SIXTH SEMESTER

Sl. No.	Course Category	Subject Code	Subject Title	L	T	P	Contact Hours/week	Credit	Total Marks
1.	Program Core-21	PC CE 601	Design of Structures-II	3	0	0	3	3	100
2.	Program Core-22	PC CE 602	Civil Engineering Estimation and Costing	3	0	0	3	3	100
3.	Program Core-23	PC CE 603	Foundation Engineering	3	0	0	3	3	100
4.	Program Core-24	PC CE 604	Transportation Engineering-II	3	0	0	3	3	100
5.	Program Core-25	PC CE 605	Foundation Engineering Lab.	0	0	2	2	1	100
6.	Program Core-26	PC CE 606	Transportation Engineering Lab.	0	0	2	2	1	100
7.	Program Core-27	PC CE 607	CAD in Civil Engineering	0	0	2	2	1	100
8.	Program Elective-1 (any one)	PE CE 608/1	Hydraulic Engineering	3	0	0	3	3	100
		PE CE 608/2	Construction Engineering and Management	3	0	0			
		PE CE 608/3	Prestressed Concrete	3	0	0			
9.	Project - 1	PR CE 609	Mini Project	0	0	6	6	3	100
			Total :	15	0	12	27	**21**	**900**

Design of Structures-II

Course Code	PE CE 601
Course Title	Design of Structures-II
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Nil
Course Category	Professional Core (PC)
Number of classes	36 hours

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

CO Number	CO Description	K-level
CO-1	Design riveted and welded steel connections.	K-5
CO-2	Design steel tension and compression members.	K-5
CO-3	Design steel beams and plate girders.	K-5
CO-4	Design foundation used in steel structures and steel industrial roofs.	K-5

Course Contents:-

Module 1: Riveted and Welded Connections (9 hours)

Properties of structural steel, I.S. Rolled Sections, I.S. Specifications. Factor of safety, permissible and working stresses, elastic method, plastic method, introduction to limit states of design. Riveted, bolted and welded connections, strength & efficiency and design of joints.

Module 2: Tension and Compression Members (9 hours)

Tension Members- Design of tension members. Compression members-Strut and column, built-up column, column with lacings and batten, Column splices.

Module 3: Steel Beams (9 hours)

Beams-Stability of flange and web, build-up sections, plate girders including stiffeners, connections, web crippling, web buckling. Design of web splice. Beam-column connection- Stability considerations, Interaction formulae. Welded Plate Girder.

Module 4: Steel Column, Column Bases and Roof Truss (9 hours)

Columns and Bases- Design of columns under axial loads using single or multiple rolled steel sections, columns subjected to axial load and bending, design of slab base, gusseted base and grillage footing. Roofing systems and simple design of industrial roofs.

References / Suggested learning Resources:-

1. Limit State Design of Steel Structures IS:800-2007, V.L.Shah and Veena Gore, Structures Publications, 2010.
2. Design of Steel Structures, S.S.Bhavikatti , I.K. International Publishing House Limited, 2010.

3. Design of Steel Structures, Ramchandra, Standard book House (Vol –I, II).
4.Design of Steel Structures, L.S.Negi, Tata McGraw Hill.
5.Design of steel structures, A.S Arya & J.L.Azmani, Nemchand&Brothers.
6. Design of Steel Structures, N. Subramanian, Oxford University Press, 2010
7. Relevant IS Codes

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Civil Engineering Estimation and Costing

Course Code	PE CE 602
Course Title	Civil Engineering Estimation and Costing
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Basic Units
Course Category	Professional Core (PC)
Number of classes	36 hours

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

CO Number	CO Description	K-level
CO-1	Explain types of estimate and duties of estimator and also calculate the quantity with cost in detail of various Civil Engineering works.	K-2, K-5
CO-2	Detecting the rates for various items of Civil work.	K-5
CO-3	Implementing different specification of construction items.	K-3
CO-4	Focusing on tender and tender documents for execution of works and also the valuation of the property.	K-4

Course Contents:-

Module 1: Estimate of Buildings **9 Hours**

Estimates-Various types, their relative importances. Factors to be considered complete set of Estimate. Approximate estimates- importance, purpose, different methods. Methods of preparation of estimates for projects such as: R.C.C. Building and Load bearing Building.

