GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

**COMPETENCY BASED CURRICULUM**

# FITTER

**(Duration: Two Years)**
**Revised in July 2022**

## CRAFTSMEN TRAINING SCHEME (CTS)

## NSQF LEVEL- 4

## SECTOR – CAPITAL GOODS AND MANUFACTURING

Directorate General of Training

# FITTER

## (Engineering Trade)

**(Revised in July 2022)**

**Version: 2.0**

## CRAFTSMEN TRAINING SCHEME (CTS)

## NSQF LEVEL - 4

Developed By

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Directorate General of Training
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# 1. COURSE INFORMATION

During the two-year duration a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation and Employability Skill related to job role. In addition to this a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The practical part starts with basic fitting with tolerance level ± 0.5mm and finally to ± 0.02mm and angular tolerance from 1° to 10' at the end of the course. The broad components covered under Professional Skill subject are as below:

**FIRST YEAR:** The practical part starts with basic fitting in the beginning and the candidate also imparted training on allied trades viz., Sheet Metal, Welding (Gas & Arc) which leads to multi-skilling. In the basic fitting the skills imparted are sawing, filing, marking, chipping, measurement, riveting, soldering, brazing, drilling and observation of all safety aspects is mandatory. The accuracy achieved is of±0.25 mm. The safety aspects cover components like OSH&E, PPE, Fire extinguisher, First Aid and in addition 5S being taught.

Different drilling operations (through, blind, angular), reaming, offhand grinding, tapping, dieing, different fits viz., sliding fit, etc., scraping, fastening (nuts & bolts, riveting, studs, screws, etc.,). The accuracy achieved is of± 0.04 mm and angular accuracy to 30minutes. Different turning operations on lathe (step, grooving, chamfering, drilling, boring, knurling & threading), simple repair, overhauling and lubrication work on machine are being taught in the practical.

**SECOND YEAR**: Power tool operation, different complex assembling and fitting, fastening, lapping, making gauges, pipe works and pipe joints, Dismantling, overhauling& assembling valves are covered. The accuracy achieved is of an accuracy of ± 0.02 mm & 10 minutes.

Making & using drill jigs, making of critical components, repair & maintenance of power transmission system, making of template &complex gauges, identify different Pneumatic & hydraulic components and circuit construction, repair & maintenance of machinery like lathe, drill, grinding, bench drilling, Inspection of Machine tools, Accuracy testing of Machine tools and erection of simple machines are being performed as part of practical training.

Professional Knowledge subject is simultaneously taught in the same fashion to apply cognitive knowledge while executing task. In addition components like Physical properties of engineering materials, Interchangeability, Method of expressing tolerance as per BIS Fits,

different types of iron, properties and uses, special files, honing, Metallurgical and metal working processes such as Heat treatment, the various coatings used to protect metals, different bearing, working material with finished surface as aluminium, duralumin and stainless steel, topics related to non-ferrous metals, Method of lubrication are also covered under theory part.

Total two projects need to be completed by the candidates in a group. In addition to above components the core skills components viz., Workshop calculation & science, Engineering drawing, employability skills are also covered. These core skills are essential skills which are necessary to perform the job in any given situation.

# 2. TRAINING SYSTEM

## 2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development &Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer schemes of DGT for strengthening vocational training.

Fitter trade under CTS is one of the most popular courses delivered nationwide through network of ITIs. The course is of two years duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) impart professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skills, knowledge and life skills. After passing out of the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

### Candidates broadly need to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs.
- Check the job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

## 2.2 PROGRESSION PATHWAYS:

- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise to the level of Manager.
- Can become Entrepreneur in the related field.
- Can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/ Technical education.

- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

## 2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years: -

| S No. | Course Element | Notional Training Hours | |
|---|---|---|---|
| | | 1st Year | 2nd Year |
| 1 | Professional Skill (Trade Practical) | 840 | 840 |
| 2 | Professional Knowledge (Trade Theory) | 240 | 300 |
| 3 | Employability Skills | 120 | 60 |
| | **Total** | **1200** | **1200** |

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

| | | | |
|---|---|---|---|
| 4 | On the Job Training (OJT)/ Group Project | 150 | 150 |

Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10th/ 12th class certificate along with ITI certification, or, add on short term courses

## 2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The **Continuous Assessment (Internal)** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning

outcomes. The training institute has to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure are being notified by DGT from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

### 2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one-year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects are 33%.

### 2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work
- Computer based multiple choice question examination
- Practical Examination

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examination body. The following marking pattern to be adopted for formative assessment:

| Performance Level | Evidence |
|---|---|
| (a) Marks in the range of 60 -75% to be allotted during assessment | |
| For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship. | • Demonstration of good skill in the use of hand tools, machine tools and workshop equipment<br>• 60-70% accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A fairly good level of neatness and consistency in the finish<br>• Occasional support in completing the project/job. |
| (b) Marks in the range of above75% - 90% to be allotted during assessment | |
| For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship. | • Good skill levels in the use of hand tools, machine tools and workshop equipment<br>• 70-80% accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A good level of neatness and consistency in the finish<br>• Little support in completing the project/job |
| (c) Marks in the range of above 90% to be allotted during assessment | |
| For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety | • High skill levels in the use of hand tools, machine tools and workshop equipment<br>• Above 80% accuracy achieved while |

| | |
|---|---|
| procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship. | undertaking different work with those demanded by the component/job/set standards.<br>• A high level of neatness and consistency in the finish.<br>• Minimal or no support in completing the project. |

# 3. JOB ROLE

**Fitter General;** Sizes metal parts to close tolerances and fits and assembles them using hand tools for production or repairs of machines, or other metal products. Studies drawings to understand specification of different parts, fittings or assembles to be made and their functions. They select materials, appropriate tool and equipments to carry out their work. Holds the work in Vice, Cuts and shapes required parts to dimensions and specifications by processes of sawing, chipping, filing, grinding, drilling holes, screw cutting, scrapping etc., using hand tools for making specimens or finished components. Measures object while working using foot rules, calipers, micrometer, gauges etc. and checks for correct filing with square. Gets half-finished object marked or marks it himself using face plate, marking block scriber, vernier, height gauges, vee-blocks, angle plate, sine plate, slip gauges, combination set, etc. depending on accuracies required, to indicate guide lines for finished sizes, holes to be drilled and pitch centres, threads to be cut and other working details as specified in drawing or sample. Clamps object securely in correct position in vice and files it to required dimensions according to punch marks and guide lines frequently measuring it with calipers, micrometre, vernier, gauges etc, makes holes with drill, cuts threads with taps and dies ensuring that they are square or at required angle to base. Measures finished article with dial indicator, micrometre, vernier, height gauges, screw gauges, plug gauges, sine bar, slip gauge, etc according to prescribed accuracies. May make parts separately and assemble those with screws, rivets, pins, etc. as specified so as to make complete unit according to drawing. Dismantles or removes worn out, broken or defective parts using hand tools or power tools and replaces them by repaired or new ones. Performs repairing and maintenance work (including preventive maintenance) of simple machines, dismantles and replaces different components to construct circuit of Pneumatics and Hydraulics. Tests completed article/ assembly to ensure correct performance. May do simple turning of parts on machines and perform welding, brazing, and like operations. May explain heat treatment processes viz., annealing, hardening, tempering etc. May specialize in particular type of machine or product and be designated accordingly. May suggest alterations.

In addition, Fitter have the ability to visualize the job, good coordination, mechanical attitude, manual dexterity and perform work related mathematical calculations.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

May be designated as FITTER General according to nature of work done.

