

Integrated Program in Civil Engineering

Semester	Courses for Civil Engineering		
	Course Name	Credits per course	Number of Courses
I	Engineering Graphics and Design	3	1
II	A Professional's Approach to Law and Ethics (2022 Batch) Design Thinking and Creativity (2023 Batch and subsequent)	3	1
III	Applied Industrial IoT	3	1
IV	Foundation Engineering Practices	3	1
	Building Information Modelling in Construction	3	1
V	i) Concrete Building Systems Design ii) Practical Design of Structural Steel Members	3	2
VI	i) Structural Steel Buildings - Design and Practices ii) Precast Members: Systems & Construction	3	2
VII	Project Management for Professionals	3	1
Total			10

Engineering Graphics & Design

Unit 1	Basics of Engineering Graphics, Projection of Points & Lines
Introduction to Engineering Drawing, Manual & Computer-Aided Design, and Drafting, Lettering, Dimensioning, Geometrical Constructions, Plane Curves, Conic Sections, Cycloidal Curves, Involute – Projection of point placed in a quadrant – Projection of a line using first angle projection method, rotating line method, trapezoidal plane method – Solve & draw projections of a line kept inclined to two planes – Determination of true length, true inclinations & traces of a straight line.	
Unit 2	Projection of Planes & Solids
Description of plane shapes & solids - Drawing plane projections & solids using change of position and auxiliary plane method – Projection of solids with inclined axis – Drawing projection of solids using change of position and auxiliary plane method.	
Unit 3	Orthographic Projections & Sections of Solids
Visualization & drawing orthographic projections – Description & drawing of Plan, elevation, side elevation of objects, simple machine parts using first angle projection method – Description of section plane & a portion of solid – Drawing sectional top view, front view, the true shape of the section on an auxiliary plane	
Unit 4	Isometric & Perspective Projection, Development of Surfaces
Drawing isometric view of solids (Box method) – Drawing isometric scale & construction of isometric projection from orthographic projection – Drawing perspective projection of small, and large objects and building components using suitable methods – Drawing section plane & determining lateral surface – Determination of the shortest distance between points – Drawing & determining the shape of metal sheet to cut objects	
Unit 5	Building Drawing, Solid Modeling, Building Information Modeling
Drawing plan, elevation, and sectional elevation of a small residential & office building – Description & creation of Solid models in general and with respect to engineering – Designing and creating a new product & generating various views – Basics of Building Information Modeling (BIM)	

A Professional's Approach to Law and Ethics

Unit - I

General Principles of Contracts Management : General Principles of Contract, Competency and Enforceable Contracts- Various Types of Contracts and their Features- Government Contracts - Tenders, Request for Proposals and Bid Evaluations- Specific Contract- Insurance, Taxation, Contract Documentation- Performance , Joint Liabilities, Impossibility, Excusable Non-performance and Doctrine of Frustration- Breach of Contract, Consequences, Remedies- Specific Performance and Sale of Goods Act- Public /Private Partnerships- Build, Own, Operate and its Variations- Engineering Contracts, Standard Issues, Certification process and Issues relating to the Final Bill- FIDIC Model Contracts

Professional Ethics: Definition Types and Theories of Ethics- Code of Ethics and Professional Ethics - Gift vs. Bribery and Anti-corruption Laws - Whistle Blowing and Vigil Mechanism - Confidentiality Information and Data Protection - Tortious Liability -Environmental Breaches and Disaster Management - Discrimination at Workplace

Unit - II

Arbitration and Mediation : Introduction and Evolution of Arbitration Law Salient -Arbitration Agreements -Notice of arbitration and appointment of arbitrators - Seat v. Venue- Procedure to be followed by arbitral tribunal and jurisdiction of arbitral tribunal- Interim orders and How to challenge them- The Arbitration & the Award - Challenging the Arbitral Award - Arbitration's beyond India's borders- SIAC & LIAC - Enforcement of Foreign awards - Dispute Resolution Boards & Lok Adalats - Difference between Arbitration, Mediation, Conciliation and Negotiation - Alternate Dispute Resolution methods and Confidentiality

