. • Station -Purpose, requirement of railway station, important technical terms, types of rail- way 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.	
		45

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 Broth-ers, 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 Interna-tional (P) Limited, Publishers, New Delhi.
8. Subramanian, K.P., Highway, Railway, Airport and Harbour Engineering, Scitech Publications,Hyderabad.

TH:3- MECHANICS OF MATERIAL

L	T	P	Total Marks: 100	Course Code: CEPC 205	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45 Hrs		End Term Exam	70
				Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PC	

RATIONALE

Mechanics of Materials deals with the internal behavior of variously loaded solid bodies, such as; shafts, bars, beams, plates, and columns, as well as structures and machines that are assemblies of these components. Mechanics of materials focuses primarily on mechanical properties of materials, analysis of stress, strain and evaluation of deformations. The aim of this course is to develop background of students for taking up engineering subjects like Theory and Design of Structures, Design of Machines etc.

LEARNING OUTCOME

After completion of this course, the students will be able to

- Describe the Mechanical properties of important Engineering materials.
- Determine stresses, strains and deformations in elastic bodies of different shapes under different loading conditions for engineering applications
- Determine load carrying capacity of different types of members
- Calculate the design load to design the column

COURSE CONTENT DETAILS

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
UNIT-I	**Centre of Gravity and Moment of Inertia** ● Definition of centre of gravity -Centre of gravity of of Symmetrical shapes (solid / hollow square, rectangular, circular, I Sections) • Moment of inertia (M.I.): Definition, M.I. of plane lamina, Radius of gyration, section mod- ulus, Parallel and Perpendicular axes theorems (without derivations), M.I. of rectangle, square, circle, semicircle, quarter circle and triangle section (without derivations). • M.I. of symmetrical and unsymmetrical I-section, Channel section, T-section, Angle section, Hollow sections and built up sections about centroidal axes and any other referenceaxis.	**8**

	• Polar Moment of Inertia of solid circular sections.	
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, Hook's law, Elastic limit, Modulus of elastic-ity. • Type of Stresses-Normal, Direct, Bending and Shear and nature of stresses i.e. Tensile and Compressive stresses. • 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. • 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) • Longitudinal and lateral strain, Modulus of Rigidity, Poisson's ratio, Biaxial and tri-axial stresses, volumetric strain, change in volume, Bulk modulus (Introduction only). Relation between modulus of elasticity, modulus of rigidity and bulk modulus (without derivation). **COMPLEX STRESSES AND STRAINS** **Principal stresses and strains:** Occurrence of normal and tangential stresses - Concept of Principal stress and Principal Planes – major and minor principal stresses and their orientations – stresses on a given plane –shear and normal stress components on any inclined plane – Mohr's circle and its use in solving problems on complex stresses - Numerical problems	**12**
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 (without derivation). • 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.	**10**

UNIT-IV	**Bending and Shear Stresses in beams** • Concept and theory of pure bending, assumptions, flexural equation (without derivation), bending stresses and their nature, bending stress distribution diagram. • Concept of moment of resistance and simple numerical problems using flexural equation. ▪ Shear stresss equation (without derivation),	**9**
	relation between maximum and average shear stress for rectangular and circular section, shear stress distribution diagram. • Shear stress distribution for square, rectangular, circle, hollow, square, rectangular, circular, angle sections, channel section, I-section, T section. Simple numerical problems based on shear equation.	
UNIT-V	**Columns** • Concept of compression member, short and long column, Effective length, Radius of gy- ration, Slenderness ratio, Types of end condition for columns, Buckling of axially loadedcolumns. • Euler's theory, assumptions made in Euler's theory and its limitations, Application of Eu- ler's equation to calculate buckling load. • Rankine' s formula and its application to calculate crippling load. • Concept of working load/safe load, design load and factor of safety.	**6**
	Total	**45**

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.

TH:4- GEOTECHNICAL ENGINEERING

L	T	P		**Course Code: CEPC 209**	
3	0	0			
Total Contact Hours			**Total Marks: 100**	**Theory Assessment**	
Theory		: 45 Hrs		End Term Exam	70
				Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PC	

RATIONALE

The knowledge and skills of Geo-Technical Engineering help the Practicing Civil Engineers in Civil Engineering Construction Works, especially in the design and construction of building foundation.