**Reference NCO 2015:**

i) 7233.0100 –Fitter, General
ii) 7233.0200 – Fitter, Bench

**Reference NOS:**

i) CSC/N0304,
ii) CSC/N0301,
iii) CSC/N0110

# 4. GENERAL INFORMATION

| | |
|---|---|
| **Name of the Trade** | **FITTER** |
| **Trade Code** | DGT/1002 |
| **NCO - 2015** | 7233.0100, 7233.0200 |
| **NOS Covered** | CSC/N0304, CSC/N0301, CSC/N0110 |
| **NSQF Level** | Level – 5 |
| **Duration of Craftsmen Training** | Two Years (2400 hours + 300 hours OJT/Group Project) |
| **Entry Qualification** | Passed 10th class examination with Science and Mathematics or with vocational subject in same sector or its equivalent. |
| **Minimum Age** | 14 years as on first day of academic session. |
| **Eligibility for PwD** | LD, LC, DW, AA, LV, DEAF |
| **Unit Strength (No. Of Student)** | 20 (There is no separate provision of supernumerary seats) |
| **Space Norms** | 88 Sq.m |
| **Power Norms** | 3.51 KW |
| **Instructors Qualification for** | |
| **1. Fitter Trade** | B.Voc/Degree in Mechanical Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.<br>**OR**<br>03 years Diploma in Mechanical Engineeringfrom AICTE/recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.<br>**OR**<br>NTC/NAC passed in the Trade of "Fitter" With three years' experience in the relevant field.<br><br>**<u>Essential Qualification</u>:**<br>Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) under DGT. |

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| | ***Note:-Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.*** |
| **2. Workshop Calculation & Science** | .Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.<br>**OR**<br>03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.<br>**OR**<br>NTC/ NAC in any one of the engineering trades with three years' experience.<br><br>**Essential Qualification:**<br>Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade<br>**OR**<br>Regular / RPL variants NCIC in RoDA or any of its variants under DGT |
| **3. Engineering Drawing** | B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.<br>**OR**<br>03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.<br>**OR**<br>NTC/ NAC in any one of the Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience.<br><br>**Essential Qualification:**<br>Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade<br>**OR**<br>Regular / RPL variants of NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT. |
| **4. Employability Skill** | MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability |

| | |
|---|---|
| | Skills.<br>(Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)<br>**OR**<br>Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills. |
| **5. Minimum Age for Instructor** | 21 Years |
| **List of Tools and Equipment** | As per Annexure – I |

# 5. LEARNING OUTCOME

***Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.***

## 5.1LEARNING OUTCOMES (TRADE SPECIFIC)

**FIRST YEAR:**

1. Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy following safety precautions. *[Basic fitting operation – Marking, Hacksawing, Chiselling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]* CSC/N0304
2. Manufacture simple sheet metal items as per drawing and join them by soldering, brazing and riveting. CSC/N03001
3. Join metal components by riveting observing standard procedure. CSC/N0304
4. Join metal component by arc welding observing standard procedure. CSC/N0304
5. Cut and join metal component by gas (oxyacetylene) CSC/N0304
6. Produce components by different operations and check accuracy using appropriate measuring instruments. [Different Operations - Drilling, Reaming, Taping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer] CSC/N0304
7. Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality. [Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.] CSC/N0304
8. Produce components involving different operations on lathe observing standard procedure and check for accuracy. [Different Operations – facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, boring, taper turning, threading (external 'V' only)] CSC/N0110
9. Plan & perform simple repair, overhauling of different machines and check for functionality. [Different Machines – Drill Machine, Power Saw, Bench Grinder and Lathe]
10. Read and apply engineering drawing for different application in the field of work.
11. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.

**SECOND YEAR:**

12. Make & assemble components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality. [Different Mating Surfaces – Dovetail fitting, Radius fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance - ±0.02mm, angular tolerance ± 10 min.] CSC/N0304
13. Make different gauges by using standard tools & equipment and checks for specified accuracy. [Different Gauges – Snap gauge, Gap gauge; Specified Accuracy - ±0.02mm] CSC/N0304
14. Apply a range of skills to execute pipe joints, dismantle and assemble valves & fittings with pipes and test for leakages. [Range of skills – Cutting, Threading, Flaring, Bending and Joining] CSC/N0304
15. Make drill jig & produce components on drill machine by using jigs and check for correctness. CSC/N0304
16. Plan, dismantle, repair and assemble different damaged mechanical components used for power transmission & check functionality. [Different Damage Mechanical Components – Pulley, Gear, Keys, Jibs and Shafts.] CSC/N0304
17. Identify, dismantle, replace and assemble different pneumatics and hydraulics components. [Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]
18. Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect.
19. Plan & perform basic day to day preventive maintenance, repairing and check functionality. [Simple Machines – Drill Machine, Power Saw and Lathe] CSC/N0304
20. Plan, erect simple machine and test machine tool accuracy. [Simple Machines – Drill Machine, Power Saw and Lathe]
21. Read and apply engineering drawing for different application in the field of work.
22. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.

# 6. ASSESSMENT CRITERIA

| LEARNING OUTCOMES | ASSESSMENT CRITERIA |
|---|---|
| **FIRST YEAR** | |
| 1. Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy following safety precautions. *[Basic fitting operation – marking, Hacksawing, Chiselling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]* CSC/N0304 | Plan & Identify tools, instruments and equipment for marking and make this available for use in a timely manner. |
| | Select raw material and visual inspect for defects. |
| | Mark as per specification applying desired mathematical calculation and observing standard procedure. |
| | Measure all dimensions in accordance with standard specifications and tolerances. |
| | Identify Hand Tools for different fitting operations and make these available for use in a timely manner. |
| | Prepare the job for Hacksawing, chiselling, filing, drilling, tapping, grinding. |
| | Perform basic fitting operations viz., Hacksawing, filing, drilling, tapping and grinding to close tolerance as per specification to make the job. |
| | Observe safety procedure during above operation as per standard norms and company guidelines. |
| | Check for dimensional accuracy as per standard procedure. |
| | Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal. |
| | |
| 2. Manufacture simple sheet metal items as per drawing and join them by soldering, brazing and riveting. CSC/N0301 | Identify Hand Tools for Sheet Metal work, Soldering, Brazing & riveting and make these available for use in a timely manner. |
| | Mark and develop various forms as per drawing using sheet metals. |
| | Make of simple items with sheet metal as per drawing. |
| | Prepare the job for Soldering, Brazing &riveting. |
| | Identify different type of rivets and use as per requirement. |
| | Identify tools for drilling and use these tools. |
| | Mark according to drawing. |
| | Drill through holes on the job. |
| | Solder, Braze and Rivet to prepare a job as per given drawing / sample following standard practices. |
| | Observe safety procedure during riveting as per standard norms and company guidelines. |
| | |
| 3. Join metal components by | Identify Tools and equipments for riveting and make these |

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|---|---|
| riveting observing standard procedure. CSC/N0304 | available for use in a timely manner. |
| | Prepare the job for lap and butt joint. |
| | Identify different type of rivets and use as per requirement. |
| | Identify tools for drilling and use these tools. |
| | Mark according to drawing. |
| | Drill through holes on the job. |
| | Rivet to prepare a job as per given drawing / sample following standard practices. |
| | Observe safety procedure during riveting as per standard norms and company guidelines. |
| | |
| 4. Join metal component by arc welding observing standard procedure. CSC/N0304 | Identify different components/parts of arc welding machine, collect desired information and set each components/parts as per standard procedure. |
| | Observe safety/ precaution during operation. |
| | Select appropriate material & plan for arc welding. |
| | Weld metal parts / mechanical components as per specification observing standard procedure. |
| | Check joined part portion to ascertain proper welding. |
| | |
| 5. Cut and join metal component by gas (oxyacetylene). CSC/N0304 | Identify different components/parts of Gas (oxyacetylene) machine, collect desired information and set each components/parts as per standard procedure. |
| | Observe safety/ precaution during operation. |
| | Select appropriate material & plan for gas cutting & joining operation. |
| | Cut & join metal parts / mechanical components as per specification observing standard procedure. |
| | Check cut portion/ joined part to ascertain proper welding. |
| | |
| 6. Produce components by different operations and check accuracy using appropriate measuring instruments.*[Different Operations - Drilling, Reaming, Taping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer]* CSC/N0304 | Ascertain and select tools and materials for the job and make this available for use in a timely manner. |
| | Plan work in compliance with standard safety norms. |
| | Produce component by observing standard procedure. |
| | Check the dimensions of the produced components to ensure dimensions are within prescribed limit. |
| | Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal. |
| | |
| 7. Make different fit of | Recognize general concept of Limits, Fits and tolerance |

