

CRAFTSMEN TRAINING SCHEME (CTS)

ANNUAL INSTRUCTIONAL PLAN (WEEK 1 TO WEEK 42)

DRAUGHTSMAN CIVIL — FIRST YEAR

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

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 1	• Demonstration of tools, instruments, and equipment used in Draughtsman Civil trade. • Practice safety equipment uses, Personal Protective Equipment (PPEs), and basic first aid. • Demonstration of safe waste disposal procedures, hazard identification, avoidance, and safety signs. • Practice preventive measures for electrical accidents and operation of fire extinguishers.	1. Importance of trade training, soft skills, housekeeping, and good shop floor practices. 2. General safety precautions, health, safety, and environmental (OSH&E) regulations in civil works. 3. First aid principles, treatment of electric shock, and response to workshop emergencies. 4. Introduction to 5S concept, its application in drawing offices, and trade career pathways.
Week 2	• Identification, handling, care, and maintenance of drawing instruments and equipment. • Practice fixing drawing sheets on drawing boards using clips, pins, and drafting tapes. • Practice standard layout of drawing sheets (A0 to A4) and standard folding of sheets. • Draw freehand sketches of civil hand tools: hoe, head pan, trowel, wooden float, plumb bob, and sand screener.	1. Overview of Draughtsman Civil syllabus and examination pattern. 2. Drawing instruments: T-square, mini-drafter, set squares, compasses, divider, protractor, scales, and French curves. 3. Standard drawing sheet sizes (ISO 'A' series), title block position, layout margins, and folding rules. 4. Purpose and technique of freehand sketching in engineering communication.
Week 3	• Draw conventional signs and symbols for building materials in sections as per IS:962-1989 and SP-46:2003. • Draw standard lines: visible outlines, hidden lines, center lines, cutting plane lines, dimension lines, and break lines. • Practice single-stroke vertical and inclined lettering (capital and small) and standard dimensioning systems.	1. Importance of Bureau of Indian Standards (BIS) in architectural and civil engineering drafting. 2. Code of practice for Architectural and Building Drawings (IS:962-1989 & SP-46:2003). 3. Types of lines, line weights, thickness ratios, and applications in civil drafting. 4. Lettering standards, lettering sizes, dimensioning principles (aligned and unidirectional systems).
Week 4	• Construction of plane geometrical figures: bisecting lines and angles, perpendicular lines, parallel lines. • Construct triangles, quadrilaterals, circles, tangents, and regular polygons (inscribing and circumscribing). • Construct engineering curves: ellipse, parabola, hyperbola, and involutes from given parameters.	1. Geometrical constructions: Principles, angles of 15° increments using set squares. 2. Methods of constructing regular polygons (inscribed circle, arc, and general methods). 3. Conic sections: Definition of focus, directrix, eccentricity; construction of ellipse and parabola. 4. Building materials: Stones - quarrying, classification, characteristics of good building stones, and dressing.
Week 5	• Construction of Plain scale and determine Representative Fraction (RF). • Construction of Comparative scale and Diagonal scale for measuring three consecutive units. • Construction of Vernier scale (direct and retrograde) and Scale of Chords for angular measurements.	1. Scales: Definition, necessity in civil drawings, reducing scales, full scale, and enlarging scales. 2. Representative Fraction (RF) principles and calculation of maximum length of scale. 3. Plain vs Diagonal scales: Principles of diagonal division and vernier principle. 4. Bricks: Composition of good brick earth, manufacturing processes, testing, and classification.
Week 6	• Orthographic projection: Projection of points in all four quadrants. • Projection of straight lines parallel, inclined to HP and VP, and determination of true lengths. • Projection of plane surfaces (triangles, rectangles, polygons, circles) inclined to reference planes.	1. Theory of projection: Planes of projection (Horizontal Plane and Vertical Plane), reference ground line. 2. First angle projection vs Third angle projection: Symbol, principles, and international conventions. 3. Traces of lines and planes; Auxiliary Vertical Plane (AVP) and Auxiliary Inclined Plane (AIP). 4. Lime and Pozzolana: Classification, calcination, slaking, pozzolanic materials, and applications.