LEARNING OUTCOME

After completion of this course, the students will be able to

- Determine physical and index properties and classification of soil
- Estimate permeability and shear strength of soil
- Identify the load bearing capacity of soil
- Explain various soil stabilization and compaction methods
- Use IS codes for different soil testing

COURSE CONTENT DETAILS

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
UNIT-I	**Overview of Geology and Geotechnical Engineering** • Introduction of Geology, Branches of Geology, Importance of Geology for civil engineering structure and composition of earth, • Definition of a rock: Classification based on their genesis (mode of origin), formation. Classification and engineering uses of igneous, sedimentary and metamorphic rocks. (Concepts only) • Importance of soil as construction material in Civil engineering structures and as foundation bed for structures. (Concepts only) • Field application of geotechnical engineering for foundation design, pavement design, design of earth retaining structures, design of earthen dam. (Concepts only)	**5**
UNIT-II	**Physical and Index Properties of Soil** • Soil as a three phase system, water content, determination of water content by oven drying method as per BIS code, void ratio, porosity and degree of	**8**

	saturation, density index., air Content,Percentage of air voids, Relation between the parameters. • Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight. Determination of bulk unit weight and dry unit weight by core cutter and sand replacement method, Determination of specific gravity by pycnometer. • Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit. Plasticity index. • Particle size distribution test and plotting of curve, Determination of effective diameter of soil, well graded and uniformly graded soils, BIS classification of soil.	
UNIT-III	**Permeability and Seepage** • Definition of permeability, Darcy's law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of permeability by constant head and falling head tests, simple problems to determine coefficient of permeability. Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, application of flow net, (Concepts only No numerical problems).Effective stress,quick Sand	**8**
UNIT-IV	**Compaction,Consolidation and stabilization of soil** Concept of compaction, Standard and Modified proctor test as per IS code, Plotting of Compaction curve for determining: Optimum moisture content (OMC), maximum dry density (MDD), Zero air voids line. Factors affecting compaction, field methods of compaction – rolling, ramming and vibration. ● Consoildation,Difference between compaction and consolidation.Terzaghi's Model analogy of compression/springs showing the process of consolidation,Field implications • Concept of soil stabilization, necessity of soil stabilization, different methods of soil stabiliza tion. California bearing ratio (CBR) test - Meaning and Utilization in Pavement Construction • Necessity of site investigation and soil exploration: Types of exploration, criteria for decidingthe location and number of test pits and bores. Field identification of soil – dry • strength test, dilatancy test and toughness test.	**8**
UNIT-V	**Shear Strength of Soil** • Shear failure of soil-General, local and punching shear, concept of shear strength of soil. • Components of shearing resistance of soil – cohesion, internal friction. Mohr-Coulomb failure theory, Strength envelope, strength equation for purely cohesive and cohesion less soils. Direct shear, triaxial and vane shear test laboratory methods.	**8**

UNIT-VI	**Bearing Capacity of Soil and Foundation** • Bearing capacity and theory of earth pressure. Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure. Introduction to Terzaghi's analysis and assumptions, effect of water table on bearing capacity. • Field methods for determination of bearing capacity – Plate load and Standard Penetration Test. Test procedures as per IS:1888 & IS:2131. Definition of earth pressure, Active and Passive earth pressure for no surcharge condition, coefficient of earth pressure, Rankine's theory and assumptions made for non- cohesive Soils. ● Type of foundations-shallow,deep foundation	**8**
		45

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 andCompany 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.

TH:5- BUILDING MATERIAL & CONCRETE TECHNOLOGY

L	T	P		
3	0	0		**Course Code: CEPC207**
Total Contact Hours				**Theory Assessment**
Theory		: 45 Hrs	**Total Marks: 100**	End Term Exam 70
				Progressive Assessment : 30
Pre Requisite		**: Nil**		
Credit		**3**		Category of Course : PC

RATIONALE

The course relates to the fundamentals related to building material, concrete and concrete material, besides dealing with masonry, reinforcement, etc. The course includes what concrete is, what are the processes involved in formation of concrete, various materials that are used in concrete formation, properties of each ingredient of concrete, standard tests to be applied to concrete and concrete ingredients.

