

CRAFTSMEN TRAINING SCHEME (CTS)

ANNUAL INSTRUCTIONAL PLAN

DRAUGHTSMAN CIVIL (SECOND YEAR – 42 WEEKS)

(Curriculum as per DGT / CSTARI Guidelines for Draughtsman Civil CTS Scheme - 2nd Year)

Trade Name	DRAUGHTSMAN CIVIL (Engineering Trade)
NSQF Level & Duration	NSQF Level-4 Two Years (Second Year - 42 Weeks)
Academic Session	20____ - 20____
Institute Name & Address	
Instructor Name & Designation	
Group Instructor (GI) Name	
Principal / Superintendent Name	

WEEKLY INSTRUCTIONAL BREAKUP (WEEK 1 TO WEEK 42)

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 1	- Drawing details of single-storied residential building with attached bath (pitched and flat roof). - Develop line plans into detailed working plans, elevations, and sectional elevations to suitable scale. - Layout and detailing of rooms, wall thicknesses, openings, and verandas.	- Principles of building planning: Aspect, prospect, privacy, grouping, roominess, sanitation, and flexibility. - Objectives and importance of building drawing in civil engineering works. - Orientation of buildings with respect to sun path, prevailing wind directions, and climatic conditions.
Week 2	- Create municipal submission drawings of residential buildings showing boundary setbacks and road widths. - Draw key plan, layout plan, site plan, and calculate plot coverage and floor area ratios. - Prepare area statements (built-up area, carpet area, plinth area, super built-up area).	- Local building bye-laws as per National Building Code (NBC) and municipal regulations. - Setback distances, open spaces around buildings, maximum permissible height, and FAR/FSI. - Provisions for fire safety, means of escape, green belt requirements, and rainwater harvesting.
Week 3	- Computer practice: Operating system setup, CAD software installation, and GUI overview. - Practice basic drafting function keys, cursor controls, display controls, and zoom commands. - Practice elementary drawing commands: Line, Polyline, Circle, Arc, Rectangle, Polygon, and Ellipse.	- Computer Aided Drafting (CAD): Hardware requirements, input/output devices, and software architecture. - Graphical User Interface (GUI): Ribbon menus, toolbars, command prompt, status bar, and workspace settings. - Coordinate systems in CAD: Absolute coordinates, relative Cartesian coordinates, and relative polar coordinates.
Week 4	- Practice basic CAD modify commands: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Trim, Extend. - Setting up drawing parameters: Units, limits, snap, grid, ortho, polar tracking, and object snap (Osnap). - Create objects in different layers with assigned colors, line types, and line weights.	- Drafting and modification tools in CAD; efficiency in using shortcut keyboard commands. - Layer management: Purpose of layers, creating layers, locking, freezing, turning on/off, and layer filters. - Object properties: Color, line type scale (LTSCALE), line weight, and matching properties.
Week 5	- Customize Text styles and Dimension styles as per civil engineering drafting standards. 2D drafting of civil components: Flush doors, panelled doors, glazed windows, ventilators, and hand railings. 2D drafting of plumbing fittings, wash basins, water closets, and sewerage pipe joints.	- Dimensioning in CAD: Linear, aligned, angular, radius, diameter, continuous, and baseline dimensioning. - Dimension style manager: Dimension lines, extension lines, arrowheads, text placement, and tolerances. - Standard architectural detailing of joinery and plumbing fixtures.
Week 6	- Creating reusable Blocks of doors, windows, sanitary fixtures, electrical fittings, and trees. - Make custom WBlocks and organize standard library folders for architectural drafting. - Create layout space (Paper Space), viewports, title block templates, and plot drawings to required scale.	- CAD Blocks and Attributes: Advantages of blocks, creating blocks, inserting, exploding, and dynamic blocks. - Library folder management and symbol libraries for building components. - Plotting and printing: Model space vs Paper space, page setup, plot styles (CTB/STB), scale factors, and plotters.
