(4th – SEMESTER)

Concrete Technology

Subject code – CIV401

1. Rationale: Diploma holders in Civil Engineering are supposed to supervise concreting operations involving proportioning, mixing, transporting, placing, compacting, finishing and curing of concrete. To perform above functions, it is essential to impart knowledge and skills regarding ingredients of concrete and their properties; properties of concrete in fresh and hardened stage, water cement ratio and workability; proportioning for ordinary concrete; concreting operations and joints in concrete.

2. Course Outcomes/Skill Sets: At the end of this course students will be able to

CO-01	Identify the ingredients of concrete, test the properties and study the behaviour of concrete ingredients to ensure it can be used for the given construction activity
CO-02	Design concrete mix proportions for required compressive strength and perform appropriate concrete operation procedures under a given exposure condition.
CO-03	Identify the types of admixtures based on its properties, behaviour and determine the type of admixtures to be used in concrete for a given construction activity.
CO-04	Differentiate between special concrete and conventional concrete with regards to composition, its applications and sustainability along with advantages and disadvantages of both.

3. Course Content

Week	**CO**	**PO**		**Lecture (Knowledge Criteria)**	**Tutorial (Activity Criteria)**	**Practice (Performance Criteria)**

				3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice ina week)
			1	Cement – Chemical composition, grades of cement, Tests on cement- fineness, normal consistency, specific gravity on cement.	1.Conduct field test on cement. 2. Conduct market analysis on price, grades and brand of cement.	1. a. Fineness test on Cement- sieve analysis by Blaine's air permeability test. 1.b. Normal Consistency test on cement.
			2	Setting time, Soundness and compressive strength of cement cube.		2. a. Initial setting time & final setting time test. 2.b. Specific gravity test on cement.
			3	Storing Cement: - (a) Storing of cement in the warehouse. (b) Storingof cement at site. (c) Effect of storageon strength of cement. Water -Quality of mixing water, Limits on the impurities as per ISI.		
			1	Fine aggregate – specific gravity, density, moisture content.	1.Conduct water absorption test on silt. 2.Compare properties of Manufactured sand with Natural River Sand	1. Test on Compressive strength of cement cube
			2	Bulking, sieve analysis, grading of fine aggregate, deleterious materials.		2. Fineness modulus, Specific gravity of fine aggregate
			3	Emerging trends in fine aggregate manufactured sand, P-sand, Filtered sand		
			1	Coarse aggregate - Importance of size, shape and texture, grading of coarse aggregates.	1. Study on Recycled coarse aggregate and prepare a report.	1. Bulking of Fine Aggregate-River sand, M-Sand, P-Sand.
			2	Sieve analysis, specific gravity, flakiness and elongation index of coarse aggregate.		2. Fineness modulus, Specific gravity of coarse aggregate.
			3	Moisture test, Impact test and abrasion test of coarse aggregate Storing of coarse aggregate at site.		

			1	Concrete, Behaviour of concrete- Hydration of cement, Bogue's compounds.	1.Study the advantages and uses of concrete in comparison to other building materials 2.Video demonstration on Hydration of cement and hydration process, Physical structure of hydrated cement	1. Flakiness Index, Elongation Index of coarse aggregate.
			2	Gel/space ratio, Water requirementfor hydration, Water Cement Ratio.		2. Absorption test and surface moisuretest on fine aggregateand coarse aggregates.
			3	Effect of various W/C ratios on the physical structure of hydrated cement.		
			1	Internal moisture, temperature, age, and size of specimen, cube strength.	1. Prepare Comparison report on different grades of concrete based on workability.	1. Slump Test on concrete for the nominal mix.
			2	Workability – Factors affecting workability, measurement of workability, Segregation and bleeding.		2. Compaction factor test for the nominal mix.
			3	Strength-a) Characteristic strength, (b) Durability, (c) Permeability Factors affecting strength, w/c ratio, maturity, effect of aggregate properties.		
			1	Compressive strength, split tensile strength, bond strength, modulus of rupture.	1. Study and demonstrate Pull out test on concrete.	1. Compressive strength test on concrete - cube strength.
			2	Modulus of elasticity, Poisson ratio, the relationship between these parameters. Aggregate-cement bond strength.		
			3	Shrinkage – plastic shrinkage and drying shrinkage, factors affecting shrinkage.		2. Non-destructive test on concrete. a) Ultrasonic Pulse Velocity test. b) Rebound Hammer test.
			1	Creep –Factors affecting creep, effects due to the creep of concrete,		1. Site Visit/Demonstration-