LEARNING OUTCOME

After completion of this course, the students will be able to

- Describe the properties of cement, aggregate and water used in concrete.
- Identify the suitable construction material
- Illustrate role of admixtures in concrete.
- Explain the properties of fresh and harden concrete
- Use of code for concrete mix design
- Follow the different procedure of concreting operations

COURSE CONTENT DETAILS

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
UNIT-I	**Overview of Construction Materials** • Scope of construction materials in Building Construction, Transportation Engineering, Environmental Engineering, and 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.	**2**
UNIT-II	• **Natural Construction Materials-**Requirements of good building stone; general characteristics of stone; quarrying anddressing methods and tools for stone.	**5**

	• 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. • Types of soil and its suitability in construction. • Properties of sand and uses Classification of coarse aggregate according to size	
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 • Pre-cast concrete blocks- hollow, solid, pavement blocks, and their uses. • 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.	**5**
UNIT-IV	**Cement, Aggregates , Water and Admixture** ● Composition of Cement • Manufacturing process of Cement – dry and wet (only flow chart), types of cement and its uses. Field tests on cement. • 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: 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	**10**

	of cements: Rapid hardening, Lowheat, 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 admixturesuch as accelerating admixtures, retarding admixtures, water reducing admixtures, air entraining admixtures and super plasticizers. (concepts only)	
UNIT-V	**Concrete** • Concrete: Different grades of concrete, provisions of IS 456 (Latest). • 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 expo- sure 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.	**8**
UNIT-VI	**Concrete Mix Design and Testing of Concrete** • Concrete mix design: Objectives, methods of mix design, study of mix design as per IS 10262 (only procedural steps). • 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.	**5**

UNIT-VII	**Quality Control of Concrete** • Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete. • Forms for concreting: Different types of form works	**5**
	for beams, slabs, columns, materials used for form work, requirement of good form work. Stripping time for removal of form works perIS 456. • Waterproofing: Importance and need of waterproofing, methods of waterproofing and mate rials used for waterproofing. • Joints in concrete construction: Types of joints, methods for joining old and new concrete, materials used for filling joints.	
UNIT-VIII	**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-com pacting concrete and light weight concrete. ▪ Cold weather concreting: effect of cold weather on concrete, precautions to be taken while concreting in cold weather condition. (only concepts) • Hot weather concreting: effect of hot weather on concrete, precautions to be taken while concreting in hot weather condition. (only concepts)	**5**
	Total=	**45**

SUGGESTED LEARNING RESOURCES:

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

PR:1- TRANSPORTATION ENGINEERING LAB

L	T	P		
0	0	4		**Course Code: CEPC 211**
Total Contact Hours				**Theory Assessment**
Practical		: 60Hrs	**Total Marks: 50**	End Term Exam 15
				Progressive Assessment : 35
Pre Requisite		**: Nil**		
Credit		**2**		Category of Course : PC

RATIONALE

This course intends to train the students understand and apply the types of roads as per IRC recommendations, geometrical design features of different highways.

LEARNING OUTCOME

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.
- Select the suitable material for road construction

COURSE CONTENT DETAILS

LIST OF PRACTICALS TO BE PERFORMED

1. Flakiness and Elongation Index of aggregates.
2. Determination of Crushing strength, of Aggregates
3. Determination of Impact of Aggregates
4. Determination of Abrasion value of Aggregates
5. Angularity Number of aggregates.
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. Determination of Viscosity of bitumen
11. Determination of bitumen content using centrifuging extractor.
12. Determination of stability and flow of bitumen using Marshal stability apparatus.
13. Visit the constructed road for visual inspection to identify defects and suggest remedial measures.
14. Visit the road of any one type (flexible or rigid) to know the drainage condition.
15. CBR Test of aggregates

SUGGESTED LEARNING RESOURCES:

1. L.R. Kadiyali, Transportation Engineering, Khanna Book Publishing Co., New Delhi (ISBN:978-93-82609-858) Edition 2018
2. Khanna S.K., Justo, C E G and Veeraragavan, A., Highway Engineering,

Nem Chand and Broth-ers, 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, Delhi.
6. Sharma, S.K., Principles, Practice and Design of Highway Engineering,, S. Chand
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.

PR:2- MECHANICS OF MATERIAL LAB.

L	T	P		
0	0	4		**Course Code: CEPC 213**
Total Contact Hours				**Theory Assessment**
Practical		: 60Hrs	**Total Marks: 50**	End Term Exam 15
				Progressive Assessment : 35
Pre Requisite		**: Nil**		
Credit		**2**		Category of Course : PC

RATIONALE

This course will enable the students to apply mechanics of materials theory on real specimens and learn the practical testing procedures and concepts.