Week 7	• Draw three orthographic views of solid objects: prisms, pyramids, cylinders, and cones in simple and inclined positions. • Draw sections of solids and true shapes of sections cut by auxiliary cutting planes. • Construct Isometric scale and draw isometric projections of regular geometrical solids.	1. Orthographic views of solid geometrical figures; rules for hidden and visible edges. 2. Section planes: Horizontal cutting planes, vertical cutting planes, and true shape of sections. 3. Isometric projection: Isometric axes, isometric lines, isometric scale ratio (0.816). 4. Cement: Chemical composition, manufacturing (dry and wet processes), grades (33, 43, 53), and field tests.
Week 8	• Draw Isometric views of hollow and cut section blocks. • Draw Oblique projections (Cavalier and Cabinet projections) of stepped blocks. • Draw Perspective views of building blocks using Vanishing Point method (single-point and two-point angular perspective).	1. Principles of Oblique projection: Cavalier (full scale) vs Cabinet (half scale receded depth). 2. Perspective projection: Station point, picture plane, horizon line, ground line, and vanishing points. 3. Visual ray method and multi-view perspective principles. 4. Sand, Mortar, and Concrete: Bulking of sand, mortar proportions, concrete mix design, and admixtures.
Week 9	• Draw component parts of a single-storied residential building in sectional elevation showing foundation to parapet. • Indicate standard levels: ground level (GL), plinth level (PL), sill level, lintel level, ceiling, and roof slab levels. • Draw graphical symbols for openings (doors, windows, ventilators, and chajjas).	1. Building construction: Sequence of construction operations from foundation excavation to finishing. 2. Identification, naming, and functional requirements of substructure and superstructure components. 3. Conventional levels, plinth height, ceiling height, and local building municipal bye-law provisions. 4. Timber: Structure of exogenous tree, cross-section of trunk, conversion, seasoning, and wood defects.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 10	• Draw details of dressing and variety of stone finishes, artificial stones, and natural bed of stone. • Draw detailing of RCC elements used in building components: plinth beam, lintels, chajjas, and roof slabs. • Draw alternative materials to timber: plywood, blockboard, particleboard, FRP, and MDF boards.	1. Stone dressing: Hammer dressing, chisel drafting, boasted, axed, and fine tooled finishes. 2. Reinforced Cement Concrete (RCC): Function of concrete in compression and steel in tension. 3. Timber alternatives: Manufacturing, commercial sizes, properties, and applications of plywood and MDF. 4. Protective materials: Paints, varnishes, distempers, tar, bitumen, and asphalt properties and uses.
Week 11	• Draw details of Stone Masonry: Rubble masonry (uncoursed, coursed, random rubble) and Ashlar masonry. • Draw joints in stone masonry: butt, lapped, joggle, rebated, dowelled, and cramped joints. • Draw technical terms used in stone masonry: coping, corbel, cornice, string course, quoin, spall, and through stone.	1. Stone masonry: Technical terms, general principles of stone construction, and composite masonry. 2. Comparison between Rubble and Ashlar masonry regarding structural strength, cost, and appearance. 3. Metals and Plastics in construction: Structural steel sections, reinforcement bars, PVC, and CPVC.
Week 12	• Draw plan and elevation of Brick Masonry bonds: English bond for 1 brick, 1.5 brick, and 2 brick thick walls. • Draw plan and elevation of Flemish bond (Single Flemish and Double Flemish bonds) showing alternating headers and stretchers. • Draw arrangements of bricks at corner junctions, tee-junctions, cross-junctions, brick pillars, and copings.	1. Brick masonry: Technical terms (stretcher, header, closer, queen closer, king closer, bat, frog). 2. Rules and principles for sound brick bonding; comparison between English and Flemish bonds. 3. Special bricks: Bullnose, round ended, perforated, hollow, firebricks, and paving bricks. 4. Tools and equipment used in masonry: Brick hammer, trowel, spirit level, plumb rule, and mason line.
