

**SYLLABUS OF SEMESTER SYSTEM
FOR THE TRADE OF**

FITTER

SEMESTER PATTERN

Under

**Craftsmen Training Scheme (CTS)
(Two years/Four Semesters)**

**Revised in
2014**

By

**Government of India
Ministry of Labour & Employment (DGE&T)**

GENERAL INFORMATION

1. **Name of the Trade** : **FITTER**
2. **N.C.O. Code No.** : 842.10, 842.15
3. **Duration of Craftsmen Training:** Two years (Four semesters each of six months duration).
4. **Power norms** : 3.51 KW
5. **Space norms** : 88 Sq.mt.
6. **Entry Qualification** : Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent
7. **Trainees per unit** : 16 (Supernumeraries/ Ex-Trainee allowed: 5)
- 8a. **Qualification for Instructors** : Degree in Mechanical Engineering from recognized university with one year post qualification experience in the relevant field
- OR
- Diploma in Mechanical Engineering from recognized Board of Technical Education with two years post qualification experience in the relevant field
- OR
- NTC/NAC in the Trade of “Fitter” with 3 years post qualification experience in the relevant field.
- 8b. **Desirable qualification** : Preference will be given to a candidate with Craft Instructor Certificate (CIC) in **Fitter Trade**.

Note:

- (i) Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.
- (ii) Instructor qualification for WCS and E.D, as per the training manual.

Distribution of training on Hourly basis:

Total hours /week	Trade practical	Trade theory	Work shop Cal. &Sc.	Engg. Drawing	Employability skills	Extra curricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

COURSE INFORMATION

1. Introduction:

- This course is meant for the candidates who aspire to become a professional fitter.

2. Terminal Competency/Deliverables:

After successful completion of this course the trainee shall be able to perform the following skills with proper sequence.

1. The trainees can work in the industry as semi-skilled fitter.
2. The trainee can work in the field of pipe fitting, lathe, drilling, welding, Inspection & measurement, general fitting work observing safety precautions.
3. The trainees can work on Dismantle & assemble of various valves, test the accuracy of Machine tools.
4. Perform simple repair on machinery, dovetail slides and assemble with location dowel pins, stud and bolts.
5. Prepare snap gauge for checking diameters to an accuracy of ± 0.02 mm
6. Handle different type of Fire extinguishers

3. Employment opportunities:

On successful completion of this course, the candidates shall be gainfully employed in the following industries:

1. Production & Manufacturing industries.
2. Structural Fabrication like bridges, Roof structures, Building & construction.
3. Automobile and allied industries
4. Service industries like road transportation and Railways.
5. Ship building and repair
6. Infrastructure and defence organizations
7. In public sector industries like BHEL, BEML, NTPC, etc and private industries in India & abroad.
8. Self employment

4. Further learning pathways:

- On successful completion of the course trainees can pursue Apprenticeship training in the reputed Industries / Organizations.
- On successful completion of the course trainees can opt for Diploma course (Lateral entry).
- On successful completion of the course trainees can opt for CITS course.

SYLLABUS FOR THE TRADE OF FITTER

First Semester

(Semester Code no. FTR - 01)

Duration : Six Month

Week No.	Trade Practical	Trade Theory
1.	<p>Importance of trade training, List of tools & Machinery used in the trade.</p> <p>Health & Safety: Introduction to safety equipments and their uses. Introduction of first aid, operation of Electrical mains.</p> <p>Occupational Safety & Health</p> <p>Importance of housekeeping & good shop floor practices.</p> <p>Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipments(PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message.</p> <p>Preventive measures for electrical accidents & steps to be taken in such accidents.</p> <p>Use of Fire extinguishers.</p>	<p>Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills: its importance and Job area after completion of training. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application.</p> <p>Response to emergencies eg; power failure, fire, and system failure.</p>
2.	<p>Identification of tools & equipments as per desired specifications for marking & sawing.</p> <p>Selection of material as per application</p> <p>Visual inspection of raw material for rusting, scaling, corrosion etc., Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions, sawing different types of metals of different sections.</p>	<p>Linear measurements- its units, dividers, calipers, hermaphrodite, centre punch, dot punch, their description and uses of different types of hammers. Description, use and care of 'V' Blocks, marking off table.</p>
3.	<p>Filing Channel, Parallel. Filing- Flat and square (Rough finish).</p> <p>Filing practice, surface filing, marking of straight and parallel lines with odd leg calipers and steel rule, marking practice with dividers, odd leg calipers and steel rule (circles, arcs, parallel lines).</p>	<p>Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws.</p> <p>Files- specifications, description, materials, grades, cuts, file elements, uses. Measuring standards (English, Metric Units), angular measurements, subdivisions, try square, ordinary depth gauge, protractor- description, uses and cares.</p>
4.	<p>Marking off straight lines and arcs using</p>	<p>Marking off and layout tools, dividers,</p>