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| components for assembling as per required tolerance observing principle of interchangeability and check for functionality. *[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.]* CSC/N0304 | necessary for fitting applications and functional application of these parameters. |
| | Ascertain and select tools and materials for the job and make this available for use in a timely manner. |
| | Set up workplace/ assembly location with due consideration to operational stipulation |
| | Plan work in compliance with standard safety norms and collecting desired information. |
| | Demonstrate possible solutions and agree tasks within the team. |
| | Make components according to the specification for different fit using a range of practical skills and ensuring interchangeability of different parts. |
| | Assemble components applying a range of skills to ensure proper fit. |
| | Check functionality of components. |
| | |
| *8.* Produce components involving different operations on lathe observing standard procedure and check for accuracy. *[Different Operations – facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, boring, taper turning, threading (external 'V' only)]* CSC/N01110 | Ascertain basic working principles and safety aspect of lathe machine. |
| | Understand functional application of different levers, stoppers, adjustment etc. |
| | Identify different lubrication points and lubricants, their usage for application in lathe machine as per machine manual. |
| | Identify different work and tool holding devices and collect information for functional application of each device. |
| | Mount the work and tool holding devices with required alignment and check for its functional usage to perform lathe operations. |
| | Solve problem by applying basic methods, tools, materials and information during setting. |
| | Observe safety procedure during mounting as per standard norms. |
| | Produce components observing standard procedure. |
| | Check accuracy/ correctness of job using appropriate equipment/gauge. |
| | Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal. |
| | |
| 9. Plan&perform simple repair, *overhauling* of different machines and | Ascertain and select tools and materials for the repair, overhauling and make this available for use in a timely manner. |

| | |
|---|---|
| check for functionality. *[Different Machines – Drill Machine, Power Saw, Bench Grinder and Lathe]* | Plan work in compliance with standard safety norms. |
| | Demonstrate possible solutions and agree tasks within the team. |
| | Select specific parts to be repaired and ascertain for appropriate material and estimated time. |
| | Repair, overhaul and assemble the parts in the machine with the help of blueprint. |
| | Check for functionality of part and ascertain faults of the part/ machine in case of improper function. |
| | Rectify faults of assembly. |
| | |
| 10. Read and apply engineering drawing for different application in the field of work. | Read & interpret the information on drawings and apply in executing practical work. |
| | Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters. |
| | Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work. |
| | |
| 11. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. | Solve different mathematical problems |
| | Explain concept of basic science related to the field of study |
| **SECOND YEAR** | |
| 12. Make &assemble components of different mating *surfaces* as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality. *[ Different Mating Surfaces – Dovetail fitting, Radius fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening* | Ascertain and select tools and materials for the job and make this available for use in a timely manner. |
| | Plan work in compliance with standard and collecting necessary information. |
| | Set up workplace/ assembly location with due consideration to operational stipulation |
| | Demonstrate possible solutions and agree tasks within the team. |
| | Produce different components with appropriate accuracy by observing standard procedure& method as per specification using appropriate tools & machines. |
| | Perform scraping and lapping of components to obtain required surface finish of different mating surface. |
| | Comply with safety rules when performing the above operations. |
| | Check tolerance and accuracy of components as defined |

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| *components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance - ±0.02mm, angular tolerance ± 10 min.]* CSC/N0304 | with appropriate instruments observing standard procedure. |
| | Assemble different components using different fastening components, tools and check the functionality. |
| | |
| 13. Make different gauges by using standard tools & equipment and checks for specified accuracy. *[Different Gauges – Snap gauge, Gap gauge; Specified Accuracy - ±0.02mm]* CSC/N0304 | Ascertain and select tools and materials for the job and make this available for use in a timely manner. |
| | Plan work in compliance with standard safety norms. |
| | Produce gauge by observing appropriate method and as per specification of drawing. |
| | Perform Lapping of gauge to obtain required finish as per drawing. |
| | Check tolerance and specified accuracy of gauge with appropriate measuring instruments as per drawing. |
| | Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal. |
| | |
| 14. Apply a range of skills to execute pipe joints, dismantle and assemble valves & fittings with pipes and test for leakages.*[Range of skills – Cutting, Threading, Flaring, Bending and Joining ]* CSC/N0304 | Ascertain and select tools and materials for the job and make this available for use in a timely manner. |
| | Plan to Dismantle and assemble valves and pipe fittings. |
| | Dismantle valves and fittings in pipes applying range of skills andcheck for defect as per standard procedure. |
| | Demonstrate possible solutions in case of defect and agree tasks within the team for repair or replacement. |
| | Assemble valves and various pipe fittings using range of skills and observing standard procedure. |
| | Test for leakage and appropriate functioning of valves. |
| | Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal. |
| | |
| 15. Make drill jig & produce components on drill machine by using jigs and check for correctness. CSC/N0304 | Set up workplace/ assembly location with due consideration to operational stipulation |
| | Ascertain and select tools and materials for the job and make this available for use in a timely manner. |
| | Collect information related to standard procedure, methods and tools to make drill jigs. |
| | Mark the components as per drawing. |

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| | Make drill jigs by turning, drilling, reaming, filing, taping, etc. |
| | Test the functionality of jig. |
| | Select suitable jigs for drilling considering desired result and collecting necessary information. |
| | Produce component by using jig observing standard procedure and check the correctness of the job. |
| | Comply with safety rules when performing the above operations. |
| | |
| 16. Plan, dismantle, repair and assemble different damaged mechanical components used for power transmission & check functionality. *[Different Damage Mechanical Components – Pulley, Gear, Keys, Jibs and Shafts.]* CSC/N0304 | Select and ascertain tools and materials for the job and make this available for use in a timely manner. |
| | Plan to dismantle, repair and assemble mechanical components used for power transmission as per drawing and collecting necessary information. |
| | Perform dismantling and appropriate repairing of mechanical components with accuracy applying range of skills and appropriate repairing processes. |
| | Check the accuracy of the repaired components with appropriate gauge & instruments. |
| | Assemble the repaired mechanical components observing standard procedure. |
| | Comply with safety rules when performing the above operations. |
| | Check different parameters of power transmission e.g. R.P.M, slackness of belts, matching of gears/ clutches, loss of RPM etc. |
| | Check for functionality of power transmission system or any assembly as per standard parameters. |
| | |
| 17. Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]* | Select and ascertain tools for the job and make this available for use in a timely manner. |
| | Identify different pneumatics and hydraulics components. |
| | Plan to dismantle and replace pneumatics & hydraulics circuit as per drawing and collecting necessary information. |
| | Perform dismantling and replacing of different components with accuracy applying range of skills and standard operating procedure. |
| | Assemble different components. |
| | Check functionality of the components. |
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| 18. Construct circuit of pneumatics and hydraulics | Select and ascertain tools for the job and make this available for use in a timely manner. |

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| observing standard operating procedure& safety aspect. | Plan to construct pneumatics & hydraulics circuit as per drawing and collecting necessary information. |
| | Demonstrate possible solutions and agree tasks within the team for constructing circuit. |
| | Construct circuit of pneumatics and hydraulics observing standard procedure. |
| | Comply with safety rules when performing the above operations. |
| | Check different parameters and functionality of the system. |
| | |
| 19. Plan & perform basic day *to* day preventive maintenance, repairing and check functionality. *[Simple Machines – Drill Machine, Power Saw and Lathe]* CSC/N0304 | Ascertain preventive maintenance/repair procedure as per manual of machine and select appropriate tools & equipment for undertaking job. |
| | Interpret construction, alignment and assembly of different parts of machine. |
| | Plan to carry out the preventive maintenance/repair task with appropriate accuracy of simple machine by collecting necessary information. |
| | Demonstrate possible solutions and agree tasks within the team. |
| | Perform preventive maintenance/dismantle, repair parts and assemble sub-assemblies of simple machine as per layout plan and standard procedure. |
| | Put the machine in operation complying Standard operating procedure. |
| | Check for proper functioning of repaired machine and other parameters of simple machine as per manual after erection. |
| | Dispose unsalvageable materials as per standard procedures. |
| | |
| 20. Plan, erect simple machine and test machine tool accuracy. *[Simple Machines – Drill Machine, Power Saw and Lathe]* | Ascertain erection procedure as per manual of machine and select appropriate tools & equipment for undertaking job. |
| | Interpret construction, alignment and assembly of different parts of machine. |
| | Set up workplace/ assembly location with due consideration to operational stipulation |
| | Plan to carry out the erection of simple machine by collecting necessary information. |
| | Demonstrate possible solutions and agree tasks within the team. |
| | Erect simple machine as per layout plan and standard |