				measurement of creep, Permeabilityin concrete.	1. List the remedies for cracks in concrete.	Evaluation of Compressive strength by core cutter test.
			2	Factors contributing to cracks in concrete – Settlement cracks, Thermal expansion, and structural design deficiencies.		
			3	Concrete in Aggressive Environment: Alkali – Aggregate Reaction, Sulphate Attack, Chloride Attack, Acid Attack, Effect of Sea Water, Carbonation, special coating for Waterproofing, Freezing and thawing.		2. Demonstration- Permeability test on concrete.
			1	CONCRETE OPERATIONS: - Batching (a) Batching of cement (b) Batching of aggregate: Batching by volume, using gauge box, selection of proper gauge box, Batching by weight-spring balances and by batching machines. (c) Measurement of water.	1.IS Codal provisions for mix design of concrete. 2. Importance of bulking of sand in Volume batching	1. Concrete Mix Design as per ISCodes.
			2	Mixing (a) Hand mixing (b)Machine mixing-types of mixers, capacities of mixers, choosing appropriate size of mixers, operationof mixers, mixing of water. (c)Maintenance and care of machines.		
			3	Transportation Transportation with the use of the following- pans, wheelbarrows, transit mixers, chutes, belt conveyors,pumps, tower cranes.		2. Preparation of gauge box Demonstration on Handmixing and machine mixing.
			1	Ready Mix concrete Manufacturing of ready-mix concrete, Quality inspection of Ready-Mix Concrete in site. Precautions and care before, during and after concreting Using RMC	1. Visit the construction site and study the concrete operations	1. Demonstration on volume batching in site and Weigh batching in

			2	Compaction: (a) Hand compaction (b) Machine compaction-types of vibrators-internal and external vibrators Method of handling machine vibrators and its suitability for various situations.	like batching, mixing, transportation, compaction, finishing and curing of concrete and prepare a report.	RMC(semi-automated and fully automated)
			3	Finishing-screeding, floating, and towelling Curing: - Object of curing, Method of curing - conventional and advanced methods. Recommended duration for curing		2. Prepare the trail mix for the mix designand conduct test in fresh state (slump and compaction factor test) and hardened state (Succeeding week)
			1	Mineral admixture- Fly Ash, its Composition, properties, uses and advantages	1. Study on Natural fibres and artificial fibres and prepare a report	1. Prepare mix design and Conduct Slump test and compaction factor test on fresh concrete with mineral admixtures
			2	GGBS-its Composition, properties, uses and advantages		
			3	Silica fume- its Composition, properties, uses and advantages		2. Compressive strength test on hardened concrete with mineral admixture
			1	Chemical Admixture-Plasticizers, Super plasticizers- its Composition, properties, uses and advantages.	1. Conduct market analysis on chemical admixtures and compare.	1 & 2 Site visit to study the methodology of concrete Pumping to upper floors in construction site.
			2	Accelerators and Retarders- its Composition, properties, uses and advantages.		
			3	Air Entraining and Integral Waterproofing compounds- its Composition, properties, uses and advantages.		
			1	High strength concrete, High performance Concrete-Ingredients and preparation, advantages and application.	1. Compare the special concrete with conventional	1 & 2: Prepare mix design and conduct Slump flow test, V Funnel Test, L Box

					concrete and prepare report	Test, U Box Test to determine workability of Self Compacted concrete.
			2	Pervious concrete, high density concrete. -Ingredients and preparation, advantages and application		
			3	Self-compacting concrete-Ingredients and preparation, advantages and application		
			1	Fibre reinforced concrete. - Ingredients and preparation, advantages and application	Study on Reactive powder Concrete, Roller Concrete, Epoxy concrete	1 & 2 Compressive strength test on special concrete
			2	Geopolymer concrete - Ingredients and preparation, advantages and application		
			3	Lightweight concrete-Ingredients and preparation, advantages and application		
Total in hours						

NOTE 1: The course content shall be delivered through lectures, PowerPoint presentations, video demonstrations and field visits

NOTE 2: The TUTORIAL (Activity criteria) shall be conducted / executed by the student (Minimum ONE suggested activity from each week) and to be submitted in portfolio evaluation of activities through rubrics to the faculty.

NOTE 3: The PRACTICE (Performance criteria) shall be conducted by the student and observations and report to be submitted at the end of each session to the faculty

4. Reference:

Sl. No.	Description
1	Concrete technology- MS Shetty , Chand S and Co.
2	Concrete Technology, Tata McGraw Hill, New Delhi
3	Concrete Technology - Theory & Practice - R.S. Varshney
4	Relevant BIS codes

Building Estimation & Valuation

Subject code – CIV402

1. Rationale: The procedure of calculating the measures as per the working drawings and cost of various construction items is called an Estimate. Before initiating the construction works, the contractor/ owner should have thorough knowledge of the amount of work which is to be done and it's costing. For this purpose, it is very essential to have an estimated quantity of work and the total amount it is going to cost. Estimation helps us in knowing the quantity of work, labour, materials and funds that will be required for the entire project thus enabling us to be prepared beforehand. Valuation is the technique of estimation or determining the fair price or value of property such as land, a building, a factory, other engineering structures of various types, etc. Valuation of building or property is the method of calculating the present marketable cost of a building. Valuation of a building depends on the sort of building, its structure, durability, location, size, shape, and the width of roads, frontage, types and quality of building materials used and the cost of these materials.It is expected the students should know the basics of the same to apply it in the field. Through this course students will develop the desired skills and competencies which are expected from them for Estimation and valuation related works.