	scribing block and dividers, chipping flat surfaces along a marked line.	scribing block, odd leg calipers, punches- description, classification, material, care & maintenance.
5.	Marking, filing, filing square, use of tri-square.	Calipers- types, material, constructional details, uses, care & maintenance of cold chisels- materials, types, cutting angles.
6&7	Marking according to simple blue prints for locating, position of holes, scribing lines on chalked surfaces with marking tools, finding center of round bar with the help of 'V' block and marking block. Joining straight line to an arc.	Marking media, marking blue, Prussian blue, red lead, chalk and their special application, description. Use, care and maintenance of scribing block.
8.	Chipping, Chip slots & oils grooves (Straight). Filing flat, square, and parallel to an accuracy of 0.5mm. Chip curve along a line-mark out, key ways at various angles & cut key ways.	Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types and uses, workshop surface plate- their uses, accuracy, care and maintenance. Types of files- convexing, taper, needle, care and maintenance of files, various types of keys, allowable clearances & tapers, types, uses of key pullers.
9.	File thin metal to an accuracy of 0.5 mm. Chip & chamfer, grooving and slotting	Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity.
10.	Saw along a straight line, curved line, on different sections of metal. Straight saw on thick section, M.S. angle and pipes.	Power Saw ,band saw, Circular saw machines used for metal sections cutting
11.	File steps and finish with smooth file accuracy ± 0.25 mm. File and saw on M.S. Square and pipe.	Micrometer- outside and inside – principle, constructional features, parts graduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer.
12.	File radius along a marked line (Convex & concave) & match. Chip sheet metal (shearing). Chip step and file.	Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital vernier caliper.
13.	Mark off and drill through holes, drill and tap on M.S. flat, Punch letter and number (letter punch and number punch), use of different punches.	Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size.
14.	Revision & Test (Two days) Prepare forge. Fire for heating metals. Forge a square rod from round stock. Judge the forging temperature of various metals.	Revision & Test Safety precautions to be observed in a smith shop, forge - necessity, description uses, fuel used for heating, bellows blowers, description and uses

15.	Forge M.S. round rod to square Forge flat chisel, grind.	Anvil and swage blocks. Description and uses. Forging tools- hammers- band and sledge, description and uses. Chisels, set hammers, flatters, hardier, fuller swage & uses. Measuring and checking tools- steel rule, brass rule, calipers, try square, description and uses. General idea about the main operations performed in a forging shop such as upsetting drawing, twisting, bending, punching, drilling, and welding.
16.	Forge – punches, screw drivers, chisels, grind them to shape and heat treat to requirement, bending metals to angles, curves & twisting, Preparation of brackets.	Metallurgical and metal working processes such as Heat treatment, various heat treatment methods -normalizing, annealing, hardening, case hardening and tempering. Power hammer – construction, features, method of operating and uses.
17.	Marking of straight lines, circles, profiles and various geometrical shapes and cutting the sheets with snips. Marking out of simple development, marking out for flaps for soldering and sweating.	Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications.
18-19.	Make various joints: wiring, hemming, soldering and brazing, form locked, grooved and knocked up single hem straight and curved edges form double hemming,. Punch holes-using hollow and solid punches. Do lap and butt joints.	Marking and measuring tools, wing compass, Prick punch, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, Soldering iron, types, specifications, uses. Trammel- description, parts, uses. Hand grooves- specifications and uses.
20.	Bend sheet metal into various curvature form, wired edges- straight and curves, fold sheet metal at angle using stakes. Bend sheet metal to various curvatures. Make simple Square, container with wired edge and fix handle.	Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection & application. Wired edges -
21.	Make square tray with square soldered corner Practice in soft soldering and silver soldering.	Solders-composition of various types of solders, and their heating media of soldering iron, fluxes types, selection and application-joints
22.	Make riveted lap and butt joint. Make funnel as per development and solder joints. Drilling for riveting. Riveting with as many types of rivet as available, use of counter sunk head rivets.	Rivets-Tin man's rivets types, sizes, and selection for various works. Riveting tools, dolly snaps description and uses. Method of riveting, shearing machine- description, parts and uses.
23-25	Revision	
26	Examination	

SYLLABUS FOR THE TRADE OF FITTER

Second Semester

(Semester Code no. FTR - 02)

Duration : Six Month

Week No.	Trade Practical	Trade Theory
1	Welding - Striking and maintaining arc, laying Straight-line bead.	Safety-importance of safety and general precautions observed in a welding shop. Precautions in electric and gas welding. (Before, during, after) Introduction to safety equipment and their uses. Machines and accessories, welding transformer, welding generators,
2	Making square, butt joint and 'T' fillet joint-gas and arc. Do setting up of flames, fusion runs with and without filler rod, and gas	Hand tools: Hammers, welding description, types and uses, description, principle, method of operating, carbon dioxide welding. H.P. welding equipment: description, principle, method of operating L.P. welding equipment: description, principle, method of operating. Types of Joints-Butt and fillet <u>as per BIS SP: 46-1988</u> specifications. Gases and gas cylinder description, kinds, main difference and uses.
3	Make butt weld and corner, fillet in arc welding	Setting up parameters for arc welding machines-selection of Welding electrodes
4	Gas cutting of MS plates	Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses.
5	Mark off and drill through holes, drill on M.S. flat, file radius and profile to suit gauge.	Drill- material, types, (Taper shank, straight shank) parts and sizes. Drill angle-cutting angle for different materials, cutting speed feed. R.P.M. for different materials. Drill holding devices- material, construction and their uses.
6	Counter sink, counter bore and ream split	Counter sink, counter bore and spot facing-tools