Module 2: Measurement of Various Items **9 Hours**

Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Earthwork Calculations. Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Estimate of Road, Culvert and Irrigation.

Module 3: Specifications and Rate Analysis **9 Hours**

Specifications-Types, requirements and importance, detailed specifications for the buildings, roads, minor bridges and industrial structures. Rate analysis-Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment.

Estimate of water supply and sewerage: miscellaneous works like Manhole, water storage tank, septic tanks; trusses of steel.

Module 4: Tender and Contracts **9 Hours**

Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and items, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Introduction to acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights, Valuation.

Team Work Assignments to include:

1. To find out the approximate estimate of a single-storied building by approximate method.
2. Detailed estimate of the following with the required material survey for the same.
    a. ground plus two storied building (RCC)
    b. bridge with minimum 2 spans
    c. road work
    d. cross drainage work
    e. load bearing structure
3. Assignments on rate analysis, specifications and simple estimates.
4. Bar bending schedule.

References / Suggested learning Resources:-

1. M Chakravarty, Estimating, Costing Specifications & Valuation.
2. Joy P K, Handbook of Construction Management, Macmillan.
3. B.S. Patil , Building & Engineering Contracts.
4. Relevant Indian Standard Specifications.
5. World Bank Approved Contract Documents.
6. FIDIC Contract Conditions.
7. Acts Related to Minimum Wages, Workman‟s Compensation, Contract, and Arbitration.

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Foundation Engineering

Course Code	PC CE 603
Course Title	Foundation Engineering
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Geotechnical Engineering
Course Category	Program Core
Number of classes	38 hours

Course Outcome:

CO Number	CO Description	K-level
CO-1	To compute the exploration and determine the bearing capacity and settlement of soil.	K-3
CO-2	To practice the ground improvement and analyze and design the substructures.	K-3 & K-4 & K-5
CO-3	To analyze the lateral earth pressure and retaining structure.	K-4
CO-4	To assess the fundamentals of pile foundations and underground conduits including cuts.	K-6

Course Content:

Module 1: Exploration, Bearing Capacity and Settlement (11 hours)

Introduction- Foundations: their importance and purpose, types of foundations- selection criteria.

Exploration, Sampling and In Situ soil measurements- Data required, methods of exploration, planning of exploration program, Number and depth of boring, the standard penetration test (SPT), SPT correlations, Cone penetration test (CPT), bore log preparation.

Bearing Capacity of Shallow Foundations- Introduction, Definitions of ultimate, net ultimate, net safe, gross safe bearing capacity, net safe settlement pressure, net allowable bearing pressure, modes of failure in soil. Bearing capacity theories: Terzaghi's approach (1943), Meyerhof's (1963) general bearing capacity, Vesic (1973), IS code of practice for computing bearing capacity, Effect of water table on bearing capacity, bearing capacity equations for square and circular footings, performance of footings in different soils, ultimate bearing capacity in case of local shear failure, ultimate bearing capacity of footings based on the SPT(N) and CPT values. Field Plate load test and estimation of allowable bearing pressure by plate load test,

Settlement of foundation- Types of settlement under load, determination of immediate settlement of cohesive and cohesionless soil, consolidation settlement of cohesive soil.

Module 2: Ground Improvement and Foundation Design (8 hours)

Improvement site soils for foundation use- different approaches to soil properties modification, mechanical compaction: determination of zero air voids line, effect of compaction on engineering behaviour, field

compaction and control; compaction for deeper layers of soil: vibroflotation, dropping of heavy weight, blasting; preloading: sand drain and wick drains; sand compaction pile and stone columns; stabilization by use of admixtures.