2. Course Outcomes/Skill Sets: At the end of the semester student will be able to:

CO-01	Study the importance of estimation and detailed specifications for the various items required for construction of different types of structures.
CO-02	Analyse the rates and study factors affecting the rates for all works by applying standard rates for a given construction project.
CO-03	Prepare Bill of materials, Bill of Quantities and valuation report for a given construction project.
CO-04	Prepare contract documents for a given construction project with Negotiation and project financing skills

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week(2 hours/batch twice in a week)
			1.INTRODUCTION TO ESTIMATION Types of estimates. Roles and responsibility of estimator, Different items of works, unit of measurement andunits of payment of different items of work, Bill of Quantities 2.ANALYSIS OF RATES, purpose, importance and Procedure for rate analysis, rates of different construction materials, Categories of labours and theirskills, number of labours and daily wagesfor different items of work, 3.Load carrying capacity of different types of vehicles, transportation of materials and their hiring charges., GST charges, lead, lift, overhead charges, water charges and contractor's profit. factors affecting rate analysis	1. Prepare detailed report on Specifications of different items of work and study the importance of specification in Bill of Quantities 2. Analyse the rates for reusable materials in different construction activities	1. SPECIFICATIONS Earthwork in excavation for foundation, Cement concrete in foundation, Brick masonry, R.C.C Work, Plastering in Cement mortar, pointing with cement mortar, Cement concrete flooring, Granite /Vitrified / Marble flooring 2. Centering and shuttering works, Distempering, Exterior painting (Cement), Woodwork for windows and doors, Painting woodwork and steel, Glazing works for building, waterproofing systems
			Method of Analysis of rates for the following items of works 1. a) Earthwork excavation and filling b) Cement concrete bed in foundation c) Size stone masonry in Cement mortar for substructure 2. a) Brick masonry in C.M for superstructure b) Hollow concrete block masonry in Cement Mortar c) Solid concrete blocks masonry in Cement mortar for superstructure 3. a) Pointing with cement mortar b) Plastering with cement mortar c) Waterproofing - Terrace, bathrooms and toilets.	1. Conduct market analysis on the present rate of materials, Daily wages of labours, number of labours, transportation charges, hire charges for tools and equipment's for different items of work and Compare with the Standard	1 &2. Collect the present detailed Schedule of Rates and execute rate analysis in spreadsheet (For the lecture content for week 2)

				Schedule of rates	
			Method of Analysis of rates for the following items of works 1. a) CC Flooring, Granite / Vitrified / Marble flooring b) Painting of wall surface c) Painting of old and new wood work 2. a) Painting of Steel work b) Panelled and glazed doors 3.a) Panelled and glazed windows b) R.C.C roof slab c) Corrugated galvanized iron sheet roofing.	1.Prepare the rate analysis for different items of work by changing cost of materials and profit percentage and compare	1 &2. Collect the present detailed Schedule of Rates and execute rate analysis in spreadsheet (For the lecture content for week 3)
			1.Introduction to methods of estimation: long wall short wall method and centre line method of estimation, Standard Format for measurement sheet, Rules fordeduction of doors, windows and opening in Masonry work, Plastering andPainting work 2. One room building- Ground floor with flat RCC roof (Long wall short wall method) 3. Two room building- Ground floor with pitched roof (Centre line method)	1. Extract measurements from existing AUTOCAD drawing file 2.Compare between long wall short wall method and centre line method of estimation	1. Execute the detailed and abstract estimate using long wall short wall method using spreadsheetfor One room building- Ground floor with flat RCCroof (Long wall short wall method) 2. Execute the detailed and abstract estimate using long wall short wall method using spreadsheetfor Two room building- Ground floor with pitched roof (Centre line method)
			Explain the methodology of Quantity estimation of the following. 1. Detailed and abstract estimate of buildings using long wall short wall Method - 1BHK Residential building - Ground floor with Pitched roof with load bearing wall. 2. Detailed and abstract estimate of buildings using long wall short wall Method -2BHK Residential building - Ground floor with flat RCC roof having semi-circular/ Hexagonal room walls (load bearing walls).	1. Prepare the BOQ for the residential building drawing from real time projects (ongoing construction projects) using Spreadsheet 2. Extract measurements from existing	1. Execute the detailed and abstract estimate using long wall short wall method using spreadsheet for 1 BHK Residential building - Ground floor with Pitched roof with loadbearing wall. 2. Execute the detailed and abstract estimate using long wall short wall method using spreadsheetfor 2BHK Residential building - Ground floor