Week 13	• Draw Shallow Foundations: Spread footings for masonry walls, stepped footings, and column isolated footings. • Draw Grillage foundations: Steel grillage and timber grillage for heavy column loads. • Draw Raft / Mat foundation details for soils with low bearing capacity. • Draw Deep Foundations: Pile foundation (friction and end-bearing piles, pile caps) and Well / Caisson foundation.	1. Foundations: Purpose, requirements, and essential causes of foundation failures. 2. Bearing capacity of soil: Ultimate and safe bearing capacity; methods to improve bearing capacity. 3. Shallow foundations vs Deep foundations: Selection criteria, dead load, live load, and wind load. 4. Setting out foundation trenches on ground: Centerline method and cross-staff/theodolite method.
Week 14	• Draw details of Shoring: Raking shore, Flying (horizontal) shore, and Dead (vertical) needle shoring. • Draw Scaffolding: Bricklayer's scaffolding (single), Mason's scaffolding (double), cantilever, and tubular steel scaffolding. • Draw Underpinning: Pit method and needle beam method for existing structural foundations.	1. Shoring: Objects, types, components of raking shore (sole plate, cleat, needle, raker, wall plate). 2. Scaffolding: Standards, ledgers, putlogs, transoms, braces, guard rails, and safety regulations. 3. Underpinning: Necessity, precautionary measures, and step-by-step pit excavation sequence.
Week 15	• Draw Formwork (centering and shuttering) for RCC rectangular columns, circular columns, beams, and slabs. • Draw details of formwork for RCC retaining walls. • Draw isometric view of timbering for trenches in soft, loose, and hard ground (stay bracing, vertical sheeting, runners).	1. Formwork: Requirements, materials (timber, plywood, steel plates), striking off periods as per IS:456. 2. Centering, shuttering, propping, and bracing arrangements for beams, slabs, and columns. 3. Timbering of trenches: Objects, safety to workers against trench cave-in, and methods.
Week 16	• Draw details of Damp Proof Course (DPC) at plinth level, basement, and external/internal walls. • Draw details of damp proofing in cavity walls with weep holes and air vents. • Draw damp proofing on flat roofs (tar felting, mud phuska with tiles) and pitched roofs; show anti-termite treatment stages.	1. Dampness in buildings: Causes, sources, ill effects on structural stability, and health hazards. 2. Damp proofing methods: Membrane damp proofing, integral damp proofing, and surface treatments. 3. Cavity wall construction: Advantages, thermal insulation, moisture prevention, and wall ties. 4. Anti-termite treatment: Chemicals used, pre-construction soil treatment, and post-construction methods.
Week 17	• Draw technical terms of Arches: span, rise, springing line, intrados, extrados, keystone, voussoirs, haunch, abutment, pier. • Draw elevations of arches based on number of centers: Flat arch, Semi-circular, Segmental, Elliptical (3-centered & 5-centered). • Draw details of centering and support framework for arch construction.	1. Arches: Stability of arches, lines of thrust, and classification according to shape and centers. 2. Centering of arches: Timber lagging, turning piece, ribs, wedges, and striking of arch centers. 3. Comparison of arches and lintels in load transfer to supports.
Week 18	• Draw Lintels: Wooden, stone, brick, reinforced brick, steel, and RCC lintels. • Draw detailed sectional view of RCC Lintel integrated with Sunshade (Chajja) showing reinforcement details. • Draw details of structural glazing and modern exterior wall cladding systems.	1. Lintels: Function, advantages over arches, minimum bearing on walls, and load distribution. 2. RCC Lintel with Chajja: Cantilever action of sunshade, reinforcement placement, and drip course. 3. Modern structural glazing: Spider fittings, curtain wall framing, and ACP cladding panels.
