Semester VI [Third year]

CE(PC)601	Construction Engineering & Management	2L + 0T	2 Credits
Course Outcome	**On completion of the course, the students will have:** **1.** An idea of how structures are built and projects are developed on the field **2.** An understanding of modern construction practices **3.** A good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics **4.** A basic ability to plan, control and monitor construction projects with respect to time and cost **5.** An idea of how to optimise construction projects based on costs **6.** An idea how construction projects are administered with respect to contract structures and issues. **7.** An ability to put forward ideas and understandings to others with effective communication processes		
Module 1	**Planning:** General consideration, Definition of aspect, prospect, roominess, grouping, circulation, Privacy.		2L
Module 2	**Regulation and Bye laws** Bye Laws in respect of side space, Back and front space, Covered areas, height of building etc., Lavatory blocks , ventilation, Requirements for stairs, lifts in public assembly building, offices		4L
Module 3:	**Fire Protection** Fire fighting arrangements in public assembly buildings, planning , offices, auditorium		2L
Module 4:	**Planning &Scheduling of constructions Projects** **Planning by CPM** Preparation of network, Determination of slacks or floats. Critical activities. Critical path. Project duration. **Planning by PERT** Expected mean time, probability of completion of project, Estimation of critical path, problems		6L
Module 5:	**Construction Methods basics** 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; Basics of construction methods for Bridges.		4L
Module 6	**Construction plants & Equipment** Plants & equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses. **Plants &Equipment for concrete construction** Batching plants, Ready Mix Concrete, concrete mixers, Vibrators etc., quality control.		3L
Module 7	Contracts Management basics Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.		4L
Module 8	**Management** Professional practice, Definition, Rights and responsibilities of owner, engineer, Contractors, types of contract		3L
Module 9	**Departmental Procedures** Administration, Technical and financial sanction, operation of PWD, Tenders and its notification, EMD and SD, Acceptance of tenders, Arbritation		2L

Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	*Construction Engineering & Management*	S.V. Deodhar & S.C. Sharma	Khanna Publishing House
	2	*Building Construction*	Varghese, P.C.	Prentice Hall India,
	3	*National Building Code*	Bureau of Indian Standards	
	4	*Construction Technology*	Chudley, R.	ELBS Publishers

	5	Construction Planning, Methods and Equipment	Peurifoy, R.L.	McGraw Hill
	6	Construction Methods and Management,	Nunnally, S.W.	Prentice Hall
	7	Project Planning with PERT and CPM	Punmia, B.C., Khandelwal, K.K.	Laxmi Publications

CE(PC)602	**Engineering Economics, Estimation & Costing**	2L + 0T	2 Credits
Course Outcome	**On completion of the course, the students will:** **1.** Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses **2.** Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives. **3.** Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives. **4.** Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure. **5.** Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure. **6.** Be able to understand how competitive bidding works and how to submit a competitive bid proposal.		
Module 1	**Basic Principles and Methodology of Economics.** Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes		3L
Module 2	**Elements of Business/Managerial Economics and forms of organizations.** Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.		3L
Module 3:	**Estimation / Measurements for various items** Introduction to the process of Estimation; 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, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; 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. Use of Computers in quantity surveying		9L
Module 4:	**Specifications** Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.		3L
Module 5:	**Rate analysis** Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.		3L
Module 6	**Tender-** Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management		3L
Module 7	**Valuation** Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table		3L
Module 8	Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.		2L

Reference	Sl.	Book Name	Author	Publishing House
	1	Estimating, Costing Specifications & Valuation	M Chakravarty	
	2	Typical PWD Rate Analysis documents.		
	3	Estimating and Costing in Civil Engineering (Theory & Practice)	Dutta, B.N.	UBS Publishers
	4	Sociology & Economics for Engineers	Premvir Kapoor	Khanna Publishing House
	5	Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations		UBS Publishers