Unit - III

Corporate & Commercial Laws : Basic definitions and terms under Company Law- Difference between Companies and other entities - Articles and Memorandum of Association - Authentication of contracts and documents - Piercing of Corporate Veil -Corporate Social Responsibility - Appointment of Directors and Managerial Personnel- Mergers and Amalgamations- Offences Punishable under Companies Act - Adjudicating Authority under Companies Act - Landmark Judgments under Company Law - Basic Definitions and Terms under Insolvency Code - Overview of CIRP Process - Overview of Liquidation Process - Insolvency of Micro, Small and Medium Enterprises (MSME)- Insolvency Process for Personal Guarantors - Landmark Judgments under Insolvency Code - Competition Law - Anti-competitive agreement - Abuse of dominant position - Merger Control Regulations - Landmark Judgments under Competition Law

Unit - IV

Taxation : India Income-tax Introduction and Concepts - TDS-TCS Advanced Tax - Filing return of income - Tax Incentives for commercial entities - Exchange control regulations in India – FEMA - Basic terms and fundamentals - GST- Input tax credit - Customs Duty, FTP & SEZ

Engagement of Labour, and other construction related laws : Industrial Disputes Act - Building and other construction related laws - Sexual Harassment at Workplace - Health and Safety Laws - Environmental Protection laws - Social Security Laws - Labour codes and impact on construction industry

Environmental Protection laws : Environmental Laws in India - Understanding sustainable development - Environmental Impact Assessment an overview - Overview of International Conventions on Environmental Protection

Unit - V

Intellectual Property Rights (IPR) : Intellectual Property Law in India - Copyright and Trademarks - Patents and Designs - Product/ Process Patent and Terminology Role of -engineering students in Patent offices - Preparation of patent documents - IP in engineering companies- Trademarks - definition, concepts, registrable, non-registrable - Domain name and WIPO domain name process - Trademark & Copyright registration process - Computer programs and Copyright - Idea vs expression dichotomy- Designs registration process -Protection of trade sectors in India - Online Piracy - the Law in India - Competition and Confidentiality Issues, Antitrust Laws - Assignment and licensing of IPR – Patent, Trademark, Copyright, Design : infringement and remedies - IP issues in sale of business- Start-ups and IP- Software and Business Method Patenting in India & other Jurisdiction - Ownership of IPR and employment rights

Design Thinking and Creativity

Unit - I: Critical Thinking

Introduction to Critical Thinking, Styles and challenges of Critical Thinking, Benefits of Critical Thinking, Identifying & clarifying issues and arguments, Types of Arguments, Common patterns of Deductive reasoning & Inductive reasoning, Reasoning with Statistics, Fallacies of Relevance, Fallacies of Insufficient Evidence, Evaluating arguments, Critical Thinking models, Principles of Decision making, De Bono's Thinking hats, Effective Argument Writing, Critical Thinking based case study analysis, Analytical view of Science & Pseudoscience based thinking

Unit - II: Design Thinking Fundamentals and Framework

Fundamentals of Design Thinking, Design Thinking for complex problem solving, 7-stages of Design Thinking, Problem and solution spaces, Techniques of Empathy building, Empathy maps and user journey mapping, Storyboarding and role-playing, Exploring solution space, Design Thinking practising use – cases, Design Thinking for Professional Skills, Design Thinking practices for Coding skill, Co-curricular skill, Technical blog writing, Contest preparation, Designing Capstone projects, Design Thinking in industrial projects, Strategy for new technology innovations

Unit - III: Design Thinking in Creativity & Innovation

Unique characteristics of Design Thinking, Difference between Creativity and Innovation, Categories and misconceptions of creativity, Resilience in problem-solving, Analytical Thinking – Driven by Design Thinking, Case study on collaborative creativity enhanced by Design Thinking, Waterfall models and Design Thinking, Agile Development models, Agile process integrated with Design Thinking, Different use-cases, and project problem statements, Design Thinking based Product development - Design methodology, Prototyping, UX design, Value proposition, Business model