Week 7	- CAD drafting of double-storied flat roof residential building (single/double bedroom with attached bath). - Draw ground floor plan and first floor plan showing room dimensions, wall thicknesses, and openings. - Draw front elevation and sectional elevation cutting through staircase and toilet.	- Planning and designing of double-storied residential buildings: Load-bearing vs framed structures. - Vertical circulation planning, staircase location, headrooms, and stair flights. - Provisions for natural lighting, cross-ventilation, and privacy in multi-room residential layouts.
Week 8	- Draw detailed sectional plan and elevation of two-storied residential building showing partly tiled and partly RCC roof. - Draw detailed working drawings showing foundation details, plinth beam, lintels, chajjas, and slab levels. - Prepare municipal approval drawing sheet including site plan, key plan, service plan, and area statement.	- Prefabricated structures: Preparation, construction methods, modular coordination, and assembling. - Advantages and limitations of precast concrete construction in residential housing. - Composition and drafting conventions of building sanction sheets for local authority approvals.
Week 9	- Design and draft a double-storied 3-BHK residential bungalow in CAD. - Insert furniture blocks: Living room sofa sets, dining tables, beds, wardrobes, and kitchen counters. - Draw electrical appliance layouts, switchboards, conduit paths, and plumbing/sanitary pipe routings.	- Interior space planning, ergonomics, furniture clearance standards, and circulation paths. - Integration of electrical, plumbing, and sanitary service layouts with architectural floor plans. - Economy in building planning and modern trends in sustainable green residential buildings.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 10	- Introduction to 3D modeling workspace in CAD; create and manage multiple model space viewports. - Practice 3D coordinate systems (UCS - User Coordinate System), 3D orbit, and visual styles. - Create and edit 3D wireframe models and 3D solid primitives (Box, Cylinder, Cone, Sphere, Wedge, Torus). - Practice 3D operations: Extrude, Revolve, Sweep, Loft, Union, Subtract, Intersect, 3D Rotate, and 3D Mirror.	3D modeling concepts in CAD: Wireframe modeling, surface modeling, mesh modeling, and solid modeling. - User Coordinate System (UCS): World coordinate system (WCS) vs UCS, manipulating UCS axes in 3D. - Boolean operations (Union, Subtract, Intersect) and solid editing tools (Fillet Edge, Chamfer Edge, Shell).
Week 11	- Create 3D exterior model of a single-storied residential building from 2D floor plan using solid extrusion. - Create 3D wall openings, insert 3D doors and windows, and model RCC flat slab with parapet wall. - Apply materials, textures, sunlight, point lights, and render photorealistic 3D perspective views.	3D architectural modeling procedures: Generating 3D walls from 2D plinth layouts. - Materials and mapping: Diffuse maps, bump maps, reflectance, and assigning textures to civil structures. - Lighting and rendering techniques in CAD: Default lighting, sun angle, artificial lights, and camera positioning.
Week 12	- Prepare CAD drawing of a Primary Health Centre (PHC) for rural areas with RCC flat roof. - Draw layout plan showing OPD, consulting rooms, minor OT, ward, pharmacy, and emergency access. - Draw front elevation, longitudinal section, and detailed plumbing service plan.	- Planning and designing of public healthcare buildings: Zoning, patient circulation, and hygiene requirements. - Barrier-free architectural design for persons with disabilities: Ramps, grab bars, and accessible toilets. - Landscaping and recreation: Layout of public parks, playgrounds, parking norms, and open spaces.
Week 13	- Prepare CAD drawing of a Village Library building with reading rooms, stack rooms, and admin section. - Prepare CAD drawing of a small Restaurant building showing dining hall, commercial kitchen, and washrooms. - Prepare CAD drawing of a single-storied primary School building showing classrooms, verandahs, and playground.	- Architectural planning of educational and commercial public buildings as per NBC norms. - Fire safety codes, emergency fire exits, occupancy loads, and evacuation stairs in public buildings. - Concepts of earthquake-resisting building design: Symmetry, regularity, soft storeys, and flexible elements.