CE(PC)603	**Water Resources Engineering**	2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: 1. Understand the fundamentals of flow in open channels. 2. Understand the concepts of irrigation. 3. Estimate the quantity of water required by different crops in different seasons, and accordingly the irrigation water requirement. 4. Design channels and other irrigation structures required for irrigation, drainage, soil conservation, flood control and other water-management projects. 5. Learn about groundwater resources, aquifers and wells.		
Prerequisite	Introduction to Civil Engineering, Introduction to Fluid Mechanics CE(ES)401		
Module 1	**Open Channel Flow:** Channel Characteristics and parameters, Energy-depth relationships, Specific Energy concept, Critical Flow, Hydraulic Jump, Uniform flow, Efficient sections, Slope profiles, Gradually Varied Flow, Water surface profiles.		8L
Module 2	**Irrigation:** Definition, Necessity, Scope, Benefits of Irrigation; Types, techniques and sources of irrigation; Development of irrigation in India.		3L
Module 3:	**Soil-water-plant Relationship:** Types of crops, cropping seasons, water requirement of crops, base period, kor period, Duty, Delta, Commanded area, Net Irrigation Requirement, Field Irrigation Requirement, Gross Irrigation Requirement, Intensity of irrigation, Consumptive use of water, estimation of evapotranspiration, Blaney-Criddle method, Modified Penman's method, Irrigation efficiencies, Frequency of irrigation.		6L
Module 4:	**Canal irrigation:** Classification of irrigation canals, canals in alluvium; Design of unlined canals: Kennedy's method, Lacey's method; Lined canals: advantages, materials used, typical sections, design of lined canals, economics of canal lining; Canal sections – filling, cutting, partial cutting and partial filling.		6L
Module 5:	**Land drainage:** Water logging issues in irrigation, provision of drains, design and maintenance of open drains, closed drains, discharge and spacing of closed drains.		4L
Module 6	**Groundwater:** Occurrence of groundwater– Aquifers, Various Types of Aquifers, Aquifer Parameters: Specific Yield, Specific Retention, Storage Coefficient, Transmissivity.		4L

Reference	Sl.	Book Name	Author	Publishing House
	1	Irrigation and Water Power Engineering	B. C. Punmia, A. K. Jain and P. B. Lal	Laxmi Publications (P) Ltd., New Delhi, 2019.
	2	Irrigation, Water Resources and Water Power Engineering	P. N. Modi	Standard Book House, New Delhi, 2019.
	3	Irrigation Engineering and Hydraulic Structures	S. K. Sharma	S Chand Publishing, New Delhi, 2017.2012.
	4	Irrigation Engineering	N. N. Basak	Tata McGraw Hill Education India Private Limited, 2017.
	5	Open Chanel Flow	Saiful Islam	Khanna Publishing House
	6	Irrigation and Water Resources Engineering	G. L. Asawa	New Age Publishers, New Delhi, 2005.

CE(PC)604	**Design of Steel Structures**			2L + 0T	2 Credits
Course Outcome	After going through this course, the students will be able to: **1.** Identify the material properties of structural steel. Moreover, the students will identify different bolted and welded connections, analyse and design them for axial and eccentric loads. **2.** Design different steel sections subjected to axial compression and tension following Indian codes of practices. **3.** Comprehend the differences between laterally supported and unsupported flexure members. Designing of the flexure members using Indian codes of practice. **4.** Analyse and design rolled and built up compression members along with base connection subjected to axial compression, bending and tension. **5.** Calculate shear force and bending moment on rolled and built up girders, dimension the section and finally design it following Indian standard design guidelines. **6.** Identify different components of gantry system, calculate lateral and vertical loads acting on the system, dimension the components and design them. **7.** Design different components of an industrial building.				
Prerequisite	Introduction to Solid Mechanics (CE(ES)402)				
Module 1	**Materials and Specification:** Rolled steel sections, mechanical properties of steel and their specifications for structural use. Codes of practices. Design of Steel structures using **tubular**, rectangular and square section				1L
Module 2	**Structural connections:** Riveted, welded and bolted including High strength friction grip bolted joints. – types of riveted & bolted joints, assumptions, failure of joints ,efficiency of joints, design of bolted ,riveted & welded joints for axial load. Eccentric connection:- Riveted & bolted joints subjected to torsion & shear, tension & shear, design of riveted, bolted & welded connection.				6L
Module 3	**Design of Tension members:** Design of tension members, I.S code provisions. Permissible stresses, Design rules, Examples.				3L
Module 4	**Design of Compression members:** Effective lengths about major & minor principal axes, I.S code provisions. Permissible stresses, Design rules, Design of one component, two components and built up compression members under axial load. Examples. Built up columns under eccentric loading: Design of lacing and batten plates, Different types of Column Bases- Slab Base , Gusseted Base, Connection details				6L
Module 5	**Design of Beams:** Permissible stresses in bending, compression and tension. Design of rolled steel sections, plated beams. simple Beam end connections, beam -Column connections. I.S code provisions				4L
Module 6	**Design of Plate girders:** Design of webs & flanges, Concepts of curtailment of flanges – Riveted & welded web stiffeners, web flange splices - Riveted, welded& bolted.				4L
Module 7	**Design of Gantry Girder**: Design gantry girder considering lateral buckling – I.S code provisions.				4L
IS Codes	1	IS 800 – 2007(Latest Revised code)			
	2	IS 875 – I (1987), II (1987), -III (2015), -IV(1987), V (1987)			
	3	S.P.: 6(1) – 1964 Structural Steel Sections			
	4	IS 1161 : 2014			
Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**	
	1	Steel structures	N. Subramanian	OXFORD University Press	
	2	Design Of Steel Structures	S.K.Duggal	TMH	
	3	Design Of Steel Structures	Bhavikatti	I.K. Publishing House	