			3. Detailed and abstract estimate of buildings using long wall short wall Method -2BHK Residential building - Ground floor with flat RCC roof with portico / canopy.	AUTOCAD drawing file.	with flat RCC roof for with portico / canopy having semi-circular/ Hexagonal room walls
			Explain the methodology of Quantity estimation of the following. 1.Detailed and abstract estimate of buildings using long wall short wall Method for Commercial building – Ground floor with flat RCC roof involving Aluminium Composite panels for facing 2 & 3: Detailed and abstract estimate of buildings using long wall short wall Method Industrial building – (Ground floor +1) with flat RCC roof and framed structure	1.Prepare the BOQ for the Commercial building drawing from real time projects (ongoing construction projects) using Spreadsheet 2. Extract measurements from existing AUTOCAD drawing file	1. Execute the detailed and abstract estimate using long wall short wall method in using spreadsheet for School building – Ground floor with flat RCC roof 2. Execute the detailed and abstract estimate using long wall short wall method using spreadsheetfor Industrial building – (Ground floor +1) with flat RCC roof and framed structure
			Explain the methodology of Quantity estimation of the following. 1. Detailed and abstract estimate of buildings using Centre Line Method - 1BHK Residential building - Ground floor with Pitched roof with load bearing wall. 2.Detailed and abstract estimate of buildings using Centre Line Method - 2BHK Residential building - Ground floor with flat RCC roof having semi-circular/ Hexagonal room walls (load bearing walls) 3. Detailed and abstract estimate of buildings using Centre Line Method - 2BHK Residential building - Ground floor with flat RCC roof with portico / canopy	1. Prepare the BOQ for the Industrial building drawing from real time projects (ongoing construction projects) using Spreadsheet 2. Extract measurements from existing AUTOCAD drawing file	1. Execute the detailed and abstract estimate using the Centre Line method using spreadsheet for 1 BHK Residential building - Ground floor with Pitched roof with load bearing wall. 2. Execute the detailed and abstract estimate using Centre Line Method in using spreadsheet for 2BHK Residential building -Ground floor with flat RCC roof with portico / canopy having semi-circular/ Hexagonal room walls
			Explain the methodology of Quantity estimation of the following.	1.Prepare comparison statement with BOQ of	1. Execute the detailed and abstract estimate using centre line method using spreadsheet for School

			1.DETAILED AND ABSTRACT ESTIMATE OF BUILDINGS USING Centre lineMethod Commercial building – Ground floor with flat RCC roof involving structural glazing for facing 2 & 3: DETAILED AND ABSTRACT ESTIMATE OF BUILDINGS USING Centre Line Method Industrial building – (Ground floor +1) with flat RCC roof and framed structure	residential, commercial and industrial buildings 2. Study on application of various softwares used for estimation and demonstrate	building – Ground floor with flat RCC roof 2. Execute the detailed and abstract estimate using centre line method using spreadsheet for Industrial building – (Ground floor +1) with flat RCC roof and framed structure
			Prepare the Bill of materials for the following in residential building 1. Water supply fittings and fixtures 2. Sanitary Fittings and fixtures 3. Electrical Fittings and fixtures and fire fighting system	1.Conduct market analysis and prepare the rate analysis for plumbing, electrical and firefighting fixtures and fittings work 2.Extract measurements from existing AUTOCAD drawing file	1. Execute the detailed and abstract estimate using spreadsheet for Plumbing layout (Water supply and sanitary fittings) for residential building 2. Execute the detailed and abstract estimate using spreadsheet for Electrical and fire fighting fittings for residential building
			Prepare the Bill of materials for the following in Commercial building 1. Water supply fittings and fixtures 2. Sanitary Fittings and fixtures 3. Electrical Fittings and fixtures and fire fighting system	Prepare the Bill of materials, detailed and abstract estimate for the following in Industrial building 1. Water supply fittings and fixtures 2. Sanitary Fittings and fixtures 3. Electrical Fittings and fixtures and fire fighting system	1. Execute the detailed and abstract estimate using spreadsheet for Plumbing layout (Water supply and sanitary fittings) for commercial building 2. Execute the detailed and abstract estimate using spreadsheet for Electrical and firefighting fittings for commercial building