Unit - IV: Leadership and Teamwork

Defining leaders and leadership, Types of leaders and leadership styles, Understanding the people, personalities and abilities, Active listening, Non-verbal communication, Feedback, Clarity, Effective teams, Stages of team development, Understanding the psychology of change for individuals and teams, Personal resilience and well-being, Feedback and feed forward, Leaders and teams: Working effectively towards common goals, Role of integrity in leadership, Embracing growth mindset in leadership, Conflict resolution and Managing team dynamics

Unit - V: Verbal and Non-verbal Communication

Verbal and non-verbal communication, LSRW skills, Assertive communication, Persuasion Skills, Interpersonal Skills, Cross-cultural communication, Emotional intelligence, Self-awareness, Interpreting body language, Active listening, Personality development, Time management and Goal setting

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Applied Industrial IoT

Unit - I: Introduction to Industrial IoT & IoT Architecture

Phases of Industrial Revolution, Concept of Internet of Things, Summary: Overview of Industrial IoT, Drivers, Benefits and Challenges of IoT, Summary of Drivers and Challenges in IIoT, Categories of IoT.

Information and Operational Technology, Layers of IIoT Architecture, Functions of IIoT Architecture Layers, Summary of IoT Architecture, Summary of IoT Layered Architecture, Solar Plant Management, Utility Monitoring in Railways, Components of IIoT Architecture, Introduction to On-premise servers and Cloud, Review of Components in the First two layers of IoT, Review of Components in the Network Layer of IoT, Review of Components in the Application Layer of IoT, Review of the Server architecture in IoT, Annunciator Monitoring.

Unit - II: Data Acquisition

Fundamentals of Sensors, Types of Sensors, Some Common Sensors, Choosing a Sensor, Review of Sensor Fundamentals, Review of Different Types of Sensors, Review of Selection of Sensor,

Pharma Industry, Pharma Industry, Electricity cost distribution in commercial buildings, Electricity cost distribution in commercial buildings, Demo - Energy Measurement, Sensor Technologies, Thermal Sensors, Pressure, Shear and Photo Sensors, Electrical, Magnetic and Mechanical Sensors, Corrugated boxes, Bottling plant, Introduction to Measurements and Direct Measurement, Indirect Measurement, Derived Measurement, Measurement from Industrial Systems, Summary of Concepts of Measurements and Direct Measurement, Summary of Indirect and Derived Measurements, Measurements from Industrial Systems and Calibration, Energy monitoring in Casting process, Heavy Equipment Forging

Unit - III: The Edge Computing

Edge Computing, Gateway Overview, Types and Features of Gateway, Overview of Edge Computing, Summary: Overview of Gateway, Selecting a Gateway, Packaging Industry, Bottle Manufacturing, IoT Gateway, IoT Gateway Hardware, Choice of Gateway, Configuring the Gateway, IoT Video Analytics and Quality Control at the Edge, Summary of the Fundamentals of an IoT Gateway, Summary of the IoT Gateway Hardware and Configuration, Summary of Choice of Components in a IoT Gateway, Automotive Component Manufacturing, Aluminum Extrusion.

Unit – IV: IoT Connectivity Protocols

IoT Connectivity Overview, Wireless Long Range (WAN) Protocols, Wireless Short Range Protocols
IIoT Example of Sensors and Gateway - Wheel Loader, Summary of IIoT Connectivity, Summary of IIoT Wireless Short- & Long-Range Protocols, Automotive Component Casting, Tool Bit Manufacturing, LAN Protocols, Serial Protocols, Optical Networks, Transmission Protocols in IoT, Choice of Protocols, Industrial IoT Example - Smart City, Wired LAN and Fiber Optic Protocols, Serial Protocols in IIoT Solutions, Review of Transmission Protocols, Fasteners – Production Monitoring, Bucket Wheel Excavator Monitoring, Demo - Linear Level Transmitter