CE(PE)601A	**Stability of Slopes**	2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: 1. Understand the fundamental theories and knowledge in the stability analysis of soil slopes. 2. Measure the finite and infinite slope stability. 3. Develop the analytical and numerical skills in treating a complicated practical slope problem. 4. Evaluate the safety and design proper slope protection measures. 5. Analyse the strength parameters in slope stability.		
Prerequisite	Introduction to Civil Engineering (CE(HS)302), Soil Mechanics – I (CE(PC)401), Soil Mechanics – II (CE(PC)504).		
Module 1	**Introduction:** slope failure- causes, short- and long-term failure.		2L
Module 2	**Landslides:** types, multiple and complex slides, rate of land movement, factor of safety, examples.		4L
Module 3:	**Slope stability analysis:** basic concepts, finite and infinite slopes, analysis of		8L

	infinite slopes-dry or moist cohesive slope, non-cohesive slope, cohesive slope with seepage;	
Module 4:	**Analysis of finite slopes:** planar failure surface, circular failure surface, friction circle method, Taylors stability chart, locaton of critical circle, total stress analysis,	8L
Module 5:	**Method of Slices:** Fellenius method, Bishop's simplified method, effective stress stability chart.	4L
Module 6	Non-circular failure surfaces, selection of strength parameter in slope stability, various slope protection measures.	2L

Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	Soil Mechanics and Foundation Engineering	P. Purushothama Raj	Pearson publication
	2	Principles of Foundation Engineering	Braja M. Das	Thomson Asia Pvt. Ltd., Singapore, 2005.
	3	Soil strength and slope stability	J.M. Duncan, S.G. Wright	John Wiley & Sons (Imprint: Hoboken, N.J.), 2005.
	4	Slope Analysis.	R. Chowdhury	Elsevier Scientific Publishing
	5	The Stability of Slopes.	E.N. Bromhead	Blackie Academic & Professional

CE(PE)601B	**Foundation Engineering**	2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: **1.** Determine the load carrying capacity of pile foundation. **2.** Compute the efficiency and settlement of pile group. **3.** Understand different subsoil exploration methods and interpret field and laboratory test data to obtain design parameters for geotechnical analysis. **4.** Correlate bearing capacity of shallow foundation from field test data. **5.** Analyze and design sheet pile structure on the basis of earth pressure theories. 6. Understand and apply various types of ground improvement methods for solving complex geotechnical problems.		
Prerequisite	Introduction to Civil Engineering (CE(HS)302), Soil Mechanics – I (CE(PC)401), Soil Mechanics – II (CE(PC)504).		
Module 1	**Introduction** Classification, selection- shallow and deep foundations.		2L
Module 2	**Deep foundations** Pile foundation: Types of piles, material, Suitability and uses, Method of installation of piles - classification of piles based on material, Installation Techniques – Selection and uses, Determination of types and lengths of piles, Load transfer mechanism, Determination of load carrying capacities of piles by static and dynamic formulae as per IS codes, Pile spacing and group action, Group efficiency, Negative skin friction, Pile load test, Settlement of pile group, Lateral load capacity of pile by IS: 2911 and Reese & Matlock methods, Uplift capacity of pile - introduction.		9L
Module 3:	**Site Investigation & Soil Exploration** Planning of sub-surface exploration, Methods of boring, sampling, Different types of samples, Spacing, Depth and number of exploratory borings, Bore log, Preparation of sub-soil investigation report. **In-situ tests** Standard penetration test, Static cone penetration test, Dynamic cone penetration test, Field vane shear test, Plate load test. **Indirect methods of soil exploration** Geophysical method: seismic refraction and electrical resistivity methods.		6L
Module 4:	**Shallow Foundations** Bearing Capacity from SPT, SCPT and Plate load Test data.		3L
Module 5:	**Sheet pile structures** Type of sheet pilling, Design of sheet pile, Cantilever sheet piling, Anchored sheet piling, Free earth and fixed earth support methods, Analysis with anchored bulk heads.		4L
Module 6	**Introduction to Ground Improvement Techniques** Introduction, Economic considerations, Consolidation by preloading and sand		6L

	drains, Stone columns, Compaction by vibro-floatation, Grouting techniques and principles, Applications of geo-synthetics, Ground anchors and soil nailing.			
Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)	V.N.S. Murthy	CBS Publishers
	2	Soil Mechanics and Foundations	Punmia, B.C. and Jain A. K	Laxmi Publications (P) Ltd
	3	Basic and Applied Soil Mechanics	Gopal Ranjan & A.S.R. Rao	New Age International Pvt.Ltd, Publishers
	4	Principles of Geotechnical Engineering	B.M. Das	Thomson Brooks / Cole
	4	Soil Mechanics and Foundation Engineering	P. Purushothama Raj	Pearson publication
	5	Soil strength and slope stability	J.M. Duncan, S.G. Wright	John Wiley & Sons (Imprint: Hoboken, N.J.), 2005.
	6	Slope Analysis.	R. Chowdhury	Elsevier Scientific Publishing
	7	The Stability of Slopes.	E.N. Bromhead	Blackie Academic & Professional

CE(PE)601C	**Ground Improvement Technique**		2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: 1. gain competence in properly devising alternative solutions to difficult and earth construction 2. evaluate their effectiveness before, during and after construction. 3. understand different approaches to the ground modification. 4. Understand the soil stabilisation for reinforced earth construction.			
Prerequisite	Introduction to Civil Engineering CE(HS)302, Soil Mechanics – II CE(PC)504, Soil Mechanics – I CE(PC)401.			
Module 1	**Introduction:** ground modification by vibro-replacement, stone columns, preloading and prefabricated drains, Reinforcedearth structures,			4L
Module 2	**Insitu densification:** Introduction, Compaction: methods and controls Densification of granular soil: Vibration at ground surface, Impact at ground surface, Vibration at depth (Vibroflotation), Impact at depth.			6L
Module 3:	**Geo-textiles:** Introduction to geotextiles and geomembranes, applications of geotextiles, design methods using geotextiles, geogrids, geonets, geomembranes, geotubes,			6L
Module 4:	**Grouting:** Over view: Suspension and Solution grout, Grouting equipment and methods, Grout design and layout, Grout monitoring schemes.			6L
Module 5:	**Soil stability:** Reinforced earth fundamentals, Soil nailing, Soil and Rock Anchors, Underpinning			4L
Module 6	**Densification of Cohesive Soils:** Preloading and dewatering, Design of Sand drains and Stone columns, Electrical and thermal methods.			4L
Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	Construction and Geotechnical methods in foundation engineering	R.M. Koener	McGraw Hill
	2	Reinforced Earth	T S Ingold	Thoam Telford
	3	Designing with Geosynthetics	R M Koerner	Prentice Hall
	4	Ground Improvement Techniques	P. Purushothama Raj	Laxmi Publications Pvt Limited, 2nd edition.
	5	Principles and Practice of Ground Improvement	Jie Han	Wiley publishers, 1st edition.

CE(PE)602A	**Building Construction Practice**	2L + 0T	2 Credits
Module 1	Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone		12L

	masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick –– weather and water proof – roof finishes – acoustic and fire protection;	
Module 2	**Sub Structure Construction** Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunnelling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points – Dewatering and stand by Plant equipment for underground open excavation;	10L
Module 3	**Super Structure Construction** Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks	8L

CE(PE)602B	**Structural Analysis – II**	2L + 0T	2 Credits
Course Outcome	After going through this course, the students will be able to: **1.** Apply the Slope Deflection and Moment Distribution Method to analyze indeterminate structures. **2.** Develop and analyze the concept of suspension bridge and stiffness girders **3.** Apply and analyze the concepts of curved beam analysis in hooks, rings and Bow girders. **4.** Develop the concept bending in unsymmetrical beams. **5.** Develop the fundamental concepts of plastic analysis using kinematic method and apply them in frames and continuous beam analysis. **6.** Develop and analyze the portal frames using Portal and Cantilever method. Develop and analyze the indeterminate structures (continuous beams and frames) using flexibility and stiffness matrix method.		
Prerequisite	Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503)		
Module 1	**Analysis of statically Indeterminate Structures:** Moment distribution method-solution of continuous beam, effect of settlement and rotation of support, frames with or without side sway. Slope deflection method: method and application in continuous beams and frames. Suspension Bridge and stiffening girders.		8L
Module 2	**Curved Beam analysis:** Hooks, rings and Bow girders. Unsymmetrical bending.		8L
Module 3	**Plastic analysis of structures:** beams and portal frames.		5L
Module 4	**Approximate method of analysis of structures:** Portal and Cantilever methods.		4L
Module 5	Matrix methods of structural analysis – Stiffness and flexibility approaches for analysis of beam.		5L

Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	Structural Analysis	R. Agor	Khanna Publishing House
	2	Structural Analysis (Vol I & Vol II)	S S Bhavikatti	Vikas Publishing House Pvt. Ltd
	3	Structural Analysis	Ramammurtham	
	4	Strength of Materials and Theory of Structures (Vol I & Vol II)	Punmia, Jain, Jain	Laxmi Publication
	5	Structural Analysis	R.C. Hibbeler	Prentice Hall
	6	Theory of Structures	Timoshenko and Young	McGrawHill
	7	Structural Analysis	Pandit and Gupta	TMH
	8	Theory of Matrix Structural Analysis	J.S. Przemieniechki	DOVER PUBLICATIONS, INC.

CE(PE)602C	**Industrial Structure**	2L + 0T	2 Credits
Course Outcome	After going through this course, the students will be able to: 1. To perform the analysis and design of reinforced concrete members and their connections. 2. To identify and apply the industrial design codes relevant to the design of Reinforced concrete members. 3. To be familiar with the professional and contemporary design issues and fabrication of Reinforced concrete members.		
Prerequisite	Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503), Design of RC Structures (CE(PC)501)		
Module 1	**Overall Review of RC Design:** Review of Limit State Design of Beams, Slabs & Columns according to IS 456-2000. Yield line theory, Biaxial Bending & Slander Column. **Analysis and Design of beams curved in plan:** Design principle, structural design of beams curved in plan of circular and rectangular types. **Flat slabs:** Introduction, components – IS code provisions Design method – Design for flexure and shear and Detailing.		8L
Module 2	**Deep beams:** Introduction, Flexural and shear stresses in deep beam and Design and Detailing. **Water tank**: Introduction, Types, Analysis and Design of water tanks e.g. Underground & Elevated water tank (Circular, Rectangle and Intz)		7L
Module 3	**Raft Foundation:** Introduction, Types and Design of raft foundation. **Design of folded plate** **Design of shear wall** as per IS 13920		7L
Module 4	**Design of bunkers and silos:** Introduction, Difference between Bunkers and Silo (rectangular, square and circular bunker and silo design for storage of cement). **Analysis and design of chimneys:** Introduction and different type of linings, wind load calculation on chimney (Static and dynamic) Analysis and design of chimney linings, foundation types.		8L
IS Codes	**1** IS: 456 – 2000 (latest revision) **2** IS 875 – I (1987), II (1987), -III (2015), -IV(1987), V (1987) **3** SP: 16 Design Aid to IS 456 **4** IS 1893-Part-I: 2016, IS 1893-Part-II: 2014 **5** IS 3370 –I (1967), II (2009), III (1967), IV (1967)		

Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	R.C.C. Design	B.C. Punmia	Laxmi Publication
	2	Reinforced concrete structures	N. Subramanian	OXFORD University Press
	3	Advanced Reinforced Concrete Design	P. C. Varghese	PHI
	4	Advanced Reinforced Concrete Design	N. KrishnaRaju	CBS Publishers

CE(OE)601A	**Soft Skills and Interpersonal Communication – I**	2L + 0T	2 Credits
Course Outcome	1. Analyse the dynamics of business communication and communicate accordingly. 2. Write business letters and reports 3. Learn to articulate opinions and views with clarity 4. Appreciate the use of language to create beautiful expressions 5. Analyse and appreciate literature. 6. Communicate in an official and formal environment.		
Module 1	Communication Skill Definition, nature & attributes of Communication Process of Communication Models or Theories of Communication Types of Communication Levels or Channels of Communication Barriers to Communication		3L
Module 2	Business Communication- Scope & Importance Writing Formal Business Letters Writing Reports Organizational Communication: Agenda & minutes of a meeting, notice, memo, circular Project Proposal Technical Report Writing Organizing e-mail messages E-mail etiquette Tips for e-mail effectiveness		8L
Module 3	Language through Literature Modes of literary & non-literary expression Introduction to Fiction, (An Astrologer's Day by R.K. Narayan and Monkey's Paw by W.W. Jacobs), Drama (The Two Executioners by Fernando Arrabal) or (Lithuania by Rupert Brooke) & Poetry (Night of the Scorpion by Nissim Ezekiel and Palanquin Bearers by Sarojini Naidu)		8L

Module 4	Grammar in usage (nouns, verbs, adjectives, adverbs, tense, prepositions, voice change) - to be dealt with the help of the given texts.			10L
Reference	**Sl.**	**Book Name**	**Author**	**Publishing House**
	1	Theories of Communication: A Short Introduction	Armand Matterlart and Michele Matterlart	Sage Publications Ltd
	2	Professional Writing Skills	Chan, Janis Fisher, and Diane Lutovich	San Anselmo, CA: Advanced Communication Designs, 1997.
	3	Effective Business Communications	Kulbhushan Kumar	Khanna Publishing House
	3	Writing and Speaking at Work: A Practical Guide for Business Communication	Edward P.Bailey	Prentice-Hall
	4	Intercultural Business Communication	Lillian Chaney and Jeanette Martin	Prentice Hall

CE(OE)601B	**Introduction to Philosophical Thoughts**	2L + 0T	2 Credits
Module 1	Introduction to Indian Philosophy: Brief discussion on Veda and Upanishads; Origin of Indian Philosophy		1L
Module 2	Charvaka Philosophy: Epistemology; Metaphysics		2L
Module 3	Samkhya Philosophy: Metaphysics; Theory of Causation. --Prakṛti, Purusa, Evolution; Epistemology		3L
Module 4	Yoga Philosophy: Organization of the YogaSutras; Psychology of Yoga -- Stages of Citta, Forms of Citta, Modifications of Citta, Kinds of Klesas; The Eight-Fold Yoga; God and Liberation		3L
Module 5	Nyaya Philosophy : Epistemology -- Perception (Pratyaksa), Inference (Anumāna), Comparison (Upamāna), Testimony (Sabda); Theory of Causation (Asatkāryavāda); Self and Liberation; The Concept of God		5L
Module 6	Mimansa Philosophy: Epistemology -- Validity of Knowledge; Sources of Valid Knowledge (Pramāna) – Perception, Inference, Comparison, Verbal Testimony, Postulation (Arthapati), Non Apprehension (Anupalabdhi); Theories of Error (Khyativāda) – Akhyativāda, AnirvacaniyaKhytivāda, Viparitakhyativāda; Metaphysics -- Theory of Causation; Nature of Self; God and Liberation		4L
Module 7	Vaisesika Philosophy: Metaphysics and the Categories -- Substance (Dravya), Quality (Guṇa), Action (Karma), Generality (Sāmānya), Particularity (Vaiśeṣa), Inherence (Samavāya), Nonexistence (Abhāva); Epistemology; The Concept of God; Bondage and Liberation		3L
Module 8	Buddhist Philosophy:Epistemology -- Dependent Origination; Four Noble Truths; Eight Fold Paths; Ethics; Karma and Rebirth; Liberation		4L
Module 9	Jaina Philosophy: Syādavāda; Anekāntavāda; Ethics; Karma and Liberation		3L

CE(PC)693	**Water Resource Engineering Laboratory**	2P	1 Credits
Course Outcome	On completion of the course, the students will be able to: **1.** Delineate the watershed of any reservoir using DEM. **2.** Determine the average rainfall over a catchment. **3.** Use the raingauge properly for a specified purpose. **4.** Measure the rate of infiltration of water through the soil. **5.** Measure the sunshine hours in a particular day.		
Prerequisite	Engineering Hydrology CE(PC)502 & Water Resources Engineering CE(PC)603		
Experiment 1	Catchment area delineation (Manually and using DEM)		
Experiment 2	Calculation of average rainfall over a catchment area with arithmetic mean method, Thiessen polygon method and Isohyetal Method.		
Experiment 3	Use of different type of Rain gauges.		
Experiment 4	Measurement of infiltration rate using double ring infiltrometer.		
Experiment 5	Measurement of evaporation using evaporimeter.		
Experiment 6	Measurement of bright sunshine hours using sunshine recorder.		

CE(PC)694	**Steel Structure Design Sessional**	2P	1 Credits
Course Outcome	After going through this course, the students will be able to: **1.** Identify the material properties of structural steel. Moreover, the students will identify different bolted and welded connections, analyse and design them for axial and eccentric loads. **2.** Design different steel sections subjected to axial compression and tension following Indian codes of practices. **3.** Comprehend the differences between laterally supported and unsupported flexure members. Designing of the flexure members using Indian codes of practice. **4.** Analyse and design rolled and built up compression members along with base connection subjected to axial compression, bending and tension. **5.** Calculate shear force and bending moment on rolled and built up girders, dimension the section and finally design it following Indian standard design guidelines. **6.** Identify different components of gantry system, calculate lateral and vertical loads acting on the system, dimension the components and design them. **7.** Design different components of an industrial building.		
Prerequisite	Design of Steel Structures (CE(PC)604		
	Design of a factory shed including preparation of necessary working drawings and report in accordance with CE(PC)604		

CE(PC)695	**Quantity Survey Estimation and Valuation Sessional**	1T+2P	2 Credits
Course Outcome	The subject aims to provide the student with: 1. An introduction to quantity surveying 2. The capability to know analysis and schedule of rates 3. The ability to know specification of materials 4. An understanding about specification of works 5. The introduction to valuation		
Prerequisite	Introduction to Civil Engineering [CE(HS)302], Construction Engineering & Management [CE(PC)601], Engineering Economics, Estimation & Costing [CE(PC)602]		
	1. Quantity Surveying: Types of estimates, approximate estimates, items of work, unit of measurement, unit rate of payment. 2. Quantity estimate of a single storied building 3. Bar bending schedule. 4. Details of measurement and calculation of quantities with cost, bill of quantities, abstract of quantities. 5. Estimate of quantities of road, Underground reservoir, Surface drain, Septic tank. 6. Analysis and schedule of rates: Earthwork, brick flat soling, DPC, PCC and RCC, brick work, plastering, flooring and finishing, 7. Specification of materials: Brick, cement, fine and coarse aggregates 8. Specification of works: Plain cement concrete, reinforced cement concrete, first class brickwork, cement plastering, pointing, white washing, colour washing, distempering, lime punning, painting and varnishing 9. Valuation: Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table		