	fit (three piece fitting). Form internal threads with taps to standard size (through holes and blind holes) – Drill through hole and tap drill blind hole and tap, prepare studs and bolt.	and nomenclature, Reamer- material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure. Screw threads: terminology, parts, types and their uses. Screw pitch gauge: material parts and uses. Taps British standard (B.S.W., B.S.F., B.A. & B.S.P.) and metric /BIS (course and fine) material, parts (shank body, flute, cutting edge). Tap wrench: material, parts, types (solid & adjustable types) and their uses removal of broken tap, studs (tap stud extractor).
7	Form external threads with dies to standard size. Prepare nuts and match with bolts.	Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses.
8	Step fit, angular fit, file and make angle, surfaces (Bevel gauge accuracy 1 degree) make simple open and sliding fits.	Drill troubles: causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds: Fraction, metric, letters and numbers, grinding of drill.
9	Enlarge hole and increase internal dia. File cylindrical surfaces. Make open fitting of curved profiles.	Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Bench grinder parts and use-radius gauge, fillet gauge, material, construction, parts function and metric, different dimensions, convex and concave uses care and maintenance.
10	Make the circles by binding previously drilled hole. Test angular match up.	Radius gauge, feeler gauge, hole gauge, and their uses.
11	Inside square fit, make combined open and sliding fit, straight sides 'T' fit.	Interchangeability: Necessity in Engg, field definition, BIS. Definition, types of limit, terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone Different standard systems of fits and limits. British standard system, BIS system
12	File fit- combined, open angular and sliding sides. File internal angles 30 minutes accuracy open, angular fit.	Method of expressing tolerance as per BIS Fits : Definition, types description of each with sketch .Vernier height gauge : material construction, parts, graduations (English & Metric) uses, care and maintenance, Pig Iron : manufacturing process (by using)Blast furnace types, of pig Iron , properties and uses.
13	Make sliding fit with angles other than 90°, sliding fit with an angle.	Cast Iron: manufacturing process by using (cupola furnace) types, properties and uses. Wrought iron- : manufacturing process (Fuddling and Astor process) properties and uses. Steel: manufacturing process plain carbon steels, types, properties and uses.
14	Make simple bracket by bending and twisting of non-ferrous metal. Drill small holes (2mm) Drill holes on sheet metal, bend short for round bracket.	Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses.

15	Counter sink, counter bore and ream split fit (three piece fitting).	Counter sink, counter bore and spot facing-tools and nomenclature, Reamer- material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure.
16	Scrap on flat surfaces, scrap on curved surfaces and scrap surface parallels and test. Make & assemble, sliding flats, plain surfaces. Check for blue math of bearing surfaces- both flat and curved surfaces by witworth method.	Simple scraper- cir., flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces)
17	File and fit combined radius and angular surface (accuracy ± 0.5 mm), angular and radius fit. Locate accurate holes. Make accurate hole for stud fit. Fasten mechanical components / sub assemblies together using screws, bolts and collars using hand tools.	Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments Introduction to mechanical fasteners and its uses. Screw thread micrometer: Construction, graduation and use.
18	Cutting threads using dies. Make sliding fits assembly with parallel and angular mating surface. (± 0.04 mm)	Dial test indicator, construction, parts, material, graduation, Method of use,. Care and maintenance. Digital dial indicator. Comparators-measurement of quality in the cylinder bores.
19 & 20	Simple repair work, simple assembly of machine parts from blue prints. Rectify possible assembly faults during assembly.	Preventive maintenance-objective and function of P.M., section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of handbooks and reference table. Possible causes for assembly failures and remedies.
21	Assemble simple fitting using dowel pins and tap screw assembly using torque wrench.	Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torquing. Dowel pins: material, construction, types, accuracy and uses.
22-23	Implant training / Project work (work in a team)	
24-25	Revision	
26	Examination	

SYLLABUS FOR THE TRADE OF FITTER

Third Semester

(Semester Code no. FTR - 03)

Duration: Six Month

Week No.	Trade Practical	Trade Theory
01	True job on four jaw chuck using knife tool, face both the ends for holding between centers, Using roughing tool parallel turn ± 0.1 mm. Measure the diameter using outside caliper and steel rule.	Safely precautions to be observed while working on a lathe, Lathe specifications, and constructional features. Lathe main parts descriptions- bed, head stock, carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centers, works with catch plate, dog, simple description of a facing and roughing tool and their applications.
02	Lathe operations- the facing, parting and form tools, plain turn, step turn, holding job in three jaw chuck- deburr, chamfer-corner, round, the ends, Shoulder turn: square, filleted, beveled undercut shoulder, turning-filleted under cut, square beveled.	Lathe cutting tools- Brief study of the nomenclature of Lathe cutting tools and necessity of correct grinding, solid and tipped, throw away type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants.
03	Cut grooves- square, round 'V' groove, Make a mandrel-turn diameter to sizes. Knurl the job.	Chucks and chucking the independent four-jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck-mounting and dismounting, chucks, chucking true, face plate, drilling - method of holding drills in the tail stock, Boring tools and enlargement of holes.
04	Bore holes –spot face, pilot drill, enlarge hole, using boring tools, make a bush step bore-cut recess, turn hole diameter to sizes. Turn taper (internal and external). Turn taper pins. Turn standard tapers to suit with gauge.	General turning operations- parallel or straight, turning. Stepped turning, grooving, and shape of tools for the above operations. Appropriate method of holding the tool on tool post or tool rest, Knurling: - tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation. Taper – definition, use and method of expressing tapers. Standard tapers-taper, calculations morse taper.