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| | procedure. |
| | Put the machine in operation complying Standard operating procedure. |
| | Check alignment of erected machine and other parameters of simple machine as per manual after erection. |
| | Dispose unsalvageable materials as per standard procedures. |
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| 21. Read and apply engineering drawing for different application in the field of work. | Read & interpret the information on drawings and apply in executing practical work. |
| | Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters. |
| | Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work. |
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| 22. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. | Solve different mathematical problems |
| | Explain concept of basic science related to the field of study |
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# 7. TRADE SYLLABUS

| SYLLABUS FOR FITTER TRADE | | | |
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| **FIRST YEAR** | | | |
| **Duration** | **Reference Learning Outcome** | **Professional Skills (Trade Practical) with Indicative Hours** | **Professional Knowledge (Trade Theory)** |
| Professional Skill 212 Hrs;<br><br>Professional Knowledge 37Hrs | Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy following safety precautions. *[Basic fitting operation – marking, Hacks awing, Chiseling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]* (Mapped NOS: CSC/N0304) | 1. Importance of trade training, List of tools & Machinery used in the trade. (1 hr.)<br>2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (5 hrs.)<br>3. First Aid Method and basic training. (2 hrs.)<br>4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (2 hrs.)<br>5. Hazard identification and avoidance. (2 hrs.)<br>6. Safety signs for Danger, Warning, caution & personal safety message. (1 hrs.)<br>7. Preventive measures for electrical accidents & steps to be taken in such accidents. (2 hrs.)<br>8. Use of Fire extinguishers. (7 hrs.)<br>9. Practice and understand precautions to be followed while working in fitting jobs. (2 hrs.)<br>10. Safe use of tools and equipments used in the trade. (1 hrs.) | All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures.<br>Soft Skills, its importance and Job area after completion of training.<br>Importance of safety and general precautions observed in the in the industry/shop floor.<br>Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs.<br>Response to emergencies e.g.; power failure, fire, and system failure.<br>**Importance of housekeeping & good shop floor practices.** Introduction to 5S concept & its application.<br>**Occupational Safety & Health**: Health, Safety and Environment guidelines, legislations &regulations as applicable.<br><br>Basic understanding on Hot work, confined space work and material handling equipment. (04 hrs.) |

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| | | 11. Identification of tools &equipment as per desired specifications for marking & sawing. (4 hrs.)<br>12. Selection of material as per application. (1 hrs.)<br>13. Visual inspection of raw material for rusting, scaling, corrosion etc. (1 hrs.)<br>14. Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions. (9 hrs.)<br>15. Sawing different types of metals of different sections. (6 hrs.) | Linear measurements- its units, dividers, calipers, hermaphrodite, centre punch, dot punch, prick punch their description and uses of different types of hammers. Description, use and care of 'V' Blocks, marking off table.<br>Measuring standards (English, Metric Units), angular measurements.<br>(04 hrs.) |
| | | 16. Filing Channel, Parallel. (5 hrs.)<br>17. Filing- Flat and square (Rough finish), (08 hrs.)<br>18. Filing practice, surface filing, marking of straight and parallel lines with odd leg calipers and steel rule. (5 hrs.)<br>19. Marking practice with dividers, odd leg calipers and steel rule (circles, ARCs, parallel lines).<br>(4 hrs.) | Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws.<br>Files- specifications, description, materials, grades, cuts, file elements, uses. Types of files, care and maintenance of files.<br>Measuring standards (English, Metric Units), angular measurements. (04 hrs.) |
| | | 20. Marking off straight lines and ARCs using scribing block and dividers. (4 hrs.)<br>21. Chipping flat surfaces along a marked line. (9 hrs.)<br>22. Marking, filing, filing square and check using tri square. (9 hrs.) | Marking off and layout tools, dividers, scribing block, - description, classification, material, care & maintenance.<br>Try square, ordinary depth gauge, protractor- description, uses and cares.<br>Uses, care & maintenance of cold chisels- materials, types, cutting angles. (04 hrs.) |
| | | 23. Marking according to simple blueprints for locating, position of holes, | Marking media, marking blue, Prussian blue, red lead, chalk and their special application, |

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| | | scribing lines on chalked surfaces with marking tools. (8 hrs.)<br>24. Finding centre of round bar with the help of 'V' block and marking block. (2 hrs.)<br>25. Joining straight line to an ARC. (08 hrs.) | description.<br>Use, care and maintenance of scribing block.<br>Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance. (03 hrs.) |
| | | 26. Chipping, Chamfering, Chip slots & oils grooves (Straight). (08 hrs.)<br>27. Filing flat, square, and parallel to an accuracy of 0.5mm. (07 hrs.)<br>28. Chip curve along a line-mark out, keyways at various angles & cut keyways. (1 hrs.)<br>29. Sharpening of Chisel. (2 hrs.)<br>30. File thin metal to an accuracy of 0.5 mm. (3 hrs.) | Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity. (04 hrs.) |
| | | 31. Saw along a straight line, curved line, on different sections of metal. (12 hrs.)<br>32. Straight saw on thick section, M.S. angle and pipes. (8 hrs.) | Power Saw, band saw, Circular saw machines used for metal cutting. (03 hrs.) |
| | | 33. File steps and finish with smooth file to accuracy of ± 0.25 mm. (12 hrs.)<br>34. File and saw on M.S. Square and pipe. (10 hrs.) | Micrometer- outside and inside – principle, constructional features, parts graduation, reading, use and care. Micrometer depth gauge, parts, graduation, reading, use and care. Digital micrometer. (03 hrs.) |
| | | 35. File radius along a marked line (Convex & concave) & match. (12 hrs.)<br>36. Chip sheet metal (shearing). (3 hrs.)<br>37. Chip step and file. (3 hrs.) | Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital Vernier caliper. |

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| | | | Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance. (03 hrs.) |
| | | 38. Mark off and drill through holes. (5 hrs.)<br>39. Drill and tap on M.S. flat. (8 hrs.)<br>40. Punch letter and number (letter punch and number punch) (3 hrs.)<br>41. Practice use of different punches. (5 hrs.) | Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine.<br>Determination of tap drill size. (03 hrs.) |
| Professional Skill 97Hrs; Professional Knowledge 21Hrs | Manufacture simple sheet metal items as per drawing and join them by soldering, brazing and riveting. (Mapped NOS: CSC/N0301) | 42. Marking of straight lines, circles, profiles and various geometrical shapes and cutting the sheets with snips. (12 hrs.)<br>43. Marking out of simple development (5 hrs.)<br>44. Marking out for flaps for soldering and sweating. (4 hrs.) | 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. Shearing machine- description, parts and uses. (05 hrs.) |
| | | 45. Make various joints: wiring, hemming, soldering and brazing, form locked, grooved and knocked up single hem straight and curved edges form double hemming. (22 hrs.)<br>46. Punch holes-using hollow and solid punches. (5 hrs.)<br>47. Do lap and butt joints. (12 hrs.) | Marking and measuring tools, wing compass, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, types, specifications, uses. Trammel- description, parts, uses. Hand grooves- specifications and uses.<br>Sheet and wire gauge. (07 hrs.) |
| | | 48. Bend sheet metal into various curvature form, wired edges- straight and curves. Fold sheet metal at angle using stakes. (6 hrs.)<br>49. Make simple Square container with wired edge and fix handle. (13 hrs.) | Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection& application. Wired edges. (04 hrs.) |

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| | | 50. Make square tray with square soldered corner. (11 hrs.)<br>51. Practice in soft soldering and silver soldering. (7 hrs.) | Solder and soldering: Introduction-types of solder and flux. Composition of various types of solders and their heating media of soldering iron. Method of soldering, selection and application-joints. Hard solder-Introduction, types and method of brazing. (05 hrs.) |
| Professional Skill 19Hrs; Professional Knowledge 03Hrs | Join metal components by riveting observing standard procedure. (Mapped NOS: CSC/N0304) | 52. Make riveted lap and butt joint. (6 hrs.)<br>53. Make funnel as per development and solder joints. (8 hrs.)<br>54. Drill for riveting. (1 hr.)<br>55. Riveting with as many types of rivet as available, use of counter sunk head rivets. (4 hrs.) | Various rivets shape and form of heads, importance of correct head size.<br>Rivets-Tin man's rivets types, sizes, and selection for various works.<br>Riveting tools, dolly snaps description and uses. Method of riveting,<br>The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting. (03 hrs.) |
| Professional Skill 21Hrs; Professional Knowledge 04Hrs | Join metal component by arc welding observing standard procedure. (Mapped NOS: CSC/N0304) | 56. Welding - Striking and maintaining ARC, laying Straight-line bead. (21 hrs.) | 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. (04 hrs.) |
| Professional Skill 64Hrs; Professional Knowledge 16Hrs | Cut and join metal component by gas (oxy-acetylene) (Mapped NOS: CSC/N0304) | 57. Making butt joint and joint-gas and ARC. (12 hrs.)<br>58. Do setting up of flames, fusion runs with and without filler rod, and gas. (8 hrs.) | Welding 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- |