			Prepare the Bill of materials for the following for a residential building 1. Septic tank with soak pit 2. Manhole 3. Rain water harvesting unit	1.Prepare Bill of materials, detailed and abstract estimate for rainwater harvesting unit in college campus	1. Execute the detailed and abstract estimate using spreadsheet for) for septic tank with soak pit and manhole 2. Execute the detailed and abstract estimate using spreadsheet for Rain water harvesting unit for a residential building
			1. Quotation preparation, Importance of Specification, rate analysis and quantity estimation in preparation of quotation, Negotiation with stakeholder in terms of estimation, Factors affecting negotiation 2. Project Financing: Factors affecting project financing, different types of loans for project , Loan agreement and Agreement with the stakeholder, Documents to be produced to stakeholder and loan approval, Repayment of loan 3.Work order, Payment Schedule: Advance payment, payment according to area of work, payment according to floor wise work, Retention details	1. Conduct a Detailed study about Negotiation and Project financing for an ongoing project and prepare a report	1. Preparation of complete report having survey drawings, working drawings, BOQ, detailed and abstract estimate, payment schedule and work order for project
			VALUATION 1.Necessity of valuation, Important terms used in valuation, Scrap value, Salvage value, Market value, Book valueand sinking fund. 2. Depreciation, Classification of buildings based on the life of a building and depreciation. 3. Methods of valuation & Fixation of rents.	1. Study factors for real time valuation of building / land and prepare report	1.Execute the calculations of sinking fund and valuation of building using depreciation method using spreadsheet 2. Execute the calculation of rent fixation using spreadsheet
Total in hours					

NOTE 1: NOTE 1: The course content shall be delivered through lectures, PowerPoint presentations, video demonstrations and field visits

NOTE 2: The TUTORIAL (Activity criteria) shall be conducted / executed by the student (Minimum ONE suggested activity from each week) and to be submitted in portfolio evaluation of activities through rubrics to the faculty.

NOTE 3: The PRACTICE (Performance criteria) shall be conducted by the student and observations and report to be submitted at the end of each session to the faculty

4. Reference:

Sl. No.	Description
1	Dutta B N, "*Estimation and costing in civil engineering theory and practice"*, 27 edition, UBS Publishers Distributors (P) Ltd New Delhi. Chakra borty M, *"Estimating, costing and specifications in Civil Engineering"-2006.*
2	D.D.Kohli Ar.R.C.Kohli, "*Estimating and Costing(CIVIL)"*2013 edition, S.CHAND Publications
3	IS: 1200 Part 1 to 28, *Method of Measurement of Building and Civil Engineering Works.*
4	Rangwala S C,*"Valuation of Real properties"*Charotar Publishing House -2008.
5	Full building estimation in spreadsheet https://www.youtube.com/watch?v=ocZu5wjh-88

Site Management

Subject code – CIV403

1. Rationale: Site management is a key element of the integrated project team. Site management is beneficial to society as the effective and efficient management of construction projects which will avoid escalation of costs, time overrun, wastage of resources, unlawful exploitation of labour and pollution of environment and safety precautions. Site management makes sure that the various tasks are conducted smoothly. Without site management, workers might not be authorized to work on their appointed tasks on time, equipment might not be distributed etc. It is expected that the students should know the basics of the same to apply it in the field. Through this course students will develop the desired skills and competencies which are expected from them for site management related works

2. Course Outcomes/Skill Sets: At the end of the semester, students will be able to

CO-01	Prepare a construction site plan on a project-specific basis to include phasing, temporary utilities and facilities, vertical and lateral transportation, storage facilities, security, safety, lighting, and environmental requirements.
CO-02	Manage staffing requirements including hiring, replacement and clearly articulate the roles of each individual recruited to operate while managing specific activities of construction at a given project site.
CO-03	Collect data and perform calculations periodically to enable an estimator to propose alternative construction methods, the right labour mix, equipment utilization and quality of construction for a given construction project.
CO-04	Implement an effective communication system, rigorous record keeping, safe keeping on site of product samples, project submittals, drawings etc and ensure compliance with safety norms as per OHSAS standards.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
			MOBILIZATION AND JOB LAYOUT 1. Concept of Key Plan & Job plan. Mobilization of construction sites. 2. Role of the owner, contractor & designer. Organization chart for private& government bodies. 3.Work Breakdown Structure, Turnkey operation.	1.Study and prepare a report on Mobilization work and job layout for differenttypes of buildings.	1. Preparation of Key Plan, Job Layout using BIM tool like Revit/Sketch up/AutoCAD. 2. Presentation on work breakdown structure & organization structure.
			1. Preparation of a layout plan for a residential area showing LIG, MIG and HIG houses and other amenities. 2. Preparation of a layout plan for an industrial area. 3. Concept of Bidding, Bid Terminologies, Bid Template, Bid form.	1. Collect a case study on bidding and prepare a report.	1. Collect local body by law & prepare a layout plan for LIG, MIG & HIG of small residential area using AutoCAD/Sketch up/Revit 2. Collect local bodies by law & prepare a layout plan for industrial areas using AutoCAD/Sketch up/Revit.
			1.CONTRACT & TENDERING: -Types of contracts, contract agreement, Tender- Pre tender & Post tender planning. 2. Procedure for inviting tender- Tender Notice & Tender documents, E-tendering process, E-procurement system.	1. Study on Project Feasibility. BOT, BOOT, PPP. and prepare a report	1. Procedure for uploading a tender in e-procurement. 2. Prepare & present process of tender/E-tender.