05	Threading practice by using cut threads using taps, dies on lathe by hand, 'V' thread – external. Prepare a nut and match with the bolt.	Screw thread definition – uses and application. Terminology of screw threads, square, worm, buttress, acme (non standard-screw threads), Principle of cutting screw thread in centre lathe – principle of chasing the screw thread – use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread.
06	Assembly sliding for using keys and dowel pin and screw, ± 0.02 mm accuracy on plain surface. Testing of sliding fitting job, scrap on two flat surfaces and curved surfaces.	Screws: material, different types (inch & metric), uses Testing scraped surfaces: ordinary surfaces without a master plate.
07	File & fit angular mating surface plain within an accuracy of ± 0.02 mm & angular 15 minutes angular fitting.	Special files: types (pillar, Dread naught, Barrow, warding) description.
08	Drill through and blind holes at an angle, using swivel table of drilling machine, Precision drilling, reaming and tapping. Test-Job..	System of drill size, Fractional size: number, letter and metric. Templates and gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses.
09	Dovetailed fitting, radius fitting.	Description and uses of gauge-types (feeler, screw, pitch, radius, wire gauge),
10	File and fit, combined fit with straight, angular surface with ± 0.02 mm accuracy, hexagonal fitting. Check adherence to specification and quality standards using equipments like Vernier calipers, micrometers etc.,	Slip gauge: Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance. Application of slip gauges for measuring, Sine bar-Principle, application & specification. Procedure to check adherence to specification and quality standards.
11	Drilling and reaming, small dia. holes to accuracy correct location for fitting Make male and female fitting parts, drill and ream holes not less than 12.7 mm.	Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use.
12	Sliding fitting, Diamond fitting, Lapping flat surfaces using lapping plate.	Lapping: Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish. Equipment for tasting surfaces quality – dimensional tolerances of surface finish.

13	Stepped keyed fitting-test job. Lapping holes and cylindrical surfaces.	Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance.
14	Making a snap gauge for checking a dia of 10 ± 0.02 mm.	. Manufacture: The name and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization
15	Scrape angular mating surface, scrape on internal surface.	Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row.
16	Practice in dovetail fitting assembly and dowel pins and cap screws assembly. Industrial visit.	Roller and needle bearings: Types of roller bearing. Description & use of each Industrial visit.
17	Preparation of gap gauges.	Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, teflon polyamide (nylon).
18	Dovetail and Dowel pin assembly, scraps cylindrical bore.	Method of fitting ball and roller bearings
19	Scrapping cylindrical bore and to make a fit-make a cotter jib assembly.	Bearing metals – types, composition and uses, lubricants purpose of using different types, description and uses of each type
20	Scrapping cylindrical taper bore, check taper angle with sine bar, check in per angle (flat) with sine bar.	Hardening and tempering, purpose of each method, tempering colour chart.
21	Preparation of centre, squares, drills gauges. File and fit straight and angular surfaces internally Identify different ferrous metals by spark test	Annealing and normalising, purpose of each method.
22-23	Implant training / Project work (work in a team)	
24-25	Revision	
26	Examination	

SYLLABUS FOR THE TRADE OF FITTER

Fourth Semester

(Semester Code no. FTR - 04)

Duration : Six Month

Week No.	Trade Practical	Trade Theory
01.	'H' fitting-	Case hardening and carburising and its methods, process of carburising (solid, liquid and gas).
02.	Exercises on lapping of gauges (hand lapping only) Hand reams and fit taper pin, drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts.	Solder and soldering: Introduction-types of solder and flux. Method of soldering, Hard solder- Introduction, types and method of brazing. Production of gauges, templates and jigs. The objective of importance for preparing interchangeable components.
03.	Simple jigs and fixtures for drilling. Prepare a 'V' block and a clamp. Marking out as per Blue print, drilling, straight and curve filing. Threading with die, cutting slot, and cutting internal threads with taps, making an adjustable spanner.	Drilling jig-constructural features, types and uses. Fixtures-Constructural features, types and uses.
04.	Flaring of pipes and pipe joints, Cutting & Threading of pipe length. Fitting of pipes as per sketch. Conditions used for pipe work to be followed. Bending of pipes- cold and hot.	Pipes and pipe fitting- commonly used pipes. Pipe schedule and standard sizes. Pipe bending methods. Use of bending fixture, pipe threads- Std. Pipe threads Die and Tap, pipe vices.
05.	Practice-dismantling & assembling – globe valves sluice valves, stop cocks, seat valves and non-return valve, fitting of pipes and testing for leakage.	Standard pipefitting-. Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and house hold taps and pipe work. Use of tools such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc.
06.	Practice in handling Fire extinguishers of different types, refilling of extinguishers.	Fire precautions-causes and types of fires, precautions against out break of fire. Fire Extinguishers-types and use.
07.	Marking detail includes male & female screw cutting, male and female fitting parts. Making and tempering springs.	Working material with finished surface as aluminium, duralumin, stainless steel, the importance of keeping the work free from rust and corrosion. The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments and provide a pleasing finish as chromium silver plating and nickel plating, and galvanising.
08.	Exercises on finished material as aluminium and stainless steel,	Aluminium and its alloys. Uses, advantages and disadvantages, weight and strength as compared