Analysis of factors considered in foundation design- footing depth and spacing, displaced soil effects, erosion problems for structures adjacent to flowing water, corrosion protection, water table fluctuation, volume change related consideration, environmental consideration.

R.C.C. design of isolated and combined footings.

Module 3: Lateral Earth Pressures and Retaining Structure (10 hours)

Lateral Earth Pressures - Introduction: applications of earth pressure theories, different types of lateral earth pressure, Rankine's Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal and inclined backfill including the direction of failure Planes for cohesion-less and cohesive soils. Coulomb's Wedge Theory: Coulomb's active pressure in cohesion-less soils, expression for active pressure, Coulomb's passive earth pressure. Culmann's graphical solutions for active soils, Wedge Method, passive pressure by friction circle method for cohesion-less and cohesive soils.

Earth Retaining Structures- types of retaining walls, Rigid and flexible retaining structures, stability analysis of retaining walls, cantilever retaining Walls, construction details, drainage and wall joints, Stability of the gravity and cantilever retaining wall.

Module 4: Pile Foundation and Underground Conduits (9 hours)

Axially Loaded Pile Foundations- Introduction to pile foundations, necessity of pile foundation, classification of piles, construction methods of bored piles, concrete bored piles, driven cast in-situ piles. Pile capacity based on static analysis, piles in sand, piles in clay, dynamic methods and their limitations, in-situ penetration tests and pile load test as per IS 2911 specifications, negative skin friction, Pile groups, ultimate capacity of pile groups.

Underground Conduits- Classes of underground conduits, load on a ditch conduit, settlement ratio, ditch condition and projection condition, imperfect ditch conduit.

Open Cuts-Difference in open cuts and retaining walls, apparent pressure diagrams, average apparent pressure diagrams for sand and stiff clay, estimation of loads on struts.

Sheet pile- types and materials used for sheet pile, pressure distribution in sheet pile, cantilever Sheet pile in granular and cohesive soil.

References / Suggested Learning Resources:

1. Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series) by V.N.S. Murthy, CBS Publishers and distributor Pvt. Ltd.
2. Foundation analysis and design by J.E. Bowles , McGraw-Hill Companies.
3. Soil mechanics and Foundations by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi publications (p) Ltd.
4. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers Distributors..
5. Soil Mechanics in Engineering Practice by K. Terzaghi& R.B. Peck Wiley 3rd Ed.

6. Design Aids in Soil Mechanics and Foundation Engineering by S.R. Kaniraj, TMH New Delhi, 2004
7. Foundation Design Manual by N.V. Nayak, Dhanpat Rai Publications, New Delhi
8. Relevant Indian Standard Specifications and Codes.
9. A. Singh, Modern Geotechnical Engineering, 3rd Ed., CBS Publishers, New Delhi, 1999.
10. B.M. Das, Principles of Foundation Engineering, 5th Ed., Thomson Asia, Singapore, 2003.
11. N. Som, Theory and Practice of Foundation Design, Prentice Hall, New Delhi, 2003.

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Transportation Engineering-II

Course Code	PE CE 604
Course Title	Transportation Engineering-II
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Nil
Course Category	Professional Core (PC)
Number of classes	38 hours

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

CO Number	CO Description	K-level
CO-1	Explain and develop the basic knowledge of different components of railway track	K-2 & K-3
CO-2	Develop a clear idea on various layouts of track junctions, station and yards with operations of signaling and interlocking.	K-3
CO-3	Develop as well as can apply the various alternative steps involved in airport planning and design of runways, taxiways.	K-3
CO-4	Identify the various classifications of ports and harbour with navigational facilities.	K-3

Course Contents:-

Module- 1: Different components of Railway Track (10 hours)

Railway track gauge, alignment of railway lines, engineering surveys and construction of new lines, tracks and track stresses; rails, sleepers; ballast; subgrade and formation, track fittings and fastenings, creep of rails, geometric design of track, curves and super-elevation.