LEARNING OUTCOME

After completion of this course, the students will be able to

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

COURSE CONTENT DETAILS

LIST OF PRACTICALS TO BE PERFORMED:

- Study and understand the use and components of Universal Testing Machine (UTM).
- Perform Tension test on mild steel as per IS:432(1) and bend rebend test on mild steel
- Perform tension test on Tor steel as per IS:1608, IS:1139 and bend -rebend test on Tor Steel
- Conduct compression test on Concrete cube using Compression Testing Machine.
- Conduct Izod Impact test on three metals. e.g. mild steel/ brass/aluminum/ copper /castiron etc. as per IS:1598.
- Conduct Charpy Impact test on three metals. e.g. mild steel/ brass/aluminum/ copper /castiron etc. as per IS:1757.
- Determine Water Absorption on bricks per IS:3495 (part II), IS:1077 or tile IS:1237.
- Determine Compressive strength of dry and wet bricks as per IS:3495(part I), IS:1077.
- Conduct Flexural test on concrete beam on rectangular section as per Indian Standards.
- Abrasion test of floor tiles
- Flexural test of floor tiles/roof tile

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.

PR:3- GEOTECHNICAL ENGINEERING LAB

L	T	P		**Course Code: CEPC 215**	
0	0	4			
Total Contact Hours				**Theory Assessment**	
Practical		: 60Hrs	**Total Marks: 50**	End Term Exam	15
				Progressive Assessment	: 35
Pre Requisite		**: Nil**			
Credit		**2**		Category of Course : PC	

RATIONALE

Determination of soil conditions is the most significant task in every civil engineering activity. Properties of the soil can be determined by both field and laboratory test methods. This course intends to train the students to evaluate various soil properties and explore the experimental procedures to identify the behaviour of soil for particular loading and able to understand results.

LEARNING OUTCOME

After completion of this course, the students will be able to

- Determine physical and index properties of soil.
- Estimate the permeability and shear strength of soil.
- Demonstrate the procedure for performing C.B.R test.
- Demonstrate various compaction methods for soil stabilization.

COURSE CONTENT DETAILS

LIST OF PRACTICALS TO BE PERFORMED:

1. Determine water content of given soil sample by oven drying method as per IS: 2720 (Part-II).
2. Determine specific gravity of soil by pycnometer method as per IS 2720 (Part-III).
3. Determine dry unit weight of soil in field by core cutter method as per IS 2720 (Part- XXIX).
4. Determine dry unit weight of soil in field by sand replacement method as per IS 2720 (Part-XXVIII).
5. Determine Plastic and Liquid Limit along with Plasticity Index of given soil sample as per IS 2720 (Part- V).
6. Determine Shrinkage limit 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 IS2720 (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 and triaxial shear test as per IS 2720 (Part-XXX).
13. Determine MDD and OMC by standard proctor test and modified proctor test of given soil sample as per IS 2720 (Part-VII).
14. Determination of CBR value on the field as per IS2720 (Part - XVI).

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 andCompany LTD., New Delhi.
4. Raj, P. Purushothama, Soil Mechanics and Foundation Engineering, Pearson India
5. Kasamalkar, B. J., Geotechnical Engineering, Pune Vidyarthi Griha Prakashan, Pune.
6. Arora K R, Soil Mechanics and Foundation Engineering, Standard Publisher.

PR:4- BUILDING MATERIALS & CONCRETE TECHNOLOGY LAB.

L	T	P		
0	0	4		**Course Code: CEPC 217**
Total Contact Hours				**Theory Assessment**
Practical		: 60Hrs	**Total Marks: 50**	End Term Exam **15**
				Progressive Assessment **: 35**
Pre Requisite		**: Nil**		
Credit		**2**		Category of Course : PC

RATIONALE

This course enables the students to have a clear understanding on structural functions and role of construction and concrete materials to achieve that. It helps understanding the concept of building construction and process. The lab course will put the theoretical data into practical concepts by site visits.

LEARNING OUTCOME

After completion of this course, the students will be able to

- Describe various construction materials, and their relevant characteristics.
- Select the suitable construction material
- Identify different types of cement by performing laboratory tests.
- Illustrate 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.