	marking out, cutting to size, drilling etc. without damage to surface of finished articles.	with steel.
09.	Marking out for angular outlines, filing and fitting the inserts into gaps. Making a simple drilling jig, Marking out, filing to line, drilling and tapping brass and copper jobs.	Tapers on keys and cotters permissible by various standards. Discuss non-ferrous metals as brass, phosphor bronze, gunmetal, copper, aluminium etc. Their composition and purposes where and why used, advantages for specific purposes, surface wearing properties of bronze and brass.
10.	Complete exercises covering the assembly of parts working to detail and arrangement – Drawings, Dismantling and mounting of pulleys. Making replacing damaged keys. Repairing damaged gears and mounting. Repair & replacement of belts.	Power transmission elements. The object of belts, their sizes and specifications, materials of which the belts are made, selection of the type of belts with the consideration of weather, load and tension methods of joining leather belts. Vee belts and their advantages and disadvantages, Use of commercial belts, dressing and resin creep and slipping, calculation.
11.	Complete exercises covering the assembly of parts working to details and arrangements as per drawings. Dismantling and mounting of pulleys. Making, replacing damaged keys. Repairing damaged gears and mounting them on shafts.	Power transmissions, coupling types-flange coupling, -Hooks coupling-universal coupling and their different uses.
12.	More difficult work in marking out including tangents, templates involving use of vernier protractor.	Pulleys-types-solid, split and 'V' belt pulleys, standard calculation for determining size crowning of faces-loose and fast pulleys-jockey pulley. Types of drives-open and cross belt drives. The geometrical explanation of the belt drivers at an angle.
13.	Fitting of dovetail slides.	Power transmission –by gears, most common form spur gear, set names of some essential parts of the set-The pitch circles, Diametral pitch, velocity ratio of a gear set, Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and rack, worm gearing, velocity ration of worm gearing. Repair to gear teeth by building up and dovetail method.
14.	Male and female dovetail fitting repairs to geared teeth. Repair of broken gear tooth by stud. Repair broker gear teeth by dovetail.	Method or fixing geared wheels for various purpose drives. General cause of the wear and tear of the toothed wheels and their remedies, method of fitting spiral gears, helical gears, bevel gears, worm and worm wheels in relation to required drive. Care and maintenance of gears.

15 - 16	Marking out on the round sections for geometrical shaped fittings. Finishing and fitting to size, checking up the faces for universality.	Lubrication and lubricants- Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal. Bearings, method of lubrication-gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants: Soluble off soaps, suds-paraffin, soda water, common lubricating oils and their commercial names, selection of lubricants. Chains, wire ropes and clutches for power transmission. Their types and brief description. Discuss the various rivets shape and form of heads, riveting tools for drawing up the importance of correct head size. The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.
17	Prepare different types of documentation as per industrial need by different methods of recording information.	Importance of Technical English terms used in industry –(in simple definition only) Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards.
18 & 19	Inspection of Machine tools. Accuracy testing of Machine tools.	Installation, maintenance and overhaul of machinery and engineering equipment and Hydraulics & pneumatic symbols & exercise. Hydraulics pneumatic circuits. Clutch: Type, positive clutch (straight tooth type, angular tooth type) .
20.	Study of power transmission system in machine tools.	Washers-Types and calculation of washer sizes. The making of joints and fitting packing. The use of lifting appliances, extractor presses and their use. Practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts.
21.	Simple repair of machinery, making of packing gaskets, use of hollow punches, extractor ,drifts, various types of hammers and spanners, etc. Practicing, making various knots, correct loading of slings, correct and safe removal of parts. Erect sample machines.	Foundation bolt: types (rag, Lewis cotter bolt) description of each erection tools, pulley block, crow bar, spirit level, Plumb bob, pipe 2 X 4', wire rope, manila rope, wooden block.
22-23	Implant training / Project work (work in a team)	
24-25	Revision	
26	Examination	

TRADE: FITTER

LIST OF TOOLS & EQUIPMENTS

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity
1	Steel Rule 15 cm with metric graduation	21 nos.
2	Try Square 10 cm blade.	21 nos.
3	Caliper inside 15 cm spring.	21 nos.
4	Caliper 15 cm hermaphrodite	21 nos.
5	Caliper outside 15 cm spring	21 nos.
6	Divider 15 cm spring	21 nos.
7	Straight Scriber 15 cm.	21 nos.
8	Centre Punch 10 cm	21 nos.
9	Screw driver 15 cm	21 nos.
10	Chisel cold flat 10 cm	21 nos.
11	Hammer ball peen 0.45 kg. With handle	21 nos.
12	Hammer ball peen 0.22 kg. With handle.	21 nos.
13	File flat 25 cm. second cut	21 nos.
14	File flat 25 cm. smooth	21 nos.
15	File half round second cut 15 cm.	21 nos.
16	Hacksaw frame fixed 30 cm.	21 nos.
17	Safety goggles.	21 nos.
18	Dot slot punch 10 cm.	21 nos.