Week 19	• Draw Carpentry joints: lengthening joints, widening joints, bearing joints, framing, housing, and corner joints. • Draw Doors: Ledged and battened; ledged, battened and braced; framed, ledged and battened doors. • Draw fully panelled door, panelled and glazed door, flush door, sliding door, and collapsible iron gate with fixtures/fastenings.	1. Carpentry joints in civil work: Classification, strength characteristics, and fasteners. 2. Doors: Location in rooms, standard sizes, parts (frame, stile, rail, panel, mullion, sill, horn). 3. Types of doors: Revolving, swinging, sliding, rolling shutters, and fire-resisting doors. 4. Windows and Ventilators: Casement, sash, pivoted, clerestory, bay, corner, dormer, and louvered windows.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 20	- Draw electrical engineering symbols used in residential building wiring plans as per BIS. - Prepare detailed electrical wiring installation layout plan for a residential building showing lighting and power circuits. - Show switchboards, distribution board, main switch, energy meter, lighting points, fans, AC points, and earthing.	- Electrical wiring: General principles of domestic supply system (single-phase 230V). - Wiring materials: Wires, cables, conduits, switches, sockets, distribution boxes, and safety fuses/MCBs. - Safety precautions in electrical installations: Earthing necessity, first aid for shock, and artificial respiration.
Week 21	- Draw details of ground floors: Timber ground floor, brick floor, flag stone, and plain cement concrete floor. - Draw upper floors: Single-joint, double-joint, and framed timber upper floors. - Draw concrete jack arch floor and brick jack arch upper floors. - Draw floor finishes: Terrazzo, mosaic, marble, ceramic tiles, and asphalt flooring.	- Floors: Functional requirements of good floors, components (sub-floor / base course and floor finish). - Ground floors vs Upper floors: Selection of materials and damp prevention. - Jack arch floors: Construction technique, tie rods, and spans. - Flooring defects: Floor cracking, sinking, hollowness, and remedial maintenance measures.
Week 22	- Draw technical terms of Stairs: tread, riser, going, nosing, flight, landing, handrail, baluster, newel post, headroom. - Draw stairs by shape: Straight stair, quarter-turn newel, dog-legged stair, open-well stair, bifurcated stair, and spiral stair. - Draw stairs by material: Timber, brick, stone, and RCC dog-legged stair with reinforcement details. - Draw schematic layout of Lift well, elevator arrangement for 10 persons, ramps, and moving stairs (escalators).	- Stairs: Planning rules, relationship between tread and riser ($2R + T = 60$ to 64 cm), slope, and width. - Comparative study of dog-legged vs open-newel stairs in multi-storied residential buildings. - Vertical transportation: Lift shafts, counterweights, pit depth, machine rooms, and escalator inclinations.
Week 23	- Draw terms of Pitched Roofs: ridge, eaves, hip, valley, gable, verge, pitch, common rafter, purlin, battens, cleat. - Draw elevations and sections of simple pitched roofs: Lean-to roof, couple roof, couple-close roof, and collar-beam roof. - Draw scissors roof and purlin roof with eaves detailing.	- Roofs: Functional requirements, classification (flat, pitched, shell, and dome roofs). - Pitched roofs: Slope determination based on rainfall, wind pressure, and roofing material. - Types of pitched timber roofs without trusses: Limitations of couple and collar roofs over large spans.
Week 24	- Draw complete elevation of King Post Roof Truss for spans 5 to 8 meters. - Draw detailed enlarged connection joints of King Post Truss: head joint, foot joint of king post, tie beam, and shoe joint. - Draw Queen Post Roof Truss for spans 8 to 12 meters with straining beam, straining sill, and queen posts.	- Timber roof trusses: Working principle of triangulated frames under tension and compression. - King post truss: Identification of tension members (king post, tie beam) and compression members (struts, principal rafters). - Queen post truss: Spans, member functions, and fabrication of timber connections with iron straps.
Week 25	- Draw Steel Roof Truss (Fink / Pratt / Howe truss) showing structural steel angles, gusset plates, and purlins. - Draw detailed joint connections of steel roof truss: Ridge joint, eaves shoe joint, and purlin cleats. - Draw tubular steel roof trusses and various roof coverings (GI corrugated sheets, asbestos cement sheets, clay tiles).	- Steel roof trusses: Advantages over timber, structural steel angle sections, gusset plates, and welded/riveted joints. - Tubular steel trusses: Strength-to-weight ratio, hollow structural sections, and corrosion protection. - Roof coverings: Fixing of AC and GI sheets using J-bolts, hook bolts, bitumen washers, and ridge caps.