COURSE CONTENT DETAILS

LIST OF PRACTICAL TO BE PERFORMED:

i. Identify various sizes of available coarse aggregates from sample of 10 kg in laboratory and prepare report (60,40, 20,10 mm)

ii. 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.

iii. Select first class, second class and third-class bricks from the stake of bricks and prepare report based on its properties.

iv. 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.

v. 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.

vi. 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.

vii. Prepare the cement mortar of proportion 1:3 or 1:6 using cement and sand only.

viii. Determine fineness of cement by Blaine's air permeability apparatus Or by sieving.

ix. Determine specific gravity, standard consistency, initial and final setting times of cement.

x. Determine compressive strength of cement.

xi. Determine bulking of sand.

xii. Determine bulk density of fine and coarse aggregates.

xiii. Determine water absorption of fine and coarse aggregates.

xiv. Determine Fineness modulus of fine aggregate by sieve analysis.

xv. Determine workability of concrete by slump cone test.

xvi. Determine workability of concrete by compaction factor test.

xvii. To prepare concrete mix of a particular grade as per IS 10262:2019 and determine compressive strength of Concrete for 7 and 28 days.

xviii. Demonstration of NDT equipment

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. Materials, New Age Publishers, NewDelhi.
8. Sharma C. P., Engineering Materials, PHI Learning, New Delhi.
9. Duggal, S. K, Building Materials, New International, New Delhi.
10. Gambhir, M.L., Concrete Technology, Tata McGraw Hill Publishing Co. Ltd., Delhi.
11. Shetty, M.S., Concrete Technology, S. Chand and Co. Pvt. Ltd., Ram Nagar, Delhi.

12. Santhakumar, A. R., Concrete Technology, Oxford University Press, New Delhi.
13. Neville, A. M., Concrete Technology, Pearson Education Pvt. Ltd., New Delhi.
14. Sood, H., Kulkarni P. D., Mittal L. N., Laboratory Manual in Concrete Technology, CBS Publishers, New Delhi.

SUMMER INTERNSHIP - I

L	T	P		Course Code: SI 201	
0	0	0			
Total Contact Hours			**Total Marks: 50**	End Term Exam	15
Practical	:			Progressive Assessment	35
Pre-Requisite	**: Nil**				
Credit	**2**			Category of Course: SI	

RATIONALE:

The rationale for a summer internship is to offer a structured and practical learning experience that prepares individuals for their future careers, helps them make informed career choices, and equips them with the skills and knowledge necessary to succeed in their chosen field. This course provides opportunities to students for hand on industry experience.

LEARNING OUTCOMES:

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

- Apply theoretical knowledge gained in their academic coursework to real-world situations.
- Develop and refine specific skills relevant to the field.
- Gains hands-on experience in a professional network by interacting with mentors and industry professionals.
- Learn to manage their time effectively.
- Clarify career goals.

DETAILED COURSE CONTENTS:

Topic	Topic/Sub-Topic
I	**Orientation:** • Introduction to the organization's mission, values, and culture. • Familiarization with workplace policies, procedures, and safety guidelines. • Orientation to the team and organizational structure.
II	**Project-Based Learning:** • Description of the main project or tasks the intern will be working on during the internship. • Detailed project goals and objectives. • Training and guidance on project-specific tools, technologies, or • methodologies.
III	**Technical and Skill Development:** • Training sessions or workshops to enhance technical skills relevant to the internship role (e.g., programming languages, software tools, laboratory techniques).

	• Soft skills development, including communication, teamwork, problem solving, and time management
IV	**Mentorship and Supervision:** • Regular meetings with a designated mentor or supervisor for guidance, feedback, and support. • Mentorship objectives and expectations.
V	**Professional Development:** • Sessions on professional etiquette, networking, and building a personal brand • Resume writing and interview preparation workshops.
VI	**Industry and Field-Specific Knowledge:** • Lectures, seminars, or presentations on industry trends, best practices, and emerging technologies. • Guest speakers from the field to share insights and experiences.
VII	**Reporting and Documentation:** • Training on how to document project progress, results, and findings. • Practice in creating reports, presentations, or other deliverables.
VIII	**Ethics and Professionalism:** • Discussions on ethical considerations within the field. • Scenarios and case studies related to ethical decision-making
IX	**Feedback and Evaluation:** • Regular performance evaluations and feedback sessions. • Self-assessment and goal-setting exercises.
X	**Networking and Industry Exposure:** • Opportunities to attend industry conferences, webinars, or networking events. • Encouragement to connect with professionals in the field.

NOTE

As per AICTE guidelines, in Summer Internship-I, students are required to be involved in Inter/ Intra Institutional Activities viz;

- Training with higher Institutions;
- Soft skill training organized by Training and Placement Cell of the respective institutions;
- contribution at incubation/ innovation /entrepreneurship cell of the institute;
- participation in conferences/ workshops/ competitions etc.;
- Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop;

Working for consultancy/ research project within the institutes and Participation in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Suggested Online Link:

Web Links:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/12110600/

*****Progressive Assessment to be conducted for ensuring learning of students.