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| | | | Butt and fillet as per BIS SP: 46-1988 specifications. Gases and gas cylinder description, kinds, main difference and uses. (05 hrs.) |
| | | 59. Make butt weld and corner, fillet in ARC welding (22 hrs.) | Setting up parameters for ARC welding machines-selection of Welding electrodes. Care to be taken in keeping electrode. (05 hrs.) |
| | | 60. Gas cutting of MS plates (22 hrs.) | Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses. (06 hrs.) |
| Professional Skill 143Hrs; Professional Knowledge 26Hrs | Produce components by different operations and check accuracy using appropriate measuring instruments.*[Different Operations - Drilling, Reaming, Taping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer]* (Mapped NOS: CSC/N0304) | 61. Mark off and drill through holes. (04 hrs.)<br>62. Drill on M.S. flat. (1 hrs.)<br>63. File radius and profile to suit gauge. (10 hrs.)<br>64. Sharpening of Drills. (1 hrs.)<br>65. Practice use of angular measuring instrument. (04 hrs.) | 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. (04 hrs.) |
| | | 66. Counter sink, counter bore and ream split fit (three piece fitting). (04 hrs.)<br>67. Drill through hole and blind holes. (2 hrs.)<br>68. Form internal threads with taps to standard size (through holes and blind holes). (3 hrs.)<br>69. Prepare studs and bolt. (13 hrs.) | 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.<br>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 (coarse and fine) material, parts (shank body, flute, cutting edge). (03 hrs.) |

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| | | 70. Form external threads with dies to standard size. (08 hrs.)<br>71. Prepare nuts and match with bolts. (15 hrs.) | Tap wrench: material, parts, types (solid &adjustable types) and their uses removal of broken tap, studs (tap stud extractor).<br>Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses. (06 hrs.) |
| | | 72. File and make Step fit, angular fit, angle, surfaces (Bevel gauge accuracy 1 degree). (12 hrs.)<br>73. Make simple open and sliding fits. (08 hrs.) | 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. (04 hrs.) |
| | | 74. Enlarge hole and increase internal dia. (2 hrs.)<br>75. File cylindrical surfaces. (5 hrs.)<br>76. Make open fitting of curved profiles. (15 hrs.) | Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use.<br>(04 hrs.) |
| | | 77. Correction of drill location by binding previously drilled hole. (04 hrs.)<br>78. Make inside square fit. (16 hrs.) | Gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses.<br>Description and uses of gauge-types (feeler, screw, pitch, radius, wire gauge). (05 hrs.) |
| Professional Skill 126Hrs;<br><br>Professional Knowledge 28Hrs | Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality.<br>*[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit* | 79. Make sliding 'T' fit. (21 hrs.) | Interchange ability: 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. (05 hrs.) |
| | | 80. File fit- combined, open | Method of expressing |

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| | *and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.]* (Mapped NOS: CSC/N0304) | angular and sliding sides. (08 hrs.)<br>81. File internal angles 30minutes accuracy open, angular fit. (12 hrs.) | 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. (04 hrs.) |
| | | 82. Make sliding fit with angles other than 90° (21 hrs.) | Pig Iron: types of pig Iron, properties and uses.<br>Cast Iron: types, properties and usesWroughtiron:- properties and uses.<br>Steel: plain carbon steels, types, properties and uses.<br>Non-ferrous metals (copper, aluminium, tin, lead, zinc) properties and uses. (05 hrs.) |
| | | 83. Scrap on flat surfaces, curved surfaces and parallel surfaces and test. (04 hrs.)<br>84. Make & assemble, sliding flats, plain surfaces. (12 hrs.)<br>85. Check for blue match of bearing surfaces- both flat and curved surfaces by wit worth method. (5 hrs.) | Simple scraper- flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces). Testing scraped surfaces: ordinary surfaces without a master plate. (04 hrs.) |
| | | 86. File and fit combined radius and angular surface (accuracy ± 0.5 mm), angular and radius fit. (15 hrs.)<br>87. Locate accurate holes & make accurate hole for stud fit. (2 hrs.)<br>88. Fasten mechanical components / sub-assemblies together using screws, bolts and collars using hand tools. (5 hrs.) | Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments.<br>Introduction to mechanical fasteners and its uses.<br>Screw thread micrometer: Construction, graduation and use. (05 hrs.) |

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| | | 89. Make sliding fits assembly with parallel and angular mating surface. (± 0.04 mm)(21 hrs.) | Dial test indicator, construction, parts, material, graduation, Method of use, care and maintenance. Digital dial indicator. Comparators- measurement of quality in the cylinder bores. (05 hrs.) |
| Professional Skill 95 Hrs;<br><br>Professional Knowledge 15 Hrs | Produce components involving different operations on lathe observing standard procedure and check for accuracy. *[Different Operations – facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, boring, taper turning, threading (external 'V' only)]* (Mapped NOS: CSC/N0110) | 90. Lathe operations-<br>91. True job on four jaw chuck using knife tool. (5 hrs.)<br>92. Face both the ends for holding between centres. (06 hrs.)<br>93. Using roughing tool parallel turn ± 0.1 mm. (06 hrs.)<br>94. Measure the diameter using outside caliper and steel rule.(1 hr.) | 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 centres, works with catch plate, dog, simple description of a facing and roughing tool and their applications. (04 hrs.) |
| | | 95. Holding job in three jaw chuck. (2 hrs.)<br>96. Perform the facing, plain turn, step turn, parting, deburr, chamfer-corner, roundthe ends, and use form tools. (08 hrs.)<br>97. Shoulder turn: square, filleted, beveled undercut shoulder, turning-filleted under cut, square beveled. (08 hrs.)<br>98. Sharpening of -Single point Tools. (1 hr.) | Lathe cutting tools- Nomenclature of single point & multipoint cutting tools,<br>Tool selection based on different requirements 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 hrs.) |
| | | 99. Cut grooves- square, round, 'V' groove. (08 hrs.)<br>100. Knurl the job. (1 hr.)<br>101. Bore holes –spot face, pilot drill, enlarge hole using boring tools. (9 hrs.) | 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 |

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| | | | enlargement of holes. (02 hrs.) |
| | | 102. Turn taper (internal and external). (10 hrs.)<br>103. Turn taper pins. (5 hrs.)<br>104. Turn standard tapers to suit with gauge. (5 hrs.) | 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.<br>Taper – definition, use and method of expressing tapers. Standard tapers-taper, calculations Morse taper. (03 hrs.) |
| | | 105. Practice threading using taps, dies on lathe by hand. (2 hrs.)<br>106. Make external 'V' thread. (8 hrs.)<br>107. Prepare a nut and match with the bolt. (10 hrs.) | Screw thread definition – uses and application. Square, worm, buttress, acme ( nonstandard-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. (03 hrs.) |
| Professional Skill 63 Hrs;<br><br>Professional Knowledge 12Hrs | Plan & perform simple repair, overhauling of different machines and check for functionality. *[Different Machines – Drill Machine, Power Saw, Bench Grinder and Lathe]* | 108. Simple repair work: Simple assembly of machine parts from blueprints. (10 hrs.)<br>109. Rectify possible assembly faults during assembly. (14 hrs.)<br>110. Perform the routine maintenance with check list (08 hrs.)<br>111. Monitor machine as per routine checklist (3 hrs.)<br>112. Read pressure gauge, temperature gauge, oil level (1 hr.) | **Maintenance**<br>-Total productive maintenance<br>-Autonomous maintenance<br>-Routine maintenance<br>-Maintenance schedule<br>-Retrieval of data from machine manuals Preventive maintenance-objective and function of Preventive maintenance, section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of |

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| | | 113. Set pressure in pneumatic system (2 hrs.) | handbooks and reference table. Possible causes for assembly failures and remedies.<br>Installation, maintenance and overhaul of machinery and engineering equipment (10 hrs.) |
| | | 114. Assemble simple fitting using dowel pins and tap screw assembly using torque wrench. (15 hrs.) | Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torqueing. Dowel pins: material, construction, types, accuracy and uses. (02 hrs.) |
| **Engineering Drawing: 40 Hrs.** | | | |
| Professional Knowledge ED- 40 Hrs. | Read and apply engineering drawing for different application in the field of work. | **Engineering Drawing:**<br>Introduction to Engineering Drawing and Drawing Instruments –<br>• Conventions<br>• Sizes and layout of drawing sheets<br>• Title Block, its position and content<br>• Drawing Instrument<br>Lines- Types and applications in drawing Free hand drawing of –<br>• Geometrical figures and blocks with dimension<br>• Transferring measurement from the given object to the freehand sketches.<br>• Free hand drawing of hand tools and measuring tools.<br>Drawing of Geometrical figures:<br>• Angle, Triangle, Circle, Rectangle, Square, Parallelogram.<br>• Lettering & Numbering – Single Stroke.<br>Dimensioning<br>• Types of arrowhead<br>• Leader line with text<br>• Position of dimensioning (Unidirectional, Aligned)<br>Symbolic representation –<br>• Different symbols used in the related trades.<br>Concept and reading of Drawing in<br>• Concept of axes plane and quadrant<br>• Concept of Orthographic and Isometric projections<br>• Method of first angle and third angle projections (definitionand difference)<br>Reading of Job drawing of related trades. | |
| **WORKSHOP CALCULATION & SCIENCE: 38 Hrs.** | | | |