Week 14	- Prepare CAD drawing of an industrial workshop building with North Light Steel Roof Truss over RCC columns (6-10m span). - Draw foundation plan, column layout, roof truss elevation, purlins, roofing sheets, and gutter details. - Draw service plans for industrial workshop: Electrical power points, compressed air, and water drainage.	- Industrial buildings: Functional requirements, ventilation, natural illumination via north light roof trusses. - Base isolation techniques and earthquake mitigation features in industrial framed structures. - Design and drafting of service plans for public, commercial, and industrial structures.
Week 15	- Reinforcement detailing of RCC members in CAD: Singly reinforced and doubly reinforced rectangular beams. - Draw longitudinal sections and cross-sections at mid-span and support showing main, anchor, and shear stirrups. - Prepare Bar Bending Schedule (BBS) for rectangular beams calculating cutting lengths and total steel weight.	- Reinforced Cement Concrete (RCC) principles: Limit state method, grades of concrete (M20, M25), and steel (Fe415, Fe500). - Singly vs Doubly reinforced beams: Compression steel necessity, cover requirements, and shear reinforcement. - Bar Bending Schedule (BBS): Terminology, standard hooks, bends, crank allowances, and bar weight formulas.
Week 16	- Reinforcement detailing of RCC Lintels with integrated Sunshade (Chajja) in CAD. - Reinforcement detailing of One-Way Slab and Two-Way Slab showing main bars, distribution bars, and corner torsional steel. - Prepare Bar Bending Schedule for one-way and two-way slabs.	- RCC slabs: Structural behavior of one-way slabs ($L_y/L_x > 2$) vs two-way slabs ($L_y/L_x \leq 2$). - Placement of reinforcement: Cranking of bars, alternate bend-up bars, distribution steel, and minimum cover. - Cantilever action in chajjas: Top tension reinforcement, anchoring length, and temperature reinforcement.
Week 17	- Reinforcement detailing of RCC isolated square/rectangular column footings (sloped and stepped footings). - Draw detailing of RCC columns showing longitudinal rebars and lateral ties/helical reinforcement. - Draw continuous RCC columns through two storeys showing lap splices, cranked rebars, and tie spacing.	- Column and footing design detailing as per IS:456-2000 and SP-34. - Column ties: Purpose of lateral ties, pitch, diameter, seismic hooks (135° bend), and confinement zones. - Lapping of reinforcement bars: Lap length in tension and compression, staggering of laps, and mechanical couplers.
Week 18	- Reinforcement detailing of RCC dog-legged staircase showing waist slab, landing beams, and flight reinforcement. - Draw reinforcement detailing of RCC T-beam, inverted beam, cantilever beam, and retaining wall (cantilever type). - Prepare comprehensive Bar Bending Schedule and calculate steel quantities for residential framed structure.	- Staircase structural detailing: Waist slab design, rebar distribution at kink points, and landing supports. - Retaining walls: Stem, heel slab, toe slab, shear key, and soil earth pressure distribution. - Concrete quality control: Slump test, cube compressive strength test, water-cement ratio, and compaction.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 19	• Draw common forms of structural steel sections using CAD: Angles (ISA), Channels (ISJC, ISMC), Beams (ISMB, ISWB, ISHB). • Draw structural steel T-sections, flat bars, round bars, square bars, and hollow structural sections (SHS, RHS, CHS). • Draw structural fasteners: Types of rivets, rivet heads, bolted connections, and weld symbols as per IS:800.	1. Structural steel: Properties, advantages in heavy construction, rolled steel sections and designations. 2. Structural fasteners: Riveted joints, pitch, gauge, edge distance, failure modes of riveted/bolted joints. 3. Welding in steel structures: Fillet welds, butt welds, welding symbols, and comparison with bolting.
Week 20	• Draw details of built-up steel stanchions (columns) with lacing and batten systems in CAD. • Draw column base connections: Slab base and Gusseted base with anchor bolts, gusset angles, and base plates. • Draw beam-to-column framed and seated connections.	1. Steel tension and compression members: Slenderness ratio, effective length, and buckling behavior. 2. Built-up columns: Design rules for lacing systems and batten plates as per IS:800. 3. Column bases: Function of slab base vs gusseted base in transmitting column axial load and moment to footing.