Module- 2: Track junctions with signalling and interlocking (8 hours)

Points and crossings, track junctions and simple track layouts; rail joints and welding of rails; track maintenance, track drainage; modern methods of track maintenance, rehabilitation and renewal of track;

tractive resistance and power, railway stations and yards; railway tunneling; signaling and interlocking; maintenance of railways and high speed trains.

Module- 3: **Airport planning and design (10 hours)**

Aircraft characteristics; Aircraft performance characteristics: airport planning and air travel demand forecasting: airport site selection; geometric design of the airfield: determination of runway capacity, taxiway, exit taxiway and gate Capacity - terminal area and airport layout, airport drainage, airport marking and lighting, air traffic control.

Module- 4: Ports and Harbour (10 hours)

Harbour Planning: Types of water transportation, water transportation in India, requirements of ports and harbours, classification of harbours, selection of site and planning of harbours, location of harbour, turning basin, harbour entrances, type of docks, its location and number, Docks and Repair Facilities: breakwaters, berthing structures - jetties, fenders, piers, wharves, dolphins, trestle, moles, Harbour docks, use of wet docks, repair docks, lift docks, dry docks, keel and bilge blocking, floating docks, slipways, lock gates, Navigational Aids, light houses, beacon lights, floating navigational aids, light ships, buoys, Port facilities: Port development, port planning, port building facilities, transit sheds, warehouses, cargo handling facilities, container handling terminal facilities, shipping terminals, inland port facilities.

References / Suggested learning Resources:-

1. Saxena S.C. and Arora S. P., A Course of Railway Engineering, DhanpatRai, New Delhi
2. Khanna and Arora, Airport Planning & Design, Nemchand Bros, Roorkee
3. Agarwal, M. M. (1991). Indian Railway Track, Sachdeva Press, New Delhi
4. Bindra S.P., Docks & Harbor Engineering, DhanpatRai, New Delhi
5. R Shrinivasan, Harbor Dock and Tunnel Engineering 6. Rao G.V., Airport Engineering, Tata McGraw Hill.
6. Horonjeff&Mcklerey, Planning & Design of Airport.
7. Quinn A D, Design and Construction of Ports and Marine Structures.

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Foundation Engineering Lab.

Course Code	PC CE 605
Course Title	Foundation Engineering Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Geotechnical Engineering
Course Category	Program Core
Number of classes	24 hours

Course Outcome:

CO Number	CO Description	K-level
CO-1	To collect the disturb and undisturbed soil sample for laboratory experiments	K-2

CO-2	To determine bearing capacity, relative density of soil by using in-situ test.	K-3
CO-3	To assess the settlement and bearing capacity of shallow and deep footing by loading test.	K-3
CO-4	To calculate the bearing capacity of soil in the laboratory by Model footing test	K-4
CO-5	To assess the swelling characteristics of soil	K-3

Course Content:

List of Experiments (*Minimum 6 or more experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

1. Disturb and undisturbed sampling of soil by using standard sampler
2. Determination of soil characteristics like ultimate bearing capacity, relative density of soil by using Standard Penetration Test (SPT)
3. Determination of bearing capacity of soils with the help of Static Cone Penetration Test (SCPT)
4. Asses the bearing capacity of soil corresponding to a given settlement by plate load test.
5. Measure of settlement of pile under working load by using pile load test
6. Predict the bearing capacity of footing in the laboratory by Model footing test.
7. Evaluation of in-place shear strength of saturated clay of soft consistency by field vane shear test
8. Asses the differential free swelling of soil.

