

INDUSTRIAL TRAINING INSTITUTE

CRAFTSMEN TRAINING SCHEME (CTS)

ANNUAL INSTRUCTIONAL PLAN BREAKUP (42 WEEKS) TURNER (1ST YEAR)

(Curriculum as per DGT / CSTARI Guidelines for Turner CTS Scheme - 1st Year)

Trade Name	TURNER (Engineering Trade)
NSQF Level & Duration	NSQF Level-4 Two Years (First Year - 42 Weeks)
Academic Session	
Instructor Name & Designation	
Group Instructor (GI) Name	
Principal / Superintendent Name	
Institute Name & Address	

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 1	- Familiarization with trade training, list of tools, machines & equipment used in the trade. - Safety attitude development: Use of Personal Protective Equipment (PPE). - First Aid methods, treatment of electrical accidents, artificial respiration. - Safe disposal of workshop waste materials (cotton waste, metal chips, burrs). - Hazard identification, avoidance, and safety signs (Danger, Warning, Caution).	- Organization of ITI system, store procedures, soft skills and career opportunities for Turner. - Importance of safety and general precautions observed in engineering workshop/shop floor. - First aid principles, treatment for electric shock, burns and cuts. - Introduction to Personal Protective Equipment (PPE) and proper usage. - Housekeeping, response to emergencies, and introduction to 5S concept.
Week 2	- Practice safe operation of electrical mains and use of fire extinguishers. - Practice occupational safety and health (OSH&E) guidelines. - Safe use, care and maintenance of hand tools, fitting tools and measuring tools. - Selection and visual inspection of raw material for rusting, scaling, and corrosion.	- Occupational Safety & Health: Health, safety and environment guidelines and regulations. - Fire prevention and classification of fires; operating procedures of fire extinguishers. - Measurement principles: Line standard and End standard. - Steel rule types, graduations and limitations; prick punch, scribe, hammer and chisel types.
Week 3	- Practice marking out lines and gripping suitably in bench vice jaws. - Hacksawing to given dimensions on different metals of various cross-sections. - Hammering, marking out, chipping practice and chisel grinding on pedestal grinder.	- Bench vice: Types, construction, jaw plates and uses. - Files: Classification by cut, grade, shape, length and material. - Try square: Types, inspection, parts and testing squareness. - Calipers: Firm joint outside & inside calipers, hermaphrodite (odd-leg) calipers and their applications.
Week 4	- Filing practice on plain flat surfaces and filing surfaces at right angles (90°). - Use of calipers and steel rule for dimensional verification to specified tolerance. - Marking out lines on flat and round jobs using surface gauge and V-block.	- Filing methods: Cross filing, draw filing and finishing techniques. - Vee-block, scribing block (surface gauge), straight edge and their workshop applications. - Hacksaw frames (fixed & adjustable) and blades: Pitch selection for different materials.
Week 5	- Drilling operation: Sensitive drilling machine practice on flat, square and round bars. - Marking holes using center punch, clamping job on machine vice/drill table. - Selection of correct cutting speed, feed and drill bits for different metals.	- Drilling machine: Sensitive pillar and bench drill machine parts and mechanisms. - Twist drill nomenclature: Flutes, margin, cutting lips, rake angle, point angle and clearance angle. - Cutting speed, feed and spindle RPM calculations for drilling operations.
Week 6	- Thread cutting with hand taps (BSW, Metric) in blind and through holes. - External thread cutting using circular split dies and die stock. - Practice extraction of broken taps using tap extractor and mechanical methods.	- Surface plate: Material, accuracy, types (granite, cast iron) and care. - Hand taps: Taper, intermediate (second) and plug/bottoming taps; tap wrench types. - Tap drill size calculation for Metric and Inch threads; dies and die stock. - Causes and remedies of tap breakage and tap extraction procedures.