Week 21	• Draw structural elevation and cross-sections of a fabricated Plate Girder using CAD. • Show flange plates, flange angles, web plate, vertical stiffeners, bearing stiffeners, and flange splices. • Draw detailed steel roof truss joint connections: Eaves joint, ridge joint, shoe joint, and purlin cleats.	1. Plate girders: Components, depth-to-span ratio, web buckling, and functions of web stiffeners. 2. Flange and web splices in plate girders: Design and detailing rules. 3. Steel roof truss fabrication: Gusset plate sizing, layout of truss members, and IS:800 requirements.
Week 22	• Draw plumbing and sanitary appliances: Wash basin, water closet (Indian & European), urinal, kitchen sink, bath tub. • Draw pipe joints used in water supply and drainage: Socket and spigot joint, flanged joint, lead joint, solvent cement joint. • Draw sanitary fittings: P-trap, Q-trap, S-trap, gully trap, intercepting trap, floor trap (nahni trap).	1. Public Health Engineering (PHE): Introduction, terms, domestic water requirements, and water supply sources. 2. Systems of sanitation: Conservancy system vs Water carriage system; advantages and hygienic aspects. 3. Traps in sanitation: Function of water seal, loss of water seal (siphonage, back pressure), and prevention.
Week 23	• Prepare detailed drawing of House Drainage System showing soil pipes, waste pipes, vent pipes, and rainwater pipes. • Draw single-pipe system, two-pipe system, one-pipe partially ventilated system, and single-stack system. • Prepare plumbing and drainage layout plans for toilets, kitchens, and multi-storied residential buildings.	1. Systems of plumbing: Single stack, one-pipe system, two-pipe system; comparison and code requirements. 2. House drainage principles: Self-cleansing velocity, pipe gradients, ventilation of house drains, and testing drains. 3. Sizing of soil, waste, and rainwater drainage pipes as per NBC norms.
Week 24	• Design and draw plan and sectional elevation of standard masonry Manholes and drop manholes in CAD. • Design and draw plan, longitudinal section, and cross-section of RCC / Brick Septic Tank with soak pit / dispersion trench. • Prepare drainage service plan for an isolated residential bungalow connected to soak pit.	1. Manholes: Classification (shallow, normal, deep), spacing, drop manholes, manhole covers, and invert levels. 2. Septic tanks: Working principle (anaerobic digestion), retention period, sludge accumulation, and capacity design. 3. Disposal of septic tank effluent: Soak pits, dispersion trenches, sub-surface irrigation, and environmental precautions.
Week 25	• Draw schematic flow diagram of modern Municipal Water Treatment Plant (WTP) using CAD. • Show intake works, screening, aeration, coagulation/flocculation, rapid sand filtration, and chlorination units. • Draw schematic flow diagram of Sewage Treatment Plant (STP) showing primary, secondary (aeration/clarifier), and tertiary treatment. • Draw plan and sectional elevation of elevated RCC Overhead Water Tank (Intze type reservoir).	1. Water Treatment Plants (WTP): Sequence of treatment processes for municipal potable water supply. 2. Sewage Treatment Plants (STP): Screen chambers, grit chambers, activated sludge process, and sludge digestion. 3. Water storage: Ground reservoirs, underground sumps, and elevated Intze-type water storage reservoirs.
Week 26	• Draw cross-sectional views of different types of roads: National Highways, State Highways, and City streets in CAD. • Draw road cross-sections in cutting and embankment showing subgrade, sub-base, base course, and wearing course. • Draw typical road elements: Carriageway, shoulder, side drain, berm, right of way (ROW), and kerbs.	1. Highway Engineering: History of highway development (Roman, Tresaguet, Macadam), Nagpur road plan. 2. Classification of roads as per Indian Roads Congress (IRC): Expressways, NH, SH, MDR, ODR, and VR. 3. Structural components of flexible pavement (WBM, bituminous) and rigid pavement (cement concrete).