Unit – V: Platform Architecture & IIoT Security

Platform Architecture Overview, Types of Server Architecture, Data Architecture, Data Ingestion and Stream Processing, Smart Monitoring of Diesel Generators, Review of the Fundamental Concepts of Platform Architecture, Review of the Different Types of Server Architecture, Big Data Architecture and Stream Processing, Aerospace Parts Manufacturing, Metal Stampings, Demo - Pulse counting with Control Input, Storage Devices, Storage Technologies, Storage Dimensioning, Database, Summary of Storage Devices and Technologies, Review of Storage Dimensioning, Databases and Data Lakes, Polymer Extrusion, Steam Turbine Monitoring, Analytics Overview, Types of Analytics, Algorithms and Machine Learning, Visualization, Summary of Data Analytics, Summary of Algorithms and Machine Learning, Summary of Visualization, Examples of Different Algorithms, Diesel Generator Monitoring, Diesel Generator Monitoring, Water Management in Public Utilities, Water Management in Public Utilities, Demo - Flow Sensing with Totalizer.

IIoT Security Concerns, IIoT Device Security, IIoT Connection Security, IIoT Application Platform and Cloud Security, Threat Modelling, Industrial Example - IoT Connected Workplace Solution, Summary of IoT Security, Securing Access, Authenticity and Data in IoT Solution, Review of Concepts of Threat Modelling, Bulk Milk Cooler Monitoring, Air Compressor Monitoring

Foundation Engineering Practices

Unit – I Introduction and IS Code provisions

Introduction to Indian standard codes for laboratory and Field testing with overview of testing equipment, Standard penetration tests, Dynamic cone Penetration tests, Plate load tests, Drilling and boring methods, Stages of investigation, Soil and Rock sampling methods and Real-time soil profile reports.

Unit – II Preparation and interpretation of geotechnical reports

Data interpretation and soil classification, Rock Classification, liquefaction of soil- Case studies from construction projects, Evaluation and Mitigation, Selection of foundation- Factors governing selection and preparation of a geotechnical report, Analysis and preparation of soil profile. Case studies.

Unit – III Bearing capacity of shallow foundations

Types, Advantages and limitations of shallow foundations, General considerations to shallow foundations- Isolated, combined, raft foundation. Bearing capacity of shallow foundation- in soil using IS 6403 Part 2, Bearing capacity of shallow foundation in rock, Calculation of bearing capacity based on SPT, PLT and SCPT values.

Bearing capacity calculations and Settlement analysis in cohesive and cohesionless soils. Overview of software for settlement calculations. Methods to reduce total and differential settlements.

Unit - IV. Raft, Piles, Special foundations

Introduction, construction and types of raft foundations, Concept of proportioning footings and contact pressure distribution, Code provisions, application of software. Need for special foundations, Machine and Floating foundations, Well foundations and Modulus of subgrade reactions, Example problems.

Design requirements of grade slabs for point loads, line loads and uniformly distributed loads, Design of joints and case studies and foundation drawings. Code provisions and construction procedures and workmanship of Bored Cast insitu piles, Precast Piles, Under Reamed Piles and Precast driven piles, Materials, equipment and stresses, Case studies. Computation of vertical and lateral capacity of piles and pile group efficiency.

Testing on piles, Pile integrity tests and Overview of software for pile foundation

Unit - V Retaining walls, earth pressure theories

Types of retaining structures, Forces on Retaining walls- Active, Passive and at rest conditions, Types of earth pressures & drainage types, Code provisions as per IS 14458 Part I, Rankine and Coulomb's active and passive earth pressure theory. Effect of Uniform surcharge and line load & Other methods, Frictional circle method, Drainage of Backfill materials, Introduction to Mechanically stabilized earth or Mechanically reinforced walls, Overview of Other Retaining Structures, Applications & Stability of Retaining walls.

Building Information Modeling in Construction

Unit – Introduction to BIM Concepts and Design Authoring

Evolution of Engineering from 2D drawings to BIM Model, Building Information Modeling – Introduction & Process.