References / Suggested Learning Resources:

1. Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series) by V.N.S. Murthy, CBS Publishers and distributor Pvt. Ltd.
2. Soil mechanics and Foundations by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi publications (p) Ltd.
3. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers Distributors..
4. Soil Mechanics in Engineering Practice by K. Terzaghi& R.B. Peck Wiley 3rd Ed.
5. Design Aids in Soil Mechanics and Foundation Engineering by S.R. Kaniraj, TMH New Delhi, 2004
6. Foundation Design Manual by N.V. Nayak, Dhanpat Rai Publications, New Delhi
7. Relevant Indian Standard Specifications and Codes.
8. A. Singh, Modern Geotechnical Engineering, 3rd Ed., CBS Publishers, New Delhi, 1999.
9. N. Som, Theory and Practice of Foundation Design, Prentice Hall, New Delhi, 2003.

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Transportation Engineering Lab.

Course Code	PC CE 606
Course Title	Transportation Engineering Lab.
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Nil
Course Category	Program Core (PC)
Number of classes	20 hours

Course Outcome: After completion of this course the students will be able to:

CO Number	CO Description	K-level
CO-1	Explain and develop the various characteristics of road aggregates.	K-2
CO-2	Determine the CBR value for road construction.	K-5
CO-3	Infer the suitability of road aggregates for the construction of road.	K-2
CO-4	Determine and characterize the pavement materials (Bitumen)	K-5
CO-5	Develop quality control tests on pavements and pavement materials.	K-3

Course Content:

List of Experiments (*Minimum 6 or more experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

1. Determination of Water absorption and Specific gravity of road aggregates.
2. Determination of Impact Test of aggregates.
3. Los Angel's abrasion and Devel's abrasion test.
4. Determination of Crushing Strength of Aggregates.
5. Determination of Flakiness and Elongation Indices of aggregates, Angularity number.
6. Determination of CBR value (Lab) and CBR value (Field).
7. Determination of penetration test of bitumen.
8. Determination of viscosity of bitumen.
9. Determination of Specific Gravity and Softening point of bitumen.
10. Determination of Ductility of bitumen.
11. Determination of Water content of bitumen.
12. Determination of Loss on Heating of bitumen.
13. Marshal Test.

References / Suggested Learning Resources:

1. Concrete Technology, M.S.Shetty, S.Chand &Comp. Ltd.
2. Method of Test for aggregate IS: 2386 (Part I,II,III,IV) 1963. Bureau of Indian Standards for concrete.
3. Determination of Specific Gravity of bitumen. IS: 1202-1978(I)Bureau of Indian Standars.
4. Determination of Viscosity of bitumen. IS: 1206-1978(I)Bureau of Indian Standards.
5. Determination of Flash Point of bitumen. IS: 1209-1978, Bureau of Indian Standards.

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CAD in Civil Engineering

Course Code	PC CE 607
Course Title	CAD in Civil Engineering
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Nil
Course Category	Program core (PC)
Number of classes	24 hours

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

CO No	CO Description	K-level
CO-1	Develop graphical skills for communicating concepts, ideas and designs of engineering products graphically/visually as well as understand another person's designs.	K-3
CO-2	Create, analyse, Produce and interpret 2D & 3D drawings.	K-6
CO-3	Examine a design critically and also develop drawings for conventional structures using 2D and 3D Computer Aided Design and drafting softwares.	K-4
CO-4	Understand the need for software tools in analysis and design in Civil Engineering systems	K-4

List of Experiments (*Minimum 6 or more experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

1. Introduction and getting started with computer aided drafting software.
2. Practice exercises on CAD commands.
3. Page set up in a layout and Plotting in CAD.
4. Drawing of Plans of single storey/ multi-storeyed residential buildings using software.
5. Developing sections and elevations for single storey/ multi-storeyed public buildings using software.
6. Layout and section of water supply and drainage connections to a building.
7. Symbols for electrical installations, water supply and sanitary fixtures.
8. Perspective view of one and two storey buildings.
9. Reinforcement drawings for typical slabs and beams, columns and spread footings.
10. Introduction to 3D modelling using software.
11. Developing a 3D modelling of a building.
12. Design and analysis of RCC buildings using ETABS, SAP, STAAD Pro Softwares etc.