Week 26	- Identification, inspection, care, and handling of Chain Surveying instruments (metric chain, arrows, ranging rods, tapes, pegs, cross staff). - Practice ranging lines (direct and indirect ranging), unfolding and folding of chains. - Practice chaining on level ground and stepping method on sloping ground; taking perpendicular and oblique offsets.	- Surveying: Definition, history, principles (working from whole to part, locating points with two measurements). - Classification of surveys: Plane surveying vs Geodetic surveying; chain surveying principles. - Instruments used in chain surveying: 20m/30m metric chains, metallic and steel tapes, ranging rods, and arrows. - Errors in chaining: Instrumental, personal, and natural errors; cumulative and compensating errors.
Week 27	- Practice booking field entries in single-line and double-line Field Books. - Plotting chain survey traverse and detail points on drawing sheets to suitable scale. - Calculation of land area by dividing into triangles and trapezoids; study and application of cadastral (Mouza) maps.	- Field book: Methods of entry, field codes, keeping records, and field etiquette. - Obstacles in chaining: Chaining free but vision obstructed, vision free but chaining obstructed, and both obstructed. - Calculation of plot area: Coordinate method, Simpson's rule, and trapezoidal formula. - Cadastral / Mouza maps: Scale, conventional signs, boundaries, and revenue village records.
Week 28	- Familiarization with Prismatic Compass and Surveyor's Compass parts, tripod, and circular box. - Centering, leveling, and optical prism focusing of prismatic compass over station. - Observing magnetic bearings of survey lines; converting Whole Circle Bearing (WCB) to Reduced Bearing (RB/QB) and vice versa.	- Compass surveying: Principle of traversing, magnetic needle, graduated ring, and sighting vanes. - Comparison between Prismatic Compass and Surveyor's Compass. - Magnetic Meridian, True Meridian, Arbitrary Meridian, and definition of bearings. - Whole Circle Bearing (WCB) system vs Quadrantal Bearing (QB) system and inter-conversions.
Week 29	- Measure Fore Bearing (FB) and Back Bearing (BB) of open and closed compass traverse lines. - Identify and correct Local Attraction caused by magnetic interference; calculate included angles. - Determine Magnetic Declination (east and west) and calculate True Bearings; plot closed compass traverse.	- Fore bearing and back bearing relationship ($BB = FB \pm 180^\circ$). - Local attraction: Causes, detection at stations, and methods of eliminating local attraction errors. - Magnetic declination: Isogonic and agonic lines, secular and diurnal variations, calculation of true bearing. - Graphical adjustment of closing error in compass traverse by Bowditch's method.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 30	- Identification and handling of Plane Table Surveying equipment: plane table board, tripod, alidade, trough compass, spirit level, plumbing fork with plumb bob. - Setting up plane table over station: centering, leveling, and orientation by back-sighting and trough compass. - Perform plane table surveying by Radiation method and plot surrounding ground details.	- Plane table surveying: Principles, merits, limitations, and field-to-office advantages. - Accessories: Function of alidade (plain and telescopic), plumbing fork, and trough compass. - Setting up plane table: Step-by-step procedure for centering, leveling, and orientation. - Radiation method: Concept, suitability, field procedure, and plotting.
Week 31	- Perform plane table surveying by Intersection method (locating inaccessible distant points). - Perform plane table survey by Traversing method for a boundary polygon. - Practice Resection methods (orientation by back-sighting and Two-Point / Three-Point problem basics). - Calculate total site area and prepare complete site plan using plane table.	- Intersection method: Base line selection, measurement, and locating inaccessible objects. - Traversing with plane table: Closed and open traverse procedures. - Resection: Definition, orientation methods, statement of Two-Point and Three-Point problems. - Care, maintenance, and precision rules in handling plane table boards and drawing sheets.
Week 32	- Identification of Levelling instruments: Dumpy Level, Tilting Level, Auto Level, and levelling staves (telescopic and folding). - Practice temporary adjustments of level: setting on tripod, leveling by foot screws, focusing eyepiece and objective to eliminate parallax. - Reading levelling staff graduated in metric units (meters, decimeters, centimeters).	- Levelling: Definitions of level surface, horizontal line, datum plane, benchmark (GTS, permanent, arbitrary, temporary). - Technical terms: Back Sight (BS), Fore Sight (FS), Intermediate Sight (IS), and Change Point (CP). - Types of levels: Dumpy level, Tilting level, and modern Automatic level (internal compensator mechanism). - Levelling staves: Target staff vs self-reading staff, inverted staff readings.