Week 27	• Draw geometric design features of highways in CAD: Camber profiles (parabolic, straight, composite). • Draw highway horizontal curves showing Super-elevation and widening of pavements on curves. • Draw highway vertical curves: Summit curves and valley curves showing ruling, limiting, and exceptional gradients.	1. Geometric design of roads: Design speed, road margins, formation width, and right of way. 2. Camber: Purpose, types, recommended values for different road surfaces as per IRC codes. 3. Super-elevation ($e = V^2 / 225R$): Derivation, centrifugal force, maximum permissible super-elevation, and runoff.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 28	- Setting out simple circular highway curves by Offsets from Long Chord and Successive Bisection method. - Draw highway drainage systems: Longitudinal surface drains, catch water drains, and sub-surface perforated pipe drains. - Prepare complete road project plan and longitudinal profile (L-section) for a highway stretch.	- Highway curves: Simple circular curves, compound curves, reverse curves, and transition curves. - Setting out highway curves: Methods of curve ranging from tangents and chords. - Highway drainage: Importance of road drainage, prevention of waterlogging, and capillary water control.
Week 29	- Draw details of different types of Culverts in CAD: Pipe culvert, RCC Slab culvert, and Box culvert. - Draw half-sectional plan, longitudinal section, and cross-section of RCC Slab Culvert with splayed wing walls. - Show bed block, abutments, wing walls, weep holes, wearing coat, and IRC loading arrangements.	- Bridges and Culverts: Definition, difference between culvert (span $\leq 6\text{m}$) and bridge (span $> 6\text{m}$). - Classification of culverts: Pipe, slab, box, and arch culverts; site selection factors. - Component parts of culverts: Waterway calculation, scour depth, and IRC standard live loadings.
Week 30	- Draw general arrangement and component parts of Bridges: Substructure (piers, abutments, wing walls) and Superstructure (girders, deck slab, bearings, handrails). - Draw details of Deep Bridge Foundations: Well foundations (caissons) showing cutting edge, steining, and well cap; Cofferdams.	- Bridge Engineering: Factors governing selection of bridge site, alignment, and economic span. - Substructure of bridges: Abutments (straight, tee, splayed), piers, and wing walls. - Bridge foundations: Shallow footings, pile foundations, pneumatic caissons, and types of coffer dams.
Week 31	- Draw half-sectional plan, longitudinal section, and cross-section of Two-Span Tee-Beam Bridge with square returns. - Draw structural details of Steel Foot Overbridge across a highway showing columns, trusses, and stairways. - Draw general elevation and cross-sections of an Arch Bridge.	- Types of superstructures: RCC T-beam deck slab, balanced cantilever, arch, and cable-stayed bridges. - Bridge bearings: Purpose of bearings, roller-rocker bearings, and elastomeric neoprene pad bearings. - Introduction to tunnel engineering: Tunnel cross-sections, tunnel driving methods in rock and soft soil.
Week 32	- Draw typical cross-section of a Railway Track (Permanent Way) in cutting and embankment (single & double line). - Draw standard rail sections (Flat-footed, Bull-headed) and show rail gauge dimensions (Broad Gauge, Meter Gauge). - Draw rail fixtures and fastenings: Fish plates, fish bolts, spikes, chairs, keys, bearing plates, and elastic clips.	- Railway Engineering: Components of permanent way, requirements of an ideal permanent way. - Rail sections: Standard broad gauge (1676 mm), rail length, coning of wheels, and tilting of rails (1 in 20). - Rail defects: Wear of rails, hogged rails, bending of rails, and creep of rails (causes, effects, and prevention).
Week 33	- Draw layout of Railway Sleepers (wooden, cast iron, steel trough, pre-stressed concrete sleepers) and ballast bed. - Draw layout plan of Railway Points and Crossings: Turnout, switches, tongue rail, stock rail, lead rails, and crossing frog. - Draw layout plans of railway platforms, goods yard, passenger station yard, and signalling arrangements.	- Sleepers and Ballast: Functions, types of sleepers, sleeper density, ballast materials, and minimum cushion depth. - Points and Crossings: Terminology, necessity, left-hand and right-hand turnouts, and crossing numbers. - Station yards: Passenger platform requirements, siding lines, marshalling yards, and track maintenance.