Week 7	- Identify and understand functions of all major parts of conventional lathe. - Practice dry/idle run of lathe, engaging headstock levers, feed levers and apron mechanism. - Setting lathe for different spindle speeds and feed rates.	- Definition of machine & machine tool; history and development of lathe. - Classification of lathes: Speed lathe, engine lathe, tool room lathe, capstan & turret lathe. - Lathe bed, headstock (all geared & cone pulley), tailstock, carriage, cross-slide and compound rest. - Feed mechanisms: Tumbler gear mechanism, lead screw and feed rod functions.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 8	- Mounting and unloading of 3-jaw self-centering chuck and 4-jaw independent chuck on lathe spindle. - Setting and truing practice of round bar on 3-jaw self-centering chuck. - Setting and truing round, square, and hexagonal bars on 4-jaw independent chuck using scribe block. - Dismantling, cleaning, lubricating and assembling of 3-jaw and 4-jaw chucks.	- Lathe spindle nose types: Threaded, taper key drive and cam lock. 3-jaw chuck vs 4-jaw chuck: Construction, operation, advantages and limitations. - Chuck mounting safety precautions and truing methods using surface gauge. - Lubrication points on lathe machine and daily maintenance procedures.
Week 9	- Turning of round stock on 3-jaw self-centering chuck. - Turning of round and square/hexagonal stock on 4-jaw independent chuck. - Grinding of R.H. and L.H. roughing tools, side cutting tools, and parting off tools on pedestal grinder. - Checking tool angles using angle gauge and bevel protractor.	- Lathe cutting tools: Single point cutting tool angles (top rake, side rake, clearances, cutting edge angles). - Tool signature and influence of rake and clearance angles on chip formation. - Cutting tool materials: High Carbon Steel (HCS), High Speed Steel (HSS), and cemented carbide. - Back gear mechanism and speed reduction arrangements on cone pulley headstocks.
Week 10	- Grinding of V-tools for 60° Metric thread cutting and checking profile with center gauge. - Facing operation to correct overall length using half center and facing tool. - Center drilling using combination drill and drilling holes to required depth on lathe.	- Lathe tool geometry for threading tools and use of center gauge. - Facing operation: Methods, setting tool to center height, facing from center to outside & vice versa. - Combination center drills: Types (A, B, R), sizes, speeds and drilling precautions on lathe.
Week 11	- Parallel turning and step turning on round bars within tolerance ± 0.5 mm. - Measurement with steel rule and outside spring calipers. - Parting off, grooving and chamfering operations on stepped components.	- Turning operations: Plain turning, step turning, grooving, undercut and chamfering. - Vernier caliper: Principle, main scale, vernier scale, reading method and least count (0.02 mm). - Cutting speed, feed and depth of cut: Mathematical formulas and charts for various materials.
Week 12	- Step turning within precision limit ± 0.06 mm with different shoulder profiles. - Turning U-cut on outside diameter and finish turning operation. - Accurate dimensional measurement using Outside Micrometer (0-25 mm, 25-50 mm).	- Outside Micrometer: Working principle (screw & nut), parts, barrel, thimble, least count (0.01 mm). - Zero errors (positive and negative) in micrometers and methods of correction. - Shoulder turning types: Square shoulder, beveled shoulder, filleted shoulder and undercut.
Week 13	- Drilling on lathe: Step drilling and deep hole drilling using drill chuck and taper shank drills in tailstock quill. - Twist drill re-grinding practice on tool grinder and checking cutting angles with drill angle gauge.	- Tailstock quill sleeve, Morse tapers, drift use and drill chuck mounting. - Twist drill lip grinding: Equal lip length, equal cutting angles and web thinning. - Cutting speeds, feeds and coolant distribution system for lathe drilling operations.
Week 14	- Boring practice on lathe: Plain through boring, counter boring and stepped boring. - Internal recessing and grooving operations using inside grooving tool. - Reaming on lathe using straight flute solid and adjustable hand/machine reamers.	- Boring tools: Types, forged tools, boring bars with tool bits, boring tool setting precautions. - Counter boring and internal recessing: Purpose and machining methods. - Reamers: Construction, cutting action, reaming allowance, speed and lubrication.
Week 15	- Trepanning operation on plate/solid stock to make large diameter bore. - Turning practice between centers on lathe mandrel (turning gear blanks). - Fitting of dissimilar metal parts (M.S. in brass, aluminum in cast iron).	- Trepanning operation: Tool design, setup, advantages in producing large holes without full chip removal. - Lathe mandrels: Plain, stepped, collar, screwed, cone and expansion mandrels. - Turning between centers: Work holding, dog carriers and driving plates.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 16	- Knurling practice on cylindrical surfaces in lathe (Diamond, straight, helical, square patterns). - Setting revolving head knurling tool and selecting appropriate knurling speed and feed.	- Knurling: Definition, purpose, types (diamond, straight, helical), and pitch grades (coarse, medium, fine). - System of limits and fits as per BIS:919; definitions of basic size, actual size, deviation and tolerance. - Hole basis system and shaft basis system; types of fits (Clearance, Transition, Interference fits).