Week 33	- Practice booking staff readings in Levelling Field Book using Height of Instrument (HI / Collimation) method. - Practice booking readings using Rise and Fall method; apply complete arithmetical checks on field data. - Carry out fly levelling, check levelling, and determine Reduced Levels (RL) of various ground points.	- Height of Instrument (HI) method: Formulas, calculations, and arithmetical checks ($\sum BS - \sum FS = \text{Last RL} - \text{First RL}$). - Rise and Fall method: Calculation procedure and triple arithmetical check. - Comparison of HI method and Rise & Fall method regarding speed and mathematical checks. - Permanent adjustments of dumpy level: Fundamental lines and relations.
Week 34	- Perform Profile Levelling (Longitudinal Sectioning - L-section) along proposed road centerline. - Perform Cross-Section levelling (Cross-sections - X-section) at regular intervals on both sides of centerline. - Plot L-section and Cross-sections on profile drawing sheet showing existing ground level (EGL) and formation level.	- Profile levelling: Purpose in highways, railways, canals, and pipeline alignments. - Longitudinal sectioning and cross-sectioning: Selection of horizontal and vertical plotting scales. - Formation line, gradient, depth of cutting, and height of embankment calculations. - Curvature and refraction corrections in long sight levelling.
Week 35	- Make Topographical contour map: Direct method of contouring by radial lines. - Indirect method of contouring: Grid method (block levelling) and cross-sections method. - Interpolation of contour points by arithmetical calculation and graphical method; drawing smooth contour lines with contour intervals.	- Contouring: Definition, contour line, contour interval, and horizontal equivalent. - Characteristics of contours: Uniform slope, steep slope, hill, depression, ridge, valley, overhanging cliff. - Methods of contour interpolation: Estimation, arithmetical computation, and graphical method. - Engineering uses of contour maps: Reservoir capacity, road alignment, inter-visibility, and earthwork computation.
Week 36	- Identification of Transit Theodolite parts: upper plate, lower plate, clamp screws, tangent screws, vernier scales, vertical circle, telescope, and optical plummet. - Temporary adjustments of theodolite: centering over station, leveling with plate levels, eliminating parallax. - Measurement of horizontal angles by General Method and Repetition Method.	- Theodolite: Scope, classification (transit and non-transit), parts, and functions. - Fundamental axes and lines of transit theodolite and their geometrical relationships. - Vernier scales on theodolite: Reading degrees, minutes, and least count (20 seconds). - Methods of horizontal angle measurement: Repetition method (eliminating errors) and Reiteration method.
Week 37	- Measurement of vertical angles (elevation and depression) using vertical circle and altitude bubble. - Running closed theodolite traverse: measuring lengths and interior angles. - Computation of traverse: Latitude ($L = l \cos \theta$), Departure ($D = l \sin \theta$), consecutive coordinates, and independent coordinates (Gale's Traverse Table).	- Measurement of vertical angles: Index error of vertical circle and method of elimination. - Closed traverse balancing: Bowditch's rule and Transit rule for adjusting coordinate errors. - Consecutive coordinates vs Independent coordinates; Northing and Easting. - Calculation of area of closed traverse from coordinates.
Week 38	- Setting out civil engineering works using theodolite: Setting out building foundation corners and wall centerlines. - Setting out circular curves on roads and railways by Offsets from Long Chord and Rankine's Tangential Angles method. - Determination of height of inaccessible objects (towers, building tops) using theodolite trigonometry.	- Setting out works: Establishing reference baseline, marking centerlines, and checking diagonals. - Circular curves: Elements of simple curve (radius, deflection angle, tangent length, curve length, apex distance). - Methods of setting out simple circular curves: Linear methods vs Instrumental methods. - Review of First Year practical competencies and preparation for All India Trade Test (AITT).
Week 39-42	On the Job Training (OJT) / Group Project	On the Job Training (OJT) / Group Project