References / Suggested Learning Resources:

1. Subhash C sharma & Gurucharan Singh(2005), "Civil Engineering Drawing," Standard Plublishers.
2. Sikka, V.B (2013), A course in civil Engineering Drawing, S.K. Kataria & Sons,
3. CAD software theory and User Mannuals.
4. Sham Tickoo Swapna D (2009), "2009, "AUTOCAD for Engineers and Designers", Pearson Education,
5. Balagopal and Prabhu (1987), "Building Drawing and detailing", Spades publishing KDR building , Calicut,
6. Autocad 2019 user manual.
7. Software Manuals.

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Hydraulic Engineering

Course Code	PE CE 608/1
Course Title	Hydraulic Engineering.
Number of Credits	3 (L: 3, T: 0, P: 0)

Prerequisites	Fluid Mechanics
Course Category	Program Elective (PE)
Number of classes	38 hours

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

CO No	CO Description	K-level
CO-1	Distinguish open channel flow, pipe flow and analyse critical flow.	K-4
CO-2	Develop understanding of uniform flow and Design the most economical channel section.	K-6
CO-3	Compute gradually varied flow.	K-6
CO-4	Formulate and solve rapidly varied flow problems.	K-6

Course contents:-

Module 1: Open Channel Flow (9 hours)

Introduction to open channel flow, difference between Open channel flow and pipe flow, classification of open channel flows, velocity and pressure distributions, energy and momentum coefficients in open channel flow and their needs.

Critical Flow- Conservation of mass, conservation of momentum and conservation of energy, specific energy and specific force concepts, introduction to critical flow and computation, various methods for critical depth estimation.

Module 2: Uniform Flow (9 hours)

Introduction to uniform flow, flow resistance formulas, roughness coefficient, computation of uniform flow using different methods, hydraulically most efficient channel sections, most economical channel design.

Module 3: Gradually Varied Flow (10 hours)

Introduction to gradually varied flow, governing equation of gradually varied flow, classification and characteristics of water-surface profiles, sketching of water-surface profiles, computation of gradually varied flow: direct-step method and standard step method, numerical methods for calculation of gradually varied flow.

Module 4: Rapidly Varied Flow (10 hours)

Introduction to rapidly varied flow, hydraulic jump, classification and practical application of hydraulic jump, ratio of sequent depths, height and length of jump, energy loss and jump location.
Energy dissipations and other uses, surge as a moving hydraulic jump. Positive and negative surges.

References / Suggested Learning Resources:

1. M. H. Chaudhry, “Open Channel Flow”, Prentice Hall, 2nd Edition, 2008
2. K.G., RangaRaju, “Flow Through Open Channels”, Tata McGraw Hill, 2nd Edition 1993.
3. K Subramanya, Flow in open channels, McGraw Hill, 3rd edition, 2009
4. F. M. Henderson, “Open Channel Flow”, Tata McGraw Hill, 1st Edition, 1992.

5. V.T. Chow, “Open Channel Hydraulics”, Tata McGraw Hill, 3rdEdition, 2009.
6. M M Das, Open channel flow, PHI, 3rd edition, 2011.

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Construction Engineering and Management

Course Code	PE CE 608/2
Course Title	Construction Engineering and Management
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Nil
Course Category	Professional Elective courses (PE)
Number of classes	38 hours

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

CO No	CO Description	K-level
CO-1	Describe how structures are built and projects are developed on the field.	K-1
CO-2	Explain about modern construction practices.	K-2
CO-3	Describe how different construction machineries are work	K-2
CO-4	Develop plan, control and monitor construction projects with respect to time and cost.	K-5

Course Contents:-

Module 1:- **Construction Project Planning (10 hours)**

Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

Module 2: Construction Methods (9 hours)

Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods: conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures;

Module 3: Construction Equipments (9 hours)

basics*:* Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities

Module 4: Planning, Organizing Construction Site and Resources (10 hours)

Site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts.