Design Authoring – Concepts and workflow, Introduction to stages of BIM Modeling process as per ISO 19650. Discipline based modeling - introduction to Revit tools, Revit Architecture modeling, Revit Structure modeling, Revit MEP modeling.

Federated model- Concepts and demonstrations, Design Co-ordination using Revit, Engineering Analysis – Concept and types of analysis, Process, and workflow of Design Review in BIM.

Unit – II Visualization and Interference/Clash check

Views in BIM Model, Visualization Modes, Walkthrough of the Model, Fly through the model, Layers & Properties, Concept of viewpoints, Sectioning and Visualization through Tablet and Mobile, Concept of BIM Kiosk & BIM Rooms, Visualization through Augment Reality (AR), Virtual Reality (VR) & Mixed Reality (MR)

Clash Check – Types, Clash avoidance process, Clash Detection Process, Clash Detection Priority Matrix and Report generation, Clash Detection Rules, Report, Grouping, Clash Detection using software tool.

Unit – III Documentation & CDE & Level of Development

Extraction of Schedules and Sheets from BIM model – Revit tool. Importing and Exporting file formats in Revit.

Documentation and CDE (Common Data Environment) - Concept of Cloud Computing, Concept and Application of CDE, Setting up the workflow and process for CDE.

Concept of LOD (Level of Development), preparation of LOD matrix and Progression matrix, LOD-Chart, Matrix and Model Progression Matrix

Unit - IV 4D / Field BIM & Its Applications

Introduction to 4D / Field BIM: Concept of 4D, Introduction to construction sequence and project schedule, Project scheduling using Gantt Chart and its limitation, 4D BIM Modeling-Project demo and workflow, Synchronization of 4D BIM Model with project schedule, Reviewing project progress w.r.t planned dates and actual dates, Generation of Reports

Application of Field BIM/ 4D BIM: Understanding concept and usage of BIM in field for coordination- 3D Coordination and Visual Communication, Site utilization planning and Construction analysis, Application of wearables in coordination. 3D Control and planning

Other Applications of Field BIM/ 4D BIM: Concept and usages of BIM in field for safety, disaster and risk analysis, digital fabrication and scan to BIM, Existing Condition Modeling, Phase Planning, As-built/ Record Models

Unit - V 5D BIM, AIM & Beyond BIM - Emerging Trends

5D BIM: Introduction concepts of 5D BIM, Quantity take off with UoM, Concept of QTO with UoM, 5D BIM with UoM with cost, Quantity take off exercise, Demo of Quantity take off: Understanding QTO for Wall, Plaster & Tile, BIM Maturity LOD and General Practice of QTO, Cost Breakup structures, 5D BIM and cost control

AIM: Introduction to Asset Information Model (AIM), COBie structures and Asset Information Deliverables, Space Attributes and Asset Attributes- Examples with data, Asset requirement-Discipline wise Infrastructure System, Classification code and Information Exchange, Information Exchange with Facility Management

Beyond BIM: Emerging Trends- Concepts of Industrialisation, IoT, Big Data, Data Analytics and their applications in BIM: Industrialisation of Construction through BIM- DfMA, IoT in BIM, BIM and Big data, Data Analytics using AI & ML

Future scope of BIM Applications: Smart Infrastructure and the need for connected infrastructure, Digital twins- Concepts and benefits, National Digital Twin or a City level Digital Twin in a Smart City, Fundamental requirements for the success of a Digital Twin and its uses, Digital Twin applications in diverse industries.

Concrete Building System Design

Unit - I : Introduction and Codes- Design Basis Parameters and Report

Indian & International Codes for Reinforced concrete Design, Design loads and detailing of reinforcement, Handbooks for reinforced concrete design, National Building Code 2016, Practical building examples, drawing sizes and scales, Reading Drawings – Architectural & Structural.

Introduction to DBR Parameters - Geometric Parameters, Occupancy Categories, Site location and associated parameters, Design life of structures, Material Specifications - Grade of concrete for vertical and floor elements – Grade of reinforcing steel, Exposure and cover requirements, Fire rating requirements, Load Combinations, Serviceability Requirements, Analysis tools, Design Basis Report, Concept explanation with example buildings.