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| Professional Knowledge WCS- 38 Hrs. | Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. | **WORKSHOP CALCULATION & SCIENCE:**<br>**Unit, Fractions**<br>Classification of unit system<br>Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units<br>Measurement units and conversion<br>Factors, HCF, LCM and problems<br>Fractions - Addition, subtraction, multiplication & division<br>Decimal fractions - Addition, subtraction, multiplication & division<br>Solving problems by using calculator<br>**Square root, Ratio and Proportions, Percentage**<br>Square and square root<br>Simple problems using calculator<br>Applications of Pythagoras theorem and related problems<br>Ratio and proportion<br>Ratio and proportion - Direct and indirect proportions<br>Percentage<br>Percentage - Changing percentage to decimal and fraction<br>**Mass, Weight, Volume and Density**<br>Mass, volume, density, weight and specific gravity<br>Related problems for mass, volume, density, weight and specific gravity<br>**Speed and Velocity, Work, Power and Energy**<br>Work, power, energy, HP, IHP, BHP and efficiency<br>**Heat & Temperature and Pressure**<br>Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals<br>Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure<br>**Basic Electricity**<br>Introduction and uses of electricity, ~~molecule, atom, how electricity is produced~~, electric current AC,DC their comparison, voltage, resistance and their units<br>**Mensuration**<br>Area and perimeter of square, rectangle and parallelogram<br>Area and perimeter of Triangles<br>Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse<br>Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder<br>Finding the lateral surface area, total surface area and capacity in litres of hexagonal, conical and cylindrical shaped vessels |

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| | | **Levers and Simple machines**<br>Simple machines - Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relationship between efficiency, velocity ratio and mechanical advantage<br>**Trigonometry**<br>Measurement of angles<br>Trigonometrical ratios<br>Trigonometrical tables |
| **In-plant training / Project work** | | |

| SYLLABUS FOR FITTER TRADE | | | |
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| **SECOND YEAR** | | | |
| **Duration** | **Reference Learning Outcome** | **Professional Skills (Trade Practical) with Indicative hrs.** | **Professional Knowledge (Trade Theory)** |
| Professional Skill 255Hrs;<br><br>Professional Knowledge 70Hrs | Make & assemble components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality. *[Different Mating Surfaces – Dovetail fitting, Radius fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance - ±0.02mm, angular tolerance ± 10 min.]* (Mapped NOS: CSC/N0304) | 115. Make 'H' fitting. (13 hrs.)<br>116. Power tools: Practice operation of power tool for fastening. (5 hrs.)<br>117. Tightening of bolt/ screw with specified torque. (2 hrs.)<br>118. Selection of right tool as for Tightening or loosening of screw/bolt as per accessibility. (1 hr.) | Screws: material, designation, specifications, Property classes (e.g. 9.8 on screw head), Tools for tightening/ loosening of screw or bolts, Torque wrench, screw joint calculation uses.<br>Power tools: its constructional features, uses & maintenance. (06 hrs.) |
| | | 119. Assembly sliding for using keys, dowel pin and screw, ± 0.02 mm accuracy on plain surface and testing of sliding fitting job. (13 hrs.)<br>120. File & fit angular mating surface within an accuracy of ± 0.02 mm & 10 minutes angular fitting. (12 hrs.) | Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use.<br>Various types of keys, allowable clearances & tapers, types, uses of key pullers. (06 hrs.) |
| | | 121. Drill through and blind holes at an angle using swivel table of drilling machine. (09 hrs.)<br>122. Precision drilling, reaming and tapping and Test-Job. (12 hrs.) | Special files: types (pillar, Dread naught, Barrow, warding) description & their uses.<br>(07 hrs.) |
| | | 123. Make Dovetailed fitting and radius fitting. (18hrs.) | Templates and Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance.<br>(05 hrs.) |

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| | | 124. File and fit, combined fit with straight, angular surface with ± 0.02 mm accuracy and check adherence to specification and quality standards using equipment like Vernier-calipers, micrometresetc.(18 hrs.) | 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. (06 hrs.) |
| | | 125. Drilling and reaming, small dia. holes to accuracy & correct location for fitting. (4 hrs.)<br>126. Perform drilling using 'V' block and a clamp. (1 hrs.)<br>127. Make male and female fitting parts, drill and ream holes not less than 12.7 mm. (18 hrs.) | Application of slip gauges for measuring, Sine Bar-Principle, application & specification. Procedure to check adherence to specification and quality standards. (05 hrs.) |
| | | 128. Make Sliding Diamond fitting. (22 hrs.)<br>129. Lap flat surfaces using lapping plate. (5 hrs.) | 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. (06 hrs.) |
| | | 130. Prepare Stepped keyed fitting and test job. (16 hrs.)<br>131. Lapping holes and cylindrical surfaces. (5 hrs.) | Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance. (05 hrs.) |

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| | | 132. Dovetail and Dowel pin assembly. (16 hrs.)<br>133. Scrape cylindrical bore. (5 hrs.) | Metallurgical and metal working processes such as Heat treatment, various heat treatment methods - normalizing, annealing, hardening and tempering, purpose of each method, tempering colour chart. (06 hrs.) |
| | | 134. Scrapping cylindrical bore and to make a fit-(12 hrs.)<br>135. Scrapping cylindrical taper bore and check taper angle with sine bar. (08 hrs.) | Annealing and normalizing, Case hardening and carburising and its methods, process of carburising (solid, liquid and gas). (07 hrs.) |
| | | 136. Make a cotter jib assembly. (20 hrs.) | Tapers on keys and cotters permissible by various standards. (06 hrs.) |
| | | 137. Hand reams and fit taper pin. (12 hrs.)<br>138. Drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts. (08 hrs.) | The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments to provide a pleasing finish such as chromium silver plating, nickel plating and galvanizing. (05hrs.) |
| Professional Skill 113Hrs;<br><br>Professional Knowledge 30Hrs | Make different gauges by using standard tools & equipment and checks for specified accuracy. *[Different Gauges – Snap gauge, Gap gauge; Specified Accuracy - ±0.02mm]* (Mapped NOS:CSC/N0304) | 139. Making a snap gauge for checking a dia. of 10 ± 0.02 mm. (20 hrs.) | Gauges and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization. (06 hrs.) |
| | | 140. Scrape external angular mating surface and check angle with sine bar. (15 hrs.)<br>141. Scrape on internal surface and check. (10 hrs.) | Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row. (06 hrs.) |
| | | 142. Practice in dovetail fitting assembly and dowel pins | Roller and needle bearings: Types of roller bearing. |

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| | | and cap screws assembly. (16 hrs.)<br>143. Industrial visit. (5 hrs.) | Description & use of each. Method of fitting ball and roller bearings (06 hrs.) |
| | | 144. Preparation of gap gauges. (12 hrs.)<br>145. Perform lapping of gauges (hand lapping only) (10 hrs.) | Bearing metals – types, composition and uses. Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, Teflon polyamide (nylon). (06hrs.) |
| | | 146. Preparation of drill gauges. (10 hrs.)<br>147. File and fit straight and angular surfaces internally. (13 hrs.)<br>148. Identify different ferrous metals by spark test (2 hrs.) | The importance of keeping the work free from rust and corrosion. (06 hrs.) |
| Professional Skill 62 Hrs.;<br><br>Professional Knowledge 18Hrs | Apply a range of skills to execute pipe joints, dismantle and assemble valves & fittings with pipes and test for leakages.*[Range of skills – Cutting, Threading, Flaring, Bending and Joining]* (Mapped NOS:CSC/N0304) | 149. Flaring of pipes and pipe joints. (02 hrs.)<br>150. Cutting & Threading of pipe length. (3 hrs.)<br>151. Fitting of pipes as per sketch observing conditions used for pipe work. (10 hrs.)<br>152. Bending of pipes- cold and hot. (06 hrs.) | 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. (06 hrs.) |
| | | 153. Dismantling & assembling – globe valves, sluice valves, stop cocks, seat valves and non-return valve. (20 hrs.) | Use of tools such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc. (06 hrs.) |
| | | 154. Fit & assemble pipes, valves and test for leakage & functionality of valves. (18 hrs.)<br>155. Visual inspection for visual defects e.g. dents, surface finish. (1 hr.)<br>156. Measuring, checking and | Standard pipefitting- Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and household taps and pipe work.<br>Inspection & Quality control |