Week 17	- Checking alignment of lathe machine: Axial slip of main spindle, true running of headstock spindle center. - Parallelism of main spindle axis to saddle movement; alignment of headstock and tailstock centers. - Mounting and adjusting tool post for perfect center alignment using dial test indicator.	- Machine tool alignment testing: Importance of periodic alignment checks for precision work. - Dial Test Indicator (plunger and lever type): Construction, magnetic stand, reading and care. - Test mandrels and procedures for testing axial slip and center height alignment.
Week 18	- Taper turning by form tool method for short steep tapers. - Taper turning by compound slide swivelling method; calculating compound slide swivel angle. - Measurement and verification of taper angle using bevel protractor and Vernier bevel protractor.	- Taper: Definition, standard tapers (Morse, Metric, Brown & Sharpe, Jarno tapers). - Methods of taper turning: Comparison of form tool, compound slide swivelling, and offset methods. - Vernier Bevel Protractor: Construction, main scale, vernier scale, least count (5 minutes) and reading.
Week 19	- Male and female taper turning using tailstock set-over (offset) method. - Male and female taper turning using taper turning attachment. - Matching male and female tapers using Prussian Blue paste.	- Tailstock offset method: Calculations for full length and partial length tapers; limitations. - Taper turning attachment: Construction, guide bar, sliding block, advantages in production. - Taper matching techniques using Prussian blue contact pattern.
Week 20	- Precision checking of tapers using Sine Bar, Slip Gauges and dial indicator. - Manufacturing MT-3 lathe dead center and checking with female Morse taper ring/sleeve (Proof machining).	- Sine bar: Principle, standard lengths, setting angle using trigonometry formula. - Slip gauges: Sets, grades, wringing process, care and handling precautions. - Inspection of external and internal tapers using precision rollers and micrometers.
Week 21	- Turning and plain boring practice on Cast Iron (CI) or medium carbon steel. - Setting up Vernier height gauge and precision V-block on marking table. - Marking out eccentric centers on cylindrical shafts.	- Machining characteristics of Cast Iron: Dry cutting, dust hazard and rake angle requirements. - Vernier height gauge: Parts, scribe, least count (0.02 mm) and marking applications. - Eccentric turning: Definition, throw/offset, applications (crankshafts, cams, eccentric bushes).
Week 22	- Setting job in 4-jaw independent chuck for eccentric turning using dial indicator/surface gauge. - Perform eccentric turning to specified offset (throw). - Counterbalance setup on chuck for unbalanced eccentric jobs.	- Methods of eccentric turning: In 4-jaw chuck, between centers, and using eccentric fixtures. - Counterbalancing in lathe operations: Necessity, calculation, and safety precautions. - Driving plate and lathe carrier selection for eccentric shafts.
Week 23	- Setting and performing eccentric boring in 4-jaw chuck. - Make a simple eccentric job with dia 22 mm and offset/throw of 5 mm. - Inspection of hole center and offset using dial test indicator and height gauge.	- Eccentric boring techniques: Work holding and tool positioning. - Combination set: Square head, center head, protractor head construction and applications. - Fundamentals of screw thread cutting on engine lathe.
Week 24	- Screw thread cutting (B.S.W.) External R/H: Tool grinding (55° profile) and checking with thread gauge. - Setting lathe gearbox, lead screw pitch calculation, and cutting external BSW thread. - Thread inspection using screw pitch gauge and thread caliper/micrometer.	- Screw thread nomenclature: Crest, root, flank, pitch, lead, depth, major dia, minor dia, pitch dia. - British Standard Whitworth (BSW) thread: 55° thread angle, proportions, depth calculation ($0.6403 \times P$). - Lathe gear train calculation: Simple gearing, driver and driven gear selection for screw cutting.