Unit - II : Loads & Setting the Structural Scheme

Introduction, dead loads, superimposed dead loads, Live loads, Wind loads, Wind pressure coefficients, Determining global wind forces and wind velocity, storey forces and base shears. Earthquake loads, response spectrum to earthquake excitation, seismic design parameters - horizontal acceleration coefficient, Time period, Evaluation and application of seismic base shear, equivalent static method.

Loads from MEP Services and architectural considerations like façade loads

Scheme Design, Concrete floor systems, Sizing and design of various slab systems, Dimensioning & designing of drop panels, Beams, Reinforced Concrete Columns - Location and Shape, Design Axial Load, Sizing, Lateral Load Systems, IS 1893- Requirements, Shear Walls – Location and thickness. Estimating relative stiffness of core walls.

Unit - III : Structural Models

Introduction to Analysis & Modelling, Modelling of Cantilever, Portal Frame, three bay Portal Frame, 3D structural models - Geometry, gravity loads, defining earthquake loads, defining wind loads, Modelling Shear walls, Practical Structural Model of building, Structural models of Floor System, Direct design method for Flat Slabs, Analysis of two-way slabs using moment coefficient method, Application of moment coefficient method, Estimation of deflections

ETABS software demonstration for correct modelling and design of Vertical and Lateral loading systems like Shear Walls

Unit - IV : Design of Structural Elements

Design of structural elements - Design of Beams- flexural reinforcement, shear reinforcement-design of edge beam, Practical examples, Design of flat slabs- Flexural Reinforcement, shear reinforcement- Practical Examples-Design of mesh reinforcement, additional bottom reinforcement, additional top reinforcement, Design of 2-way continuous slabs.

Design of Reinforcements in Columns - Post processing of column forces from analysis, Design and arrangement of vertical reinforcement, Design of horizontal reinforcement, Design of stirrups, Cardinal rules in scheme design of buildings, Coordination with other Engineering disciplines

Design of shear walls – General considerations, Seismic response of RC structures, Vertical and Horizontal Reinforcement, Calculation of design forces, moment capacity of vertical distributed reinforcement, Design of boundary elements and boundary zone. Sizing of elements based on Constructability aspects like formwork, concrete placement and compaction, rebar arrangement to satisfy economy and optimum utilization.

Unit - V : Detailing of Structural Elements- Bill of quantities and conclusion

Development length of rebars, detailing of various structural elements - flat slabs, two-way continuous slabs, beams, columns and shear wall, detailing and documentation of practical example building.

Bill of quantities - Concrete and steel indices for RC buildings, Reinforcement consumption in RC members, BoQ of practical example building.

Practical Design of Structural Steel Members

Unit - I : Introduction to Structural Steel

Overview of the classification, sections, properties & behaviour of Steel used for structural construction, and its use in different elements of a structure, design philosophies and the process of steel making.

Unit - II : Member design in tension and Compression

Behavior, failure modes & strength factors of tension members, including effects of shear lag, designing tension members for use, as various elements in structures (Bracings, Sag rods, Lug angles), with design examples from projects

Behavior of members in compression, theories of buckling & case studies of live examples of compression members, Effective length concepts, designing members for axial compressive loads, with different types of sections (Hot-rolled, built-up battened/laced columns) & column curves, with design examples from projects.

Unit - III : Design of Beams and Beam-Column

Analysis of beams, the classification of beams & sections used, and designing a beam-loading, laterally supported and unsupported, shear center concepts, biaxial bending and torsion, Serviceability criteria.

Design of Purlins with hot-rolled sections.

Analysis and design of plate girders, considering individual & combined effects of its elements-tension, shear buckling, stiffened and unstiffened webs.

Design of beam-column, effects of first & second order moments and deflection in analysis.