Week 34	- Draw typical cross-sections of Irrigation Canals in cutting, partial cutting & filling, and fully in embankment. - Draw cross-sections of Gravity Dams, Earth Dams (zoned and rolled fill), Barrages, and Weirs. - Draw Cross Drainage Works: Aqueduct, Syphon Aqueduct, Super Passage, Canal Syphon, and Level Crossing. - Draw schematic layout diagram of Hydroelectric Power Project showing reservoir, forebay, intake, penstock, surge tank, and power house.	- Irrigation Engineering: Terms (Duty, Delta, Base Period, CCA, GCA, Rabi, and Kharif crops). - Storage and diversion headworks: Weirs vs Barrages, silt excluders, head regulators, and canal falls. - Cross drainage works: Classification based on relative bed levels of canal and natural drainage. - Hydroelectric projects: Components, water head, penstocks, surge tanks, impulse/reaction turbines.
Week 35	- Practice estimating spreadsheet software: Entering measurements, formulas, and taking off quantities. - Prepare detailed estimate for a single storied residential building: Earthwork, PCC, brickwork, RCC, plastering, and flooring. - Prepare detailed estimate for boundary wall, septic tank, and RCC overhead reservoir.	- Estimating and Costing: Purpose, importance, types (approximate/preliminary vs detailed estimates). - Methods of taking off quantities: Long wall-short wall method (P.W.D. method) and Centerline method. - Units of measurement for civil works as per IS:1200; standard measurement sheets and abstract sheets.
Week 36	- Prepare Rate Analysis for major civil works: M20 grade RCC, 1:4:8 cement concrete, brick masonry, stone masonry, plastering. - Prepare Abstract of Estimate applying prevailing State PWD / CPWD Schedule of Rates (SOR). - Calculate earthwork quantities for irregular plots using Trapezoidal formula and Simpson's 1/3rd Rule.	- Rate Analysis: Factors affecting rate analysis, material costs, labor constants (task work), contractor's profit. - Standard Schedule of Rates (SOR), market survey of construction materials, and current labor wage rates. - Earthwork calculation methods: Mid-ordinate rule, average end area rule, and prismoidal formula.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 37	• Identification and handling of Total Station (TS) and accessories: Tripod, tribrach, prism reflector, and battery. • Setup Total Station over station: Centering with laser plummet, leveling, electronic bubble, and job creation. • Perform coordinate measurement, open and closed traversing, remote elevation measurement (REM), and missing line measurement (MLM). • Download survey data from Total Station to computer, process data, and generate CAD survey maps.	1. Total Station: Introduction, components, electronic distance measurement (EDM) principles, and optics. 2. Microprocessor functions: Onboard software, data storage, rectangular and polar coordinate systems. 3. Applications of Total Station: Topographical surveying, stakeout / demarcation of building layouts and alignments.
Week 38	• Set up and operate hand-held and geodetic Global Positioning System (GPS / GNSS) receivers. • Locate survey station points, record waypoints, tracks, and obtain geodetic latitude, longitude, and elevation. • Export GPS waypoint data into CAD software; compare GPS, NavIC, GIS, and Remote Sensing aerial images.	1. Global Positioning System (GPS): Working principles, segments (Space, Control, and User segments). 2. Satellite signals, pseudo-ranges, clock bias, dilution of precision (DOP), and atmospheric refraction errors. 3. Comparison of GPS, GIS, and NavIC systems; applications of remote sensing and satellite mapping in civil engineering.
Week 39	On the Job Training (OJT) / Group Project	On the Job Training (OJT) / Group Project
Week 40	On the Job Training (OJT) / Group Project	On the Job Training (OJT) / Group Project
Week 41	On the Job Training (OJT) / Group Project	On the Job Training (OJT) / Group Project
Week 42	On the Job Training (OJT) / Group Project	On the Job Training (OJT) / Group Project

APPROVAL & SIGNATURES

Sign of Instructor	Sign of Group Instructor (GI)	Sign of Superintendent / Principal