B : Instruments & General Shop Outfit

Sl. No.	Name of the items	Quantity
19	Steel Rule 30 cm	4 nos.
20	Steel Rule 60 cm.	4 nos.
21	Straight edge 45 cm steel	2 nos.
22	Surface plate 45 x 45 cm CI / Granite.	2 nos.
23	Marking table 91 x 91 x 122 cm.	1 no.
24	Universal scribing block 22 cm.	2 nos.
25	V-Block pair 7 cm and 15 cm with clamps	2 nos.
26	Square adjustable 15 cm blade.	2 nos.
27	Angle plate 10 x 20 cm.	2 nos.
28	Spirit Level 15 cm metal	1 no.
29	Punch letter 3 mm set.	1 no.
30	Punch number set 3 mm.	1 no.
31	Punch hollow 6 mm to 19 set of 5	2 nos.
32	Punch round 3mm x 4 mm set of 2	2 nos.
33	Portable hand drill (Electric) 0 to 6 mm	2 nos.
34	Drill twist straight shank 1.5 to 12 mm by 0.5 mm	1 Set
35	Drill twist straight shank 8 mm to 15 mm by ½ mm	1 Set
36	Taps and dies complete set in box B.A	1 no.
37	Taps and dies complete set in box with-worth.	1 no.
38	Taps and dies complete set in box 3-18 mm set of 10	1 no.
39	File warding 15 cm smooth	4 nos.
40	File knife edge 15 cm smooth	4 nos.
41	File cut saw 15 cm smooth	4 nos.
42	File feather edge 15 cm smooth	4 nos.
43	File triangular 15 cm smooth	2 nos.
44	File round 20 cm second cut	8 nos.
45	File square 15 cm second cut	4 nos.
46	File square 25 cm second cut	4 nos.
47	Feeler gauge 10 blades	1 set
48	File triangular 20 cm second cut.	8 nos.
49	File flat 30 cm second cut.	8 nos.
50	File flat 20 cm bastard	8 nos.
51	File flat 30 cm bastard.	8 nos.
52	File Swiss type needle set of 12.	2 sets
53	File half round 25 cm second cut.	8 nos.
54	File half round 25 cm bastard.	4 nos.
55	File round 30 cm bastard.	4 nos.
56	File hand 15 cm second cut.	8 nos.
57	Card file.	8 nos.
58	Oil Stone 15 cm x 5 cm x 2.5 cm	4 nos.
59	Stone carborandum 15 cm x 5 cm x 5 cm x 4 cm.	2 nos.
60	Oil Can 0.25 liters.	2 nos.
61	Pliers combination 15 cm	2 nos.

62	Soldering Iron 350 gm.	2 nos.
63	Blow Lamp 0.50 liters.	2 nos.
64	Spanner D.E. 6 -26 mm set of 10 pcs.	8 nos.
65	Spanner adjustable 15 cm	2 nos.
66	Interchangeable ratchet socket set with a 12 mm driver, sized 10-32 mm set of 18 socket & attachments.	1 set
67	Box spanner set 6-25 mm set of 8 with Tommy bar.	1 set
68	Glass magnifying 7 cm	2 nos.
69	Clamp toolmaker 5 cm and 7.5 cm set of 2.	2 nos.
70	Clamp "C" 5 cm	2 nos.
71	Clamp "C" 10 cm	2 nos.
72	Hand Reamer adjustable cover max 9,12,18mm – set of 3	1 set
73	Hand Reamer taper 4 -9mm set of 6 OR 4 -7 mm set of 4.	1 set
74	Reamer parallel 12 - 16mm set of 5.	1 no.
75	Scraper flat 15 cm.	8 nos.
76	Scraper triangular 15 cm	8 nos.
77	Scraper half round 15cm	8 nos.
78	Chisel cold 9 mm cross cut 9 mm diamond.	8 each
79	Chisel cold 19 mm flat	8 nos.
80	Chisel cold 9 mm round noze.	8 nos.
81	Stud Extractor EZY – out	2 nos.
82	Combination Set 30 cm.	2 nos.
83	Micrometer 0 – 25 mm outside.	2 nos.
84	Micrometer 25 – 50 mm outside.	3 nos.
85	Micrometer 50 –75 mm outside.	2 nos.
86	Micrometer inside 25 - 50 mm with extension rods.	1 no.
87	Vernier caliper 15 cm	1 no.
88	Vernier height gauges 30 cm.	1 no.
89	Vernier bevel protractor.	1 no.
90	Screw pitch gauge.	1 no.
91	Wire gauge, metric standard.	1 no.
92	Drill twist Taper Shank 12 mm to 25 mm x 1.5.	1 no.
93	Drill chuck 12 mm.	1 no.
94	Pipe wrench 40 cm	1 no.
95	Pipe vice 100mm	1 no.
96	Adjustable pipe tap set BSP with die set cover pipe size 15, 20, 25,32,38,50 mm.	1 no.
97	Wheel dresser (One for 4 units).	1 no.
98	Machine vice 10 cm.	1 no.
99	Machine vice 15 cm	1 no.
100	Sleeve drill Morse 0 - 1, 1 - 2, 2 - 3.	1 Set
101	Vice bench 12 cm jaws.	16 nos.
102	Vice leg 10 cm jaw.	2 nos.
103	Bench working 240 x 120 x 90 cm.	4 nos.

104	Almirah 180 x 90 x 45 cm.	2 nos.
105	Lockers with 6 drawers (standard size).	2 nos.
106	Metal rack 182 x 182 x 45 cm	1 no.
107	Instructor Table	1 no.
108	Instructor Chair	1 no.
109	Black board with easel.	1 no.
110	Fire extinguisher (For 4 Units)	2 nos.
111	Fire buckets.	2 nos.
112	Machine vice 100mm.	2 nos.
113	Wing compass 25.4 cm or 30 cm.	2 nos.
114	Hand hammer 1 kg. with handle.	2 nos.
115	Torque wrench (14 to 68 Nm)	1 no.