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| | | recording in control chart. (2 hrs.) | -Basic SPC<br>-Visual Inspection. (06 hrs.) |
| Professional Skill 24 Hrs.;<br><br>Professional Knowledge 06 Hrs. | Make drill jig & produce components on drill machine by using jigs and check for correctness. (Mapped NOS:CSC/N0304) | 157. Make a simple drilling jig. (20 hrs.)<br>158. Use simple jigs and fixtures for drilling. (04 hrs.) | Drilling jig-constructional features, types and uses. Fixtures-Constructional features, types and uses. (06 hrs.) |
| Professional Skill 152Hrs. Professional Knowledge 43 Hrs. | Plan, dismantle, repair and assemble different damaged mechanical components used for power transmission & check functionality. *[Different Damage Mechanical Components – Pulley, Gear, Keys, Jibs and Shafts.]* (Mapped NOS:CSC/N0304) | 159. Marking out for angular outlines, filing and fitting the inserts into gaps. (06 hrs.)<br>160. Exercises on finished material such as aluminium/ brass/ copper / stainless steel, marking out, cutting to size, drilling, tapping etc. without damage to surface of finished articles. (09 hrs.) | Aluminum and its alloys. Uses, advantages and disadvantages, weight and strength as compared with steel. Non-ferrous metals such as brass, phosphor bronze, gunmetal, copper, aluminum etc. Their composition and purposes, where and why used, advantages for specific purposes, surface wearing properties of bronze and brass. (04 hrs.) |
| | | 161. Making an adjustable spanner: - Marking out as per Blueprint, drilling, cutting, straight and curve filing, threading, cutting slot and cutting internal threads with taps. (16 hrs.) | 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. (04 hrs.) |
| | | 162. Dismantling and mounting of pulleys. (12 hrs.)<br>163. Making & replacing damaged keys. (12 hrs.)<br>164. Dismounting, repairing damaged gears and mounting and check for workability. (16 hrs.)<br>165. Repair & replacement of belts and check for workability. (12 hrs.) | Vee belts and their advantages and disadvantages, use of commercial belts, dressing and resin creep and slipping, calculation.<br>Power transmissions-coupling types-flange coupling,-Hooks coupling-universal coupling and their different uses.<br>Pulleys-types-solid, split and |

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| | | | '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. Clutch: Type, positive clutch (straight tooth type, angular tooth type).<br>Chains, wire ropes and clutches for power transmission. Their types and brief description. (15 hrs.) |
| | | 166. Making of template/gauge to check involute profile. (17 hrs.) | 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. (05 hrs.) |
| | | 167. Repair of broken gear tooth by stud and repair broker gear teeth by dovetail. (17 hrs.) | Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and rack, worm gearing, velocity ratio of worm gearing. Repair of gear teeth by building up and dovetail method. (05 hrs.) |
| | | 168. Make hexagonal slide fitting. (16 hrs.)<br>169. Prepare different types of documentation as per industrial need by different methods of recording information. (04 hrs.) | 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. (05 hrs.) |
| | | 170. Marking out on the round sections for geometrical | Fluid power, Pneumatics, Hydraulics, and their |

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| | | shaped fittings such as spline with 3 or 4 teeth. Finishing and fitting to size, checking up the faces for universality. (15 hrs.) | comparison, Overview of a pneumatic system, Boyle's law.<br>Overview of an industrial hydraulic system, Applications, Pascal's Law. (05 hrs.) |
| Professional Skill 21Hrs;<br><br>Professional Knowledge 07Hrs | Identify, dismantle, replace and assemble different pneumatics and hydraulics components.<br>*[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]* | 171. Identify pneumatic components – Compressor, pressure gauge, Filter-Regulator-Lubricator (FRL) unit, and Different types of valves and actuators. (2 hrs.)<br>172. Dismantle, replace, and assemble FRL unit. (5 hrs.)<br>173. Demonstrate knowledge of safety procedures in pneumatic systems and personal Protective Equipment (PPE). (2 hrs.)<br>174. Identify the parts of a pneumatic cylinder.(1 hrs.)<br>175. Dismantle and assemble a pneumatic cylinder.(6 hrs.)<br>176. Construct a circuit for the direction & speed control of a small-bore single-acting (s/a) pneumatic cylinder. (5 hrs.) | Compressed air generation and conditioning, Air compressors, Pressure regulation, Dryers, Air receiver, Conductors and fittings, FRL unit, Applications of pneumatics, Hazards & safety precautions in pneumatic systems.<br><br>Pneumatic actuators:- Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders. (07 hrs.) |
| Professional Skill 20Hrs;<br><br>Professional Knowledge 07Hrs | Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect. | 177. Construct a control circuit for the control of a d/a pneumatic cylinder with momentary input signals. (4 hrs.)<br>178. Construct a circuit for the direct & indirect control of a d/a pneumatic cylinder with a single & double solenoid valve. (08 hrs.) | Pneumatic valves:- Classification, Symbols of pneumatic components, 3/2-way valves (NO & NC types) (manually-actuated & pneumatically-actuated) & 5/2-way valves,<br>Check valves, Flow control valves, One-way flow control valve<br>Pneumatic valves: Roller |

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| | | 179. Dismantling &assembling of solenoid valves. (08hrs.) | valve, Shuttle valve, Two-pressure valve Electro-pneumatics: Introduction, 3/2-way single solenoid valve, 5/2-way single solenoid valve, 5/2-way double solenoid valve, Control components - Pushbuttons (NO & NC type) and Electromagnetic relay unit, Logic controls. (07 hrs.) |
| Professional Skill 20Hrs;<br><br>Professional Knowledge 07Hrs | Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]* | 180. Demonstrate knowledge of safety procedures in hydraulic systems (Demo by video) (04 hrs.)<br>181. Identify hydraulic components – Pumps, Reservoir, Fluids, Pressure relief valve (PRV), Filters, different types of valves, actuators, and hoses (04 hrs.)<br>182. Inspect fluid levels, service reservoirs, clean/replace filters (04 hrs.)<br>183. Inspect hose for twist, kinks, and minimum bend radius, Inspect hose/tube fittings (04 hrs.)<br>184. Identify internal parts of hydraulic cylinders, pumps/motors (04 hrs.) | - Symbols of hydraulic components, Hydraulic oils –function, properties, and types, Contamination in oils and its control<br>- Hydraulic Filters – types, constructional features, and their typical installation locations, cavitation, Hazards & safety precautions in hydraulic systems<br>- Hydraulic reservoir & accessories, Pumps, Classification – Gear/vane/ piston types, Pressure relief valves – Direct acting and pilot-operated types<br>- Pipes, tubing, Hoses and fittings – Constructional details, Minimum bend radius, routing tips for hoses. (07 hrs.) |
| Professional Skill 18 Hrs.;<br><br>Professional Knowledge 05Hrs | Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect. | 185. Construct a circuit for the control of a s/a hydraulic cylinder using a 3/2-way valve (Weight loaded d/a cylinder may be used as a s/a cylinder), 4/2- & 4/3-way valves. (8 hrs.)<br>186. Maintenance, troubleshooting, and safety aspects of | - Hydraulic cylinders –Types<br>- Hydraulic motors –Types<br>- Hydraulic valves: Classification, Directional Control valves – 2/2- and 3/2-way valves<br>- Hydraulic valves: 4/2- and 4/3-way valves, Centre positions of 4/3-way valves<br>- Hydraulic valves: Check |

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| | | pneumatic and hydraulic systems (The practical for this component may demonstrated by video). (10 hrs.) | valves and Pilot-operated check valves, Load holding function<br>- Flow control valves: Types, Speed control methods – meter-in and meter-out<br>- Preventive maintenance & troubleshooting of pneumatic & hydraulic systems, System malfunctions due to contamination, leakage, friction, improper mountings, cavitation, and proper sampling of hydraulic oils. (05 hrs.) |
| Professional Skill 80Hrs;<br><br>Professional Knowledge 23Hrs | Plan & perform basic day to day preventive maintenance, repairing and check functionality. *[Simple Machines – Drill Machine, Power Saw and Lathe]* (Mapped NOS:CSC/N0304) | 187. Dismantle, overhauling & assemble cross-slide & hand-slide of lathe carriage. (20 hrs.) | 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. (05 hrs.) |
| | | 188. Simple repair of machinery: - Making of packing gaskets. (04 hrs.)<br>189. Check washers, gasket, clutch, keys, jibs, cotter, Circlip, etc. and replace/repair if needed. (04 hrs.)<br>190. Use hollow punches, extractor, drifts, various types of hammers and spanners, etc. for repair work. (16 hrs.)<br>191. Dismantling, assembling of different types of bearing and check for functionality. (20 hrs.)<br>192. Perform routine check of machine and do replenish | 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.<br>Washers-Types and calculation of washer sizes. The making of joints and fitting packing. (18 hrs.) |