			3. Acceptance of contract documents and issue of work orders, duties and liabilities, completion certificate, right ofcontractor, refund of deposit.		
			1. EMD, Security deposit & Guaranties, Scrutiny of Tenders 2. Tender forms, comparative statements, administrative approval, technical sanction 3.Conditions for failure of contract and its extension, Termination of contract	1. Prepare & present tender documents	1. Prepare comparative statements of tender and checklist for applying & selecting Tender. 2. Prepare administrative approval& Technical approval report of any public/resident/industr ial building.
			1. Nominal muster roll, measurement book, method of recording bills. 2. Pre-Measurements, check measurements, preparation of bills (Concept of RA bill- submission, scrutiny and payment.) 3.Ledger accounts, Imprest Account, Cashbook, Suspense classification, Term DPR (daily productivity report), importance of DPR	1. Site visit & data collection. 2. Prepare & present procedure of DPR.	1. Collect & study measurement books of any residential building, industrial building & public building. 2. Collect & study Cash Book, RA bill & Ledgeraccount.
			1. STORES-Classification of Stores. Issues, Indents & Bin cards - maintenance inspection, inventories. 2. Work procedures adopted in P.W.D, KUWSSB, Irrigation, ZP, CMC and C.P.W.D. 3. Site Order book, Hindrance Register, Drawing Register.	1. Site visit & data collection. 2.Prepare drawing register, site order, bin card	1.snagging checklist (Snagging1-upto door & window clearance Snagging2-upto paint clearance Snagging3-Joint/grout filling clearances Snagging4-handover clearance). 2. Prepare working procedure of
			Project clearance procedure: Term Snagging, stages of snagging. Tools used		government organization &

			for snagging.		responsibilities of technocrats.
			1. Introduction to Building Information Model (BIM), Introduction to project management tools like ERP, SAP, PRIMAVERA, MSP, Project Kick start,Smarta etc. 2. Sequence of construction activity. 3. PLANNING AND SCHEDULING: Project Organization	1. Conduct a Case study on Project Management tools like ERP, R CONSTRUCT, QUADRA, SAP, MSP, PRIMAVERAetc...	1.Prepare schedule for any building from mobilization to Lintel work using MS project/PRIMAVERA 2.Prepare schedule for any building(continue) from Lintel to Slab casting using MS project/PRIMAVERA
			1. Bar Charts. Gantt chart 2. Networking techniques 3. Development of a network using CPM with simple problems.	1.Site visit	1.Prepare schedule for any building (continuous) slab casting to door & window fixing using MS project/PRIMAVERA
			1. Line of Balance Scheduling 2.Simple problem on PERT 3. Time-Cost Trade-off, Cost Control in Construction. Importance of Management Information System.	1.Site visit & data collection 2. Prepare Working tracking report using spreadsheet.	1.Prepare schedule for any building(continue)from door & window fixing to hand over using MS project/PRIMAVERA
			1. RESOURCE MANAGEMENT: Resource Planning, allocation and levelling. 2. Introduction to Material Management, Purchase management and inventory control. 3. Importance of PR (Purchase request), PO (Purchase order), WO (work order), GRN (goods received note).	1. Site visit.	1 Site visit & prepare Lead time chart for A, B & C class materials & link with scheduling. 2. Calculate man hours for construction activity & link with scheduling.
			1.ENVIRONMENTAL HEALTH AND SAFETY(EHS): ACCIDENTS-definition of accident terms: (Partial & total disablement,	1. Case study on hazards in construction.	1 & 2. Site visit & Prepare safety checklist for construction activity.