C : Tools for Allied Trade- Blacksmith & Sheet Metal Work

Sl. No.	Name of the items	Quantity
115	Hammer smith 2 kg. With handle.	2 nos.
116	Tongs roving 350mm.	2 nos.
117	Tongs fiat 350mm.	2 nos.
118	Smith's square 45 cm x 30 cm.	1 no.
119	Cold set rod 25X200mm.	2 nos.
120	Hot set rod 25X200mm.	1 no.
121	Swages top & bottom 12 mm /19	1 Each
122	Swage block 35 x 35 x 12 cm.	1 no.
123	Flatters (rod 55 mm square).	2 nos.
124	Fuller top & bottom 6 mm 9 mm (Pair).	2 nos.
125	Anvil 50 kg.	2 nos.
126	Anvil stand	2 nos.
127	Shovel.	2 nos.
128	Trammel 30cm.	1 no.
129	Rake.	2 nos.
130	Quenching tank (To be made in the Institute).	1 no.
131	Pocker.	2 nos.
132	Hardle.	2 nos.
133	Leather apron.	2 nos.
134	Prick punch	2 nos.
135	Mallet.	2 nos.
136	Snips straight 25 cm.	2 nos.
137	Setting hammers with handle.	2 nos.
138	Planishing hammer.	2 nos.
139	Snip bent 25 cm.	2 nos.
140	Stake hatchet.	2 nos.
141	Stake grooving.	2 nos.
142	Gauge imperial sheet.	1 no.

The specifications of the items in the above list have been given in Metric Units. The items which are available in the market nearest of the specification as mentioned above, if not available as prescribed should be procured Measuring instruments such as steel rule which are graduated both English and Metric Units may be procured, if available.

D : Modified list of tools for the 3rd and 4th semester for fitter trade.

Sl. No.	Name of the Tools & Equipment	Quantity
*1.	Slip Gauge as Johnson metric set.	1 Set
2.	Carbide Wear Block 1 mm – 2 mm.	2 each
*3.	Gauge snap Go and Not Go 25 to 50 mm by 5mm. Set of 6 pcs.	1 Set
*4.	Gauge plug single 3 ended 5 to 55 by 5 mm. Set of 11 pcs.	1 Set
**5.	Gauge telescopic upto 150 mm.	1 no.
6.	Dial test indicator .01 mm on stand	1 no.
7.	Sine bar 125 mm.	1 no.
8.	Sine bar 250 mm.	1 no.
9.	Lathe tools H.S.S. tipped set.	2 nos.
10.	Lathe tools bit 6 mm x 75 mm.	4 nos.
11.	Lathe tools bit 8 mm x 75 mm.	4 nos.
12.	Lathe tools bit 10 mm x 85mm.	4 nos.
13.	Arm strong type tool bit holder R.H.	2 nos.
14.	Arm strong type tool bit holder L.H.	2 nos.
15.	Arm strong type tool bit holder straight.	2 nos.
16.	Stilson wrenches 25 cm	2 nos.
17.	Pipe cutter 6 mm to 50 mm wheel type.	1 no.
18.	Pipe bender spool type up to 25 mm. with stand manually operated.	1 no.
19.	Adjustable pipe chain tonge to take pipes up to 300 mm.	1 no.
20.	Adjustable spanner 38 cm long.	1 no.
**21.	Dial vernier caliper 0 – 200 mm LCO 0.05 mm. (Universal type).	1 no.
**22.	Screw thread micrometer with interchangeable 0-25mm. Pitch anvils for checking metric threads 60.	1 no.
23.	Depth micrometer 0-25 mm. 0.01 mm.	1 no.
**24.	Vernier caliper 0-150 mm. L.C. 0.02 mm.	1 no.
**25.	Digital Micrometer 0 – 25 mm outside. L.C. 0.001 mm.	1 no.
**26.	Comparators stand with dial indicator LC 0.01mm.	1 no.
27.	Engineer's try square (knife-edge) 150 mm blade.	1 no.
**28	Surface roughness comparison plates N1-N12 grade	1 Set
29	Digital Vernier caliper 0-150 mm. L.C. 0.001 mm.(Optional)	1no.

E : General Machinery Installations –

Sl. No.	Name & Description of Machines	Quantity
*1.	SS and SC centre lathe (all geared) with minimum specification as: Centre height 150 mm and centre distance 1000 mm along with 3 & 4 jaw chucks, auto feed system, safety guard, taper turning attachment, motorized coolant system, lighting arrangement & standard accessories.	2 Nos.
2	Drilling machine pillar sensitive 0-20 mm cap with swivel table motorised with chuck & key.	1 no.
3	Drilling machine bench sensitive 0-12 mm cap motorised with chuck and key.	2 nos.
4	Forge portable hand blower 38 cm to 45 cm.	1 no.
5	D.E. pedestal Grinding machine with 200mm diameter wheels rough and smooth with twist drill grinding attachment.	1 no.

Note: - (*) No additional number of items are required to be provided up to four batches of trainees i.e. two batches in the first shift and two in the second shift.

(**) Only one number need be provided in each I.T.I. irrespective of No. of Units.