Unit - IV : Design of Structural Connections and Roof trusses

Classifying different elements, types & methods of connections between structural members at different parts of a structure, analyzing the force flow, and design. Design of bolted (normal & HSFG) and Welded connections (fillet & groove welding. Column base plates and anchor bolt design.

Roof trusses, different parts of a truss and various types used, as per loads and dimensions of a truss, assumptions, use, factors influencing economic truss structure

Unit - V : Plastic analysis & design

Behavior of a member in its plastic region, in comparison to a member in its elastic region, analysis with various support conditions and loadings, computing shape factors, hinge mechanisms, and designing a member.

Structural Steel Buildings – Design & Practices

Unit – I : Analysis & Design Philosophies, Codes of Practice and General Design Aspects

Structural steel and its Mechanical Properties, Hot Rolled steel sections, Structural Steel sections and section classification. Analysis and design of buildings as per Codes of Practice, design philosophies, Advantages of steel buildings in comparison with other types of structures

Inputs for the design of a steel building - Design Basis Report covering Site location, Site Specific aspects, building functionality, Construction planning, Geometric parameters of the building, Structural systems, Special geometries and its structural systems, Functional requirements necessary for the end user, Material specifications.

Methods of designing a steel building, Design life of a building, Exposure conditions and corrosion protection, Gravity and lateral load resisting elements and systems, Concrete and reinforcement, Block work, floors and Roofs, Structural steel, bolts, welds, fire proofing and Painting materials

Unit – II : Computation of Vertical, Lateral & Special Loads and Load combinations

Calculating the various loads acting on a steel building - Vertical & lateral loads - Effects of each loads separately and in combination – Dead, superimposed dead, live, temperature, MEP service loads - Lateral loads due to wind and seismic effects

Design of wind speed and pressure, Pressure and Force coefficient method, Deflection and drift limits, Drag, interference and dynamic effects Floor Vibration, Fire resistance, Analysis and design methods, Wind load calculation for an example steel building.

Unit – III : Selection of Load Resisting Systems, Structural Modelling, Analysis & Design

Studying the layout plans of the structure – Codes and Reference drawings, Selection of load resisting systems - Load flow in each system - Satisfying stability & strength of the structure - Vertical and lateral load resisting systems, Integration of MEP services and its supporting structures in buildings

Overview of BIM and its importance in structural modelling

Computer aided modelling, analysis & design (STAAD Pro) - Geometric & structural parameters of the structure - Loading the structure - Interpretation of the results of the software – Analysis & design of a multistoried building from a project for comprehending the design from a practical standpoint. A sample of Structural Design Basis report.

Unit - IV : Design of Various Elements & Connections of a Steel Building

Manual & software aided design – Beams, columns, floors, bracings, purlins/girts & facades, base plates & anchor bolts –different conditions of supports, exposure, and purpose of use - Design of connections between the members – Bolted and welded, moment and shear connections to be adopted in various locations of a building

Tension members in buildings – Types and grades of tension members, Design of mullions and transoms

Special connections for equipment and other services like staircases, roof, terrace, and other special elements.

Project based on excel spreadsheet development.

Unit – V : Design of an Industrial Building & Detailing, Fabrication and Erection aspects

Design of an industrial building - Selection of sections as per requirements - Configuration of the elements and their connectivity - Functional requirements

Beam design Approach for buildings – Manual and software Design of beams- Cantilever beams and built-up beam, torsion in beams and back up beam concept, Service integration in beams, Simplified floor vibration analysis Column Design Approach for buildings -Manual and software design of column, Addressing failures and optimization in column design

Beam-Column design approach for buildings- Design of beam-columns, Base plate and anchor bolts, Planning and design approach of terrace floor, Architecturally exposed steel.

Study of General Assembly drawings, Fabrication drawings and procedures - Fabrication processes - Transportation for structural Steel construction and erection - Sequence of erection - Inspection of a completed structure

Good Design, Detailing and construction Practices. Design summary of Example building

Precast Members - Systems and Construction

Unit - I - Introduction to Precast and its elements

Introduction – current scenario and constraints, the difference between precast vs conventional construction methods, needs, types, features, Advantages (for owners, architects, engineers, contractors, end users) and Limitations, Residential, Commercial & Industrial Applications of precast, Materials used, Code provisions and clauses.