			Injury frequency rate, injury severity rate). 2. Accident- Causes, Precaution & Prevention in each construction activity. Hazards on Construction Sites 3. SAFETY- Importance of safety. Safety procedures and checklist for each construction activities as per OHSAS	2. Demonstrate on Safety measures in construction site personal protective kit, Toolkits according to construction activity	
			1. Safety meetings, Safety measures for storage, handling of building material and execution. 2. QUALITY MANAGEMENT: Total Quality Management (TQM)- Introduction, Importance & Functions of total quality management in the construction industry. 3. Tools for quality control, Elements and requirements of quality management.	Study the advanced techniques used to improve the quality of construction.	1.Field visit and demonstration 2.Prepare Third- party certification, Concept of ISO, Features of ISO9000 series, Benefit of ISO9000(ISO Certification, NABLcertification)
			1. Aims and ways of TQM. BIS certification of quality system. 2.Claims, compensation and disputes, Dispute resolution techniques, Introduction to Arbitration and Conciliation Act 1996 – case studies 3.Acts & Labour Laws	Site visit & data collection	1 & 2: Case study on preparation of technology manual for each activity
Total in hours					

NOTE 1: The course content shall be delivered through lectures, PowerPoint presentations, video demonstrations and field visits

NOTE 2: The TUTORIAL (Activity criteria) shall be conducted / executed by the student (Minimum ONE suggested activity from each week) and to be submitted in portfolio evaluation of activities through rubrics to the faculty.

NOTE 3: The PRACTICE (Performance criteria) shall be conducted by the student and observations and report to be submitted at the end of each session to the faculty

4. Reference:

Sl. No.	Description
1	**Town Planning** by Rangwala
2	Collier, Kieth, "**Managing Construction Contracts**"
3	Gajaria GT, **"Law Relating to Building & Civil Engg. Contracts in India**"
4	Frank Harris and Roland McCaffer, "Modern Construction Management"- 4th Ed. Blackwell ScienceLtd. 2009
5	Chitkara K K, "**Construction Project Management, Planning, Scheduling and Controlling**,McGraw Hill Education, 3rd Ed., 2014
6	Srinath L.S, **"PERT and CPM**", East West Press Pvt Ltd New Delhi
7	Peurifoy. R L, **"Construction Planning, Equipment and Methods**"- McGraw Hill.
8.	www.eprocure.gov.in
9.	www.OHSAS.co.in
10.	ISM codes (International safety management)

Design and Detailing RCC Structures

Subject code – CIV404

1. Rationale: This course is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise RCC Construction and fabrication. Students may also be required to design simple structural elements, make changes in design depending upon availability of materials This subject thus deals with elementary design principles as per IS: 456.

2. Course Outcomes/Skill Sets: At the end of the semester student will be able to,

CO-01	Identify the various structural RCC elements of a building for a given construction project.Explain the concept of Limit state design of Reinforced Cement Concrete (RCC).
CO-02	Explain the difference between the structural behaviour of different reinforced concrete structural elements through demonstration experiments and data analysis.
CO-03	Design, draft and detail different elements of reinforced concrete structural systems subjected to gravity, dead and live loads as per IS codes.
CO-04	Prepare bar bending schedules for different structural elements of buildings as per structural detailed drawing.
CO-05	Fabricate reinforcement for structural elements as per detailed drawing and Barbendingschedule.

NOTE: Detailing and drafting shall be done in AUTOCAD.
Barbending Schedule and Material calculation shall be done in a spreadsheet.
Prototypes shall be created at the end of each week by each student
Tools used during fabrication of steel shall be taught and safety protocol shall be followed in site/field.

3. Course Content

Week	CO	PO	Lecture (Performance Criteria)		Tutorial (Activity Criteria)	Practice
			3 hours/week		1 hour/week	4 hours/week (2 hours/batch twice in a week)
			1	Introduction: Concept of reinforced cement concrete structures, Different grades of concrete and steel used in RCC. Load and loadingstandards as per IS: 875.	1. Study different codal provisions	1 & 2 Demonstrate concept of density, Load and Loading standards for materials
			2	Design Based on Limit State Method: -Fundamentals of Limit State Method, types of limit state.		
			3	Introduction to stress block parameters, Assumptions in the theory of simple bending for RCC beams, Neutral Axis, Moment of resistance.		
			1	Critical neutral axis, actual neutral axis. Concept of under reinforced, balanced and over-reinforced sections.	1. Study the Codal provisions for development Length of bars, Side face reinforcement, Nominal Cover to reinforcement.	1 & 2: Demonstrate Failure modes of RCC structural elements with Videos and Photos.
			2	Concept of balanced, under reinforced and over-reinforced sections.		
			3	Partial safety factors, Flexural strength, Shear Strength, Concept of Deflection and cracking, Design requirements.		
			1	Beams: Design Concept of Simply supported and cantilever singly reinforced Beams as per IS 456-2000.	1. Prepare Barbending schedule for singly reinforced simply supported	1 & 2: Detailing and Drafting of Singly Reinforced simply supported beam as per codal provisions.