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| | | as per requirement. (15 hrs.) | |
| Professional Skill 75 Hrs;<br><br>Professional Knowledge 16Hrs | Plan, erect simple machine and test machine tool accuracy. *[Simple Machines – Drill Machine, Power Saw and Lathe]* | 193. Inspection of Machine tools such as alignment, levelling. (10 hrs.)<br>194. Accuracy testing of Machine tools such as geometrical parameters. (15 hrs.) | Lubrication and lubricants- purpose of using different types, description and uses of each type. Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal Bearings. (04 hrs.) |
| | | 195. Practicing, making various knots, correct loading of slings, correct and safe removal of parts. (5 hrs.)<br>196. Erect simple machines. (45 hrs.) | Foundation bolt: types (Lewis cotter bolt) description of each erection tools, pulley block, crowbar, spirit level, Plumb bob, wire rope, manila rope, wooden block.<br>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. (12 hrs.) |
| **Engineering Drawing: 40 Hrs.** | | | |
| Professional Knowledge ED- 40 Hrs. | Read and apply engineering drawing for different application in the field of work. | **<u>Engineering Drawing:</u>**<br>• Reading of drawing of nuts, bolt, screw thread, different types oflocking devices e.g., Double nut, Castle nut, Pin, etc.<br>• Reading of foundation drawing<br>• Reading of Rivets and rivetted joints, welded joints<br>• Reading of drawing of pipes and pipe joints<br>Reading of Job Drawing, Sectional View & Assembly view | |
| **WORKSHOP CALCULATION & SCIENCE: 28 Hrs.** | | | |
| Professional Knowledge WCS- 28 Hrs. | Demonstrate basic mathematical concept and principles to perform practical operations.<br>Understand and explain basic science in the field of study. | **<u>WORKSHOP CALCULATION & SCIENCE:</u>**<br>**Friction**<br>Friction - Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction<br>Friction - Lubrication<br>Friction - Co- efficient of friction, application and effects of friction in workshop practice | |

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| | | **Centre of Gravity**<br>Centre of gravity - Centre of gravity and its practical application<br>**Area of cut out regular surfaces and area of irregular surfaces**<br>Area of cut out regular surfaces - circle, segment and sector of circle<br>Related problems of area of cut out regular surfaces - circle, segment and sector of circle<br>Area of irregular surfaces and application related to shop problems<br>**Elasticity**<br>Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus<br>Elasticity - Ultimate stress and working stress<br>**Heat Treatment**<br>Heat treatment and advantages<br>Heat treatment - Different heat treatment process – Hardening, tempering, annealing, normalising and case hardening<br>**Estimation and Costing**<br>Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade<br>Estimation and costing - Problems on estimation and costing |
| **In-plant training/ Project work** | | |

| SYLLABUS FOR CORE SKILLS |
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| 1. Employability Skills (Common for all CTS trades) (120 Hrs. + 60 Hrs.) |

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in/ dgt.gov.in

## ANNEXURE-I

| FITTER | | | |
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| **LIST OF TOOLS AND EQUIPMENT (For batch of 20candidates)** | | | |
| **S no.** | **Name of the Tool & Equipment** | **Specification** | **Quantity** |
| **A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-18 is required additionally)** | | | |
| 1. | Steel Rule with metric & British graduation | 150 mm, Stainless steel | (20+1) Nos. |
| 2. | Try Square. | 150 mm blade | (20+1) Nos. |
| 3. | Caliper inside spring type. | 150 mm | (20+1) Nos. |
| 4. | Caliper hermaphrodite spring type | 150 mm | (20+1) Nos. |
| 5. | Caliper outside spring type | 150 mm | (20+1) Nos. |
| 6. | Divider spring type | 150 mm | (20+1) Nos. |
| 7. | Scriber | 150 mm | (20+1) Nos. |
| 8. | Centre Punch | 10 mm and Length - 120 mm | (20+1) Nos. |
| 9. | Screw driver | 150mm insulated flat type | (20+1) Nos. |
| 10. | Chisel cold flat | 20 mm X 150 mm High carbon steel | (20+1) Nos. |
| 11. | Hammer ball peen with handle | 450 grams (1 lb) | (20+1) Nos. |
| 12. | Hammer ball peen with handle. | 220 grams (1/2 lb) | (20+1) Nos. |
| 13. | File flat - second cut | 250 mm | (20+1) Nos. |
| 14. | File flat smooth | 250 mm. | (20+1) Nos. |
| 15. | File half round second cut | 150 mm. | (20+1) Nos. |
| 16. | Hacksaw frame fixed type | 300 mm | (20+1) Nos. |
| 17. | Safety goggles. | | (20+1) Nos. |
| 18. | Dot punch | 100 mm | (20+1) Nos. |
| **B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required** | | | |
| **INSTRUMENTS** | | | |
| 19. | Steel Rule Graduated both in Metric and English Unit | 300 mm Stainless steel | 4 nos. |
| 20. | Straight edge steel | 300 mm or above | 2 nos. |
| 21. | Spirit Level metal Type - 2 | 300 mm Basic Length Accuracy 0.1mm/Meter | 1 no. |
| 22. | Stud Extractor EZY - out | Set of 8 | 2 sets |
| 23. | Combination Set | 300 mm | 2 nos. |
| 24. | Micrometer outside. | 0 - 25 mm | 2 nos. |
| 25. | Micrometer outside. | 25 - 50 mm | 2 nos. |
| 26. | Micrometer outside. | 50 - 75 mm | 2 nos. |

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| 27. | Micrometer inside with extension rods. | Accuracy 0.01 mm with extension rods up to 150 mm | 1 no. |
| 28. | Vernier caliper | 150 mm | 4 nos. |
| 29. | Vernier height gauges | 0 - 300 mm with least count = 0.02 mm | 1 no. |
| 30. | Vernier bevel protractor Blade with Acute Angle Attachment | 300 mm | 1 no. |
| 31. | Screw pitch gauge Metric | 0.25 to 6 mm | 1 no. |
| 32. | Wire gauge, metric standard. | | 1 no. |
| **GENERAL SHOP OUTFIT** | | | |
| 33. | Surface plate C.I/Granite with Stand and Cover | 600 x 600 mm | 1 no. |
| 34. | Marking table (Mild steel) | 900X900X900 mm | 1 no. |
| 35. | Universal scribing block. | 220 mm | 2 nos. |
| 36. | V-Block pair with clamps | 150 x 100 x 100 mm | 2 nos. |
| 37. | Angle plate | 150 X 150 X 250 mm | 2 nos. |
| 38. | Punch letter set. | 3 mm | 1 no. |
| 39. | Punch number set. | 3 mm | 1 no. |
| 40. | Portable hand drill (Electric) | 0 to 13 mm Capacity | 1 no. |
| 41. | Drill twist straight shank | 3 mm to 12 mm by 0.5 mm H.S.S. | 2 sets |
| 42. | Drill twist Taper shank | 8 mm to 20 mm by 0.5 mm H.S.S. | 2 sets |
| 43. | Taps and dies complete set in box. | Whitworth | 1 no. |
| 44. | Taps and dies complete set | 5, 6, 8, 10 & 12mm set of 5 | 2 Sets |
| 45. | File knife edge smooth | 150 mm | 4 nos. |
| 46. | File feather edge smooth | 150 mm | 4 nos. |
| 47. | File triangular smooth | 200 mm | 10 nos. |
| 48. | File round second cut | 200 mm | 10 nos. |
| 49. | File square second cut | 250 mm | 10 nos. |
| 50. | Feeler gauge | Gauge Feeler / Thickness - 0.05 mm to 0.3 mm by 0.05 and 0.4 mm to 1 mm by 0.1 mm - 13 leaves | 1 set |
| 51. | File triangular second cut. | 200 mm | 10 nos. |
| 52. | File flat second cut safe edge. | 300