Major elements (Beam, slab, wall, column, foundation, staircase, roof elements, façade) :
Classification, Types and shapes, selection, application, erection, advantages, Infra works -Pipes & drains, duct bank, baggage handling tunnel, culvert and sleeper, fascia element, pavement and channel.

Unit - II - Precast Structural Systems, Production, Storage, & Logistics

Structural System: Skeletal System, Portal Frame system, Large Panel system, Cell Block system and hollow block system, Guide lines of selection – Residential & office buildings, Industrial Buildings, Commercial buildings, Structural Stability and Structural Behaviour

Plant and Production: Introduction -Types & Process, Production – Design and shop drawings, check lists, Moulding, Casting and its types, Concreting, Curing, Demoulding and inspection.

Storage, Delivery, Handling- introduction and types of equipment, lifting devices, Erection and installation - Horizontal components, vertical components, special elements, Quality Inspection and Tolerance

Unit - III - Modelling, Analysis and design of Wall system

Design Basis Criteria: Geometric parameters and Occupancy, Location and Associated Parameters, Systems and material specifications, analysis tools, Loads and Load Combinations – gravity loads, lateral loads (seismic and wind)

ETABS software, Modelling, Analysis and Design of structural elements for RC Wall system: Design of RC wall, beam, slab & staircase, Design for stripping, stacking, transportation and erection for all elements.

Unit - IV - Joints Connections for RC Wall system, Modelling, Analysis, Design of the Frame system

Joints connections for RC wall system – Wall to foundation, wall to wall horizontal connection, wall to wall vertical connection, beam to wall connection, beam to beam connection, slab to wall – progressive collapse, diaphragm action & slab to beam connection, staircase to beam or wall connection.

Modelling, Analysis and design for Frame system and its connections: ETABS Modelling, Analysis and Design for frame system (foundation, column, beam, slab etc.)

Unit - V – Prestressed concrete and Preventive Measures and case studies

Prestressed Concrete, Various types of slab design and its check, Slab to beam connection

Preventive Measures – Testing requirements, water tightness, temporary supports, MEP-related preventive measures, progressive collapse – introduction and design, common defects and remedies Case Studie - Residential Project, Commercial Project

Project Management for Professionals

Unit – I Contract Management and Scope Management

Introduction to Project Management, Project and Project Lifecycle – Process, Phases, Organization, Project Financial Feasibility Methods, Non-numerical Feasibility Methods.

Basic Concepts of Contract Management, Essential elements, Contract Types, Tendering and Proposal Preparation, Key Commercial Terms and Conditions, Bid Evaluation and Contract Award, Contract Administration, Claim Management. Work Breakdown Structures- Creation & Case Study

Unit – II Schedule and Resource Management

Approach to schedule management, Charts, Sequencing and Dependency, Network Diagram, Activity Duration, Critical Path Method, Float, Case study, Relationships, Case Study, Precedence Diagramming Method.

Resource Allocation and Resource Levelling, Case Study on Schedule Compression, PERT to Predict the Probability of Project Completion.

Unit – III Project Cost and Quality Management

Cost Estimation, Budget and Variance Analysis, Monitoring and Control, Cash Flows, Case Study.

Occupational Health, Safety and Environment, Barriers, Quality Management System – Chart and tools.

Unit – IV Procurement, Subcontracts and Stakeholder Management

Supply Chain Management, Logistics and Transportation, Vendor and Inventory Management.

Stakeholder Analysis and Engagement, Project Communication, Dealing with Difficult Stakeholders.

Unit – V Project Risk Management and Project Monitoring

Process, Terminology, Identification, Analysis and Response Strategy

Analysis Techniques, Monitor and Control Schedule, Cost, Resources, Quality and risks

Creating schedules, Assigning Resources, Cost, Evaluation, Optimization and Tracking.