			2 & 3	Analysis and design of Singly reinforced simply supported beam.	beam using spreadsheet.	
			1	Continuation	1. Prepare Bar bending schedule for singly reinforced cantilever beam using spreadsheet	1 & 2: Detailing and Drafting of Singly Reinforced cantilever beam as per codal provisions
			2 & 3	Analysis and design of singly reinforced cantilever beam		
			1	Beams: Design Concept of Doubly reinforced Simply supported and cantilever Beams as per IS 456-2000	1.Prepare Bar bending schedule for Doubly Reinforced simply supported beam 2.Prepare Bar bending schedule for Doubly Reinforced cantilever beam	1. Detailing and Drafting Doubly Reinforced simply supported beam as per codal provisions.
			2	Analysis & Design of Doubly reinforced simply supported beam		2. Detailing and Drafting of Doubly Reinforced cantilever beam, as per codal provisions.
			3	Analysis & Design of Doubly reinforced cantilever beam		
			1	Design Concept of RCC One way slab.	1.Prepare Bar bending schedule for one way slab 2.Prepare a report on the design of economic section by optimization of materials.	1 & 2: Detailing and drafting of one-way slab as per codal provisions.
			2	Analysis of one-way slab.		
			3	Design of one-way slab.		
			1	Design concept of RCC two-way Slab	1.Prepare Bar bending schedule for two-way slab	1: Detailing and drafting of two-way slab as per codal provisions- Corners are not held down 2: Detailing and drafting of two-way slab as per codal provisions- Corners are held down
			2	(iii) Design of Two-way slab: a) Corners are not held down: All the Four edges discontinuous case only.		

			3	(iii) Design of Two-way slab: b) Corners are held down: All the Four edges discontinuous case only.		
			1	Design Concept of One-way continuous slab (Two span only) using moment coefficient as per IS: 456.	1.Prepare Bar bending schedule for one-way continuous slab 2.Prepare Bar bending schedule for two-way continuous slab	1. Detailing and Drafting of one-way Continuous slab, as per codal provisions
			2	Design of Two-way continuous slab: All the Four edges continuous case only.		2. Detailing and Drafting of two-way Continuous slab as per codal provisions
			3			
			1	Columns: Concept of long and short columns, Specifications for main and lateral reinforcement, interaction diagram in column design, Behaviour of RCC column under axial load.	1.Prepare Bar bending schedule for column (Square and rectangle)	Detailing and Drafting of Axially loaded short columns (square and rectangular as per IS specifications),
			2	Analysis and Design of Axially loaded column		Detailing and drafting of column subjected to uniaxial bending (square and rectangularas per IS specifications)
			3	Design of column subjected to uniaxial bending for reinforcement distributed equally on TWO sides only using SP-16 chart (Square and Rectangular).		
			1	Design of Column Footings: Concept of column footing, Design criteria for square, rectangular isolated column footings,	1.Prepare Bar bending schedule for isolated column footing (Square and rectangular)	Detailing and drafting of isolated column footing (square and rectangular) as per IS specification
			2	Design of square, rectangular isolated column footings,		
			3	Continuation		
			1	Design of Stairs: Introduction to stairs, Design of dog-legged stairs as per codal provisions.	1.Prepare Bar bending schedule for Stairs.	1.Detailing and Drafting of dog legged stair (with

						waist slab) as per codal provisions
			2	Single flight stairs-Waist slab		2.Detailing and Drafting of Folded/chain stair as per codal provisions.
			3	Design of Folded/Chain link stairs.		
			1	Design of Lintel with chejja: Introduction to lintel with chejja	1.Prepare Bar bending schedule for lintel with chejja	Detailing and drafting of lintel with chejja as per codal provisions
			2	Design of lintel with chejja		
			3	Continuation		
			1	Field Practice on bar fabrication for Beam, slab, column, column footing, lintel with chejja and field/site visit		
			2			
			3			
Total in hours						

NOTE 1: The course content shall be delivered through lectures, PowerPoint presentations, video demonstrations and field visits

NOTE 2: The TUTORIAL (Activity criteria) shall be conducted / executed by the student (Minimum ONE suggested activity from each week) and to be submitted in portfolio evaluation of activities through rubrics to the faculty.

NOTE 3: The PRACTICE (Performance criteria) shall be conducted by the student and observations and report to be submitted at the end of each session to the faculty.

Reference:

Sl. No.	Description
1	Design of Reinforced Concrete Structures by S Ramamrutham& R Narayan
2	Reinforced Concrete Structures by B C Punmia
3	SP-16 Design aid for IS 456-2000, SP-23 Handbook on concrete mixes
4	BIS, IS 456 – 2000 Code of Practice for Plain & Reinforced Concrete