F : List of additional tools for allied trade in welding

Sl. No.	Name & Description of Machines	Quantity
1.	Transformer welding set 150 amps. – continuous welding current, with all accessories and electrode holder	1 Set
2.	Welder cable to carry 200 amps. With flexible rubber cover	20 Meter
3.	Lungs for cable	12 Nos.
4.	Earth clamps.	2 Nos.
5.	Arc welding table (all metal top) 122 cm X 12 cm X 60 cm with positioner.	1 No.
6.	Oxy – acetylene gas welding set equipment with hoses, regulator and other accessories.	1 Set.
7.	Gas welding table with positioner	1 No
8.	Welding torch tips of different sizes	1 Set
9.	Gas lighter.	2 Nos
10.	Trolley for gas cylinders.	1 No
11.	Chipping hammer.	2 Nos
12.	Gloves (Leather)	2 Pairs
13.	Leather apron.	2 Nos
14.	Spindle key for cylinder valve.	2 Nos.
15.	Welding torches 5 to 10 nozzles.	1 Set.
16.	Welding goggles	4 Pairs.
17.	Welding helmet with coloured glass	2 Nos.
18.	Tip cleaner	10 Sets.

Note: - Those additional items are to be provided for the Allied Trade Training where the welding trade does not exist.

LIST OF TRADE COMMITTEE MEMBERS

Sl. No.	Name & Designation Sh/Mr./Ms.	Organization	Mentor Council Designation
Members of Sector Mentor council			
1.	A. D. Shahane, Vice-President, (Corporate Trg.)	Larsen & Tourbo Ltd., Mumbai:400001	Chairman
2.	Dr. P.K.Jain, Professor	IIT, Roorkee, Roorkee-247667, Uttarakhand	Member
3.	N. Ramakrishnan, Professor	IIT Gandhinagar, Gujarat-382424	Member
4.	Dr. P.V.Rao, Professor	IIT Delhi, New Delhi-110016	Member
5.	Dr. Debdas Roy, Asstt. Professor	NIFFT, Hatia, Ranchi-834003, Jharkhand	Member
6.	Dr. Anil Kumar Singh, Professor	NIFFT, Hatia, Ranchi-834003, Jharkhand	Member
7.	Dr. P.P.Bandyopadhyay Professor	IIT Kharagpur, Kharagpur- 721302, West Bengal	Member
8.	Dr. P.K.Ray, Professor	IIT Kharagpur, Kharagpur- 721302, West Bengal	Member
9.	S. S. Maity, MD	Central Tool Room & Training Centre (CTTC), Bhubaneswar	Member
10.	Dr. Ramesh Babu N, Professor	IIT Madras, Chennai	Member
11.	R.K. Sridharan, Manager/HRDC	Bharat Heavy Electricals Ltd, Ranipet, Tamil Nadu	Member
12.	N. Krishna Murthy Principal Scientific Officer	CQA(Heavy Vehicles), DGQA, Chennai, Tamil Nadu	Member
13.	Sunil Khodke Training Manager	Bobst India Pvt. Ltd., Pune	Member
14.	Ajay Dhuri	TATA Motors, Pune	Member
15.	Uday Apte	TATA Motors, Pune	Member
16.	H B Jagadeesh, Sr. Manager	HMT, Bengaluru	Member
17.	K Venugopal Director & COO	NTTF, Peenya, Bengaluru	Member
18.	B.A.Damahe, Principal L&T Institute of Technology	L&T Institute of Technology, Mumbai	Member
19.	Lakshmanan. R Senior Manager	BOSCH Ltd., Bengaluru	Member
20.	R C Agnihotri Principal	Indo- Swiss Training Centre Chandigarh, 160030	Member
Mentor			
21.	Sunil Kumar Gupta (Director)	DGET HQ, New Delhi.	Mentor
Members of Core Group			
22.	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator
23.	H.Charles (TO)	NIMI, Chennai.	Member

24.	Sukhdev Singh (JDT)	ATI Kanpur	Team Leader
25.	Ravi Pandey (V.I)	ATI Kanpur	Member
26.	A.K. Nasakar (T.O)	ATI Kolkata	Member
27.	Samir Sarkar (T.O)	ATI Kolkata	Member
28.	J. Ram Eswara Rao (T.O)	RDAT Hyderabad	Member
29.	T.G. Kadam (T.O)	ATI Mumbai	Member
30.	K. Mahendar (DDT)	ATI Chennai	Member
31.	Shrikant S Sonnavane (T.O)	ATI Mumbai	Member
32.	K. Nagasrinivas (DDT)	ATI Hyderabad	Member
33.	G.N. Eswarappa (DDT)	FTI Bangalore	Member
34.	G. Govindan, Sr. Draughtsman	ATI Chennai	Member
35.	M.N.Renukaradhya, Dy.Director/Principal Grade I.,	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
36.	B.V.Venkatesh Reddy. JTO	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
37.	N.M.Kajale, Principal,	Govt. ITI Velhe, Distt: Pune, Maharashtra	Member
38.	Subrata Polley, Instructor	ITI Howrah Homes, West Bengal	Member
39.	VINOD KUMAR.R Sr.Instructor	Govt. ITI Dhanuvachapuram Trivendrum, Dist., Kerala	Member
40.	M. Anbalagan, B.E., Assistant Training Officer	Govt. ITI Coimbatore, Tamil Nadu	Member
41.	K. Lakshmi Narayanan, T.O.	DET, Tamil Nadu	Member
Other industry representatives			
42.	Venugopal Parvatikar	Skill Sonics, Bangalore	Member
43.	Venkata Dasari	Skill Sonics, Bangalore	Member
44.	Srihari, D	CADEM Tech. Pvt. Ltd., Bengaluru	Member
45.	Dasarathi.G.V.	CADEM Tech. Pvt. Ltd., Bengaluru	Member
46.	L.R.S.Mani	Ohm Shakti Industries, Bengaluru	Member