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Week 25	- Screw thread cutting (B.S.W.) External L/H using tumbling gear reversing lever. - Screw thread cutting (B.S.W.) Internal R/H: Tool grinding and cutting internal thread in bored hole. - Checking thread with thread plug gauge.	- Right hand (R/H) vs Left hand (L/H) threads: Differences in tool feed direction and spindle rotation. - Internal thread cutting: Core hole diameter calculation ($D - 2 \times \text{depth}$), tool clearance. - Thread plug gauge and thread ring gauge: 'Go' and 'No-Go' limits.
Week 26	- Screw thread cutting (B.S.W.) Internal L/H. - Fitting of male and female threaded components (BSW). - Angular approach (compound rest method at 27.5°) for cutting external BSW threads.	- Angular infeed method (half thread angle) vs radial infeed method: Comparison and advantages. - Compound gearing calculations: Tumbler gear, intermediate stud gears, and lead screw gear ratios. - Fit of threaded components: Class of fit, backlash, and pitch error causes.
Week 27	- Prepare standard stud with BSW nut. - Grinding V-tool for 60° Metric thread cutting and checking profile with thread angle gauge. - External Metric thread cutting practice on lathe.	- Studs: Types, proportions, threaded ends, and mechanical applications. - Metric ISO thread profile: 60° angle, proportions, depth formula ($0.6134 \times P$), and pitch tables. - Thread chasing dial: Construction, gear ratio, engaging split nut at dial marks.
Week 28	- Internal Metric thread cutting: Core diameter calculation, tool grinding, internal threading. - Checking internal Metric thread with Metric thread plug gauge. - Assembly and fitting of male and female Metric threaded components.	- ISO Metric internal thread formulas: Tap drill size calculation, depth of cut sequence. - Screw thread micrometer: Anvils, pitch diameter measurement, least count. - Common thread defects (drunken thread, incorrect pitch, torn flanks) and remedies.
Week 29	- Make standard hexagonal bolt and nut (Metric) on lathe and assemble. - Cutting Metric threads on an English (Inch) lead screw lathe using 127-tooth or 63-tooth transposing gear.	- Hexagonal bolt and nut standards: Head proportions, chamfering, and thread runout. - Cutting Metric threads on English lead screw: Transposing gear derivation ($127/50$ or $127/100$ teeth). - Split nut engagement rules when cutting metric threads on inch lead screws.
Week 30	- Cutting English (Inch/TPI) threads on a Metric lead screw lathe. - Practice using negative rake tool on non-ferrous metals and thread cutting along with ferrous metal fitting.	- Cutting Inch threads on Metric lead screw: Calculation of change wheels and conversion gears. - Tool life: Factors affecting tool life (cutting speed, feed, tool material, coolant). - Positive rake vs Negative rake tools: Cutting force distribution and performance on tough alloys.
Week 31	- Cutting Square thread (External): Tool grinding for square thread based on pitch and helix angle. - Setting lathe gearbox and machining external square thread. - Checking square thread width and depth with vernier gear tooth caliper/gauge.	- Square thread: Profile, angle (0°), applications (lead screws, jacks, vices), and depth formula ($0.5 \times P$). - Tool thickness calculation for square thread ($0.5 \times P$), side clearances, and helix angle. - Calculation of lead, pitch, and core diameter for square threads.
Week 32	- Cutting Square thread (Internal): Internal square thread tool grinding and cutting inside bore. - Fitting of male and female square threaded components. - Make standard square thread for Screw Jack on minimum 100 mm bar length.	- Internal square threading: Tool design, shank rigidity, chip clearance, and alignment. - Helix angle of thread and setting leading/following clearance angles on tool. - Screw Jack mechanism: Square thread load capacity and self-locking principle.
Week 33	- Acme thread cutting (External): Grinding Acme threading tool (29° angle) and checking with Acme gauge. - Machining external Acme thread on round bar (minimum 25 mm dia rod over 100 mm length).	- Acme thread: Profile, angle (29°), applications in machine tool lead screws and heavy vices. - Acme thread proportions: Crest width, root width, depth formula ($0.5 \times P + 0.25 \text{ mm}$). - Infeed methods for Acme thread cutting: Straight infeed vs modified flank infeed.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 34	- Acme thread cutting (Internal): Tool grinding and internal Acme threading in sleeve/bush. - Assembly and fitting of male and female Acme threaded components.	- Internal Acme thread: Core bore diameter calculation, tool clearance, and chip removal. - Use of thread gauges and thread measurement techniques for trapezoidal threads. - Comparison between Square and Acme threads regarding strength and power transmission.
Week 35	- Buttress thread cutting (External): Tool grinding for Buttress thread (45° trailing, 7°/0° leading flank). - Machining external Buttress thread on lathe.	- Buttress thread: Profile, angles, unidirectional thrust transmission, applications in gun breeches. - Buttress thread proportions, tool grinding angles, and depth calculations. - Advantages of Buttress threads over square and Acme threads in heavy one-direction thrust.
Week 36	- Buttress thread cutting (Internal): Internal tool grinding and threading. - Fitting of male and female Buttress threaded components. - Make carpentry vice lead screw assembly.	- Internal Buttress threading: Tool setup and machining precautions. - Carpentry quick-release vice mechanism and thread selection. - Periodic inspection and lubrication of lead screws and nuts.
Week 37	- Setting and machining jobs using Lathe Accessories: Driving plate, dog carrier, and live/dead centers. - Turning slender/long shafts supported by Fixed Steady Rest and Travelling (Follower) Steady Rest. - Make test mandrel (L = 200 mm) and counterbore at end.	- Lathe accessories: Driving plate, catch plate, face plate, dog carrier types (bent tail, straight tail). - Steady rests: Fixed steady rest (3 pads) vs Travelling steady rest (2 pads); setup and care. - Lathe centers: Half center, pipe center, revolving center, tipped center and self-driving center.
Week 38	- Balancing, mounting, truing and dressing of grinding wheel on pedestal/tool grinder using diamond/star dresser. - Periodic lubrication and cleaning of lathe headstock, gearbox, carriage, and apron. - Preventive maintenance inspection of lathe machine (belt tension, gib strip adjustment, oil level).	- Grinding wheels: Abrasives (Aluminium oxide, Silicon carbide), grit size, grade, structure and bond. - Mounting and dressing: Flanges, blotters, ring test, balancing, star dresser and diamond dresser. - Lubrication: Types of lubricants, viscosity, splash lubrication, wick feed, pressure feed system. - Preventive maintenance schedule: Daily, weekly, monthly and yearly maintenance checklists.
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

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