References / Suggested Learning Resources:

1. Varghese, P.C., "*Building Construction"*, Prentice Hall India, 2007.
2. *National Building Code,* Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., *Construction Technology*, ELBS Publishers, 2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

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Prestressed Concrete

Course Code	PE CE 608/3
Course Title	Prestressed Concrete
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Design of Structures-I
Course Category	Professional Elective courses (PE)
Number of classes	36 hours

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

CO No	CO Description	K-level
CO-1	Explain the basic concept and general principles of pre-stressed concrete sections.	K-2
CO-2	Select the relevant precast concrete element for a given type of construction.	K-3, K-5
CO-3	Use relevant components for prefabricated structures.	K-3
CO-4	Design of simply supported pre-tensioned and post tensioned slabs and beams.	K-6

Course Contents:

Module 1: Introduction to Pre-stressed Concrete 9 Hours

Basic concept and general principles, materials used and their properties, methods and techniques of pre-stressing, pre-stressing systems, loss of pre-stress. Analysis of pre-stressed concrete sections: loading

stages and computation of section properties, critical sections under working load for pre-tensioned and post-tensioned members, load balancing method of analysis of pre-stressed concrete beams.

Module 2: Precast Concrete Elements **9 Hours**

Precast concrete elements- Advantages and disadvantages, Non-structural Precast elements - Paver blocks, Fencing Poles, Transmission Poles, Manhole Covers, Hollow and Solid Blocks, kerb stones as per relevant BIS specifications. Structural Precast elements – tunnel linings, Canal lining, Box culvert, bridge panels, foundation, sheet piles, testing of Precast components as per BIS standards.

Module 3: Precast Structural Buildings **9 Hours**

Precast Structural Building components such as slab panels, beams, columns, footings, walls, lintels and chajjas, staircase elements, Prefabricated building using precast load bearing and non-load bearing wall panels, floor systems - Material characteristics, Plans & Standard specifications. Design for shear: calculation of principle tension under working load, permissible principle tension, shear strength calculation under limit state of collapse for both sections cracked and un-cracked in flexure.

Module 4: Design of Pre-Stressed Concrete Beams **9 Hours**

design of simply supported pre-tensioned and post tensioned slabs and beams, cable Profile in simply supported rectangular beam section – concentric, eccentric straight and parabolic, effect of cable profile on maximum stresses at mid span and at support, determination of maximum stresses at mid spans with linear (concentric and eccentric) cable profiles only.

References / Suggested Learning Resources:

1. Plain and Reinforced Concrete Vol. I, Jain & Jaikrishna, Nemchand.
2. Design of Reinforced Concrete Structures, Dayaratnam P, Oxford & IBH.
3. Reinforced Concrete Structures, Sayal&Goel, Wheeler.
4. Design of Pre-stressed Concrete Structures, T. Y. Lin & N. H. Burns
5. Pre-stressed Concrete, R. H. Evans & E.W. Bennet.
6. Pre-stressed Concrete, N. Krishna Raju.
7. Modern Pre-stressed Concrete, James Libby.

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Mini Project

Course Code	PR CE 609
Course Title	Mini Project
Number of Credits	3 (L: 0, T: 0, P: 6)
Prerequisites	Nil
Course Category	Project (PR)
Number of classes	70 hours

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

CO Number	CO Description	K-level
CO-1	Demonstrate a through and systematic understanding of project contents	K-2
CO-2	Identify the methodologies and professional way of documentation and communication	K-3
CO-3	Illustrate the key stages in development of the project	K-2
CO-4	Develop the skill of working in a Team	K-3
CO-5	Apply the idea of mini project for developing systematic work plan in major project	K-3

Course Content:-

The mini project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The course should have the following-

1) Perform detailed study about various components of a project.
2) Study about methodologies and professional way of documentation and communication related to project work.
3) Develop idea about problem formulation.
4) Knowledge of how to organize, scope, plan, do and act within a project thesis.
5) Familiarity with specific tools (i.e. hardware equipment and software) relevant to the project selected.
6) Demonstrate the implementation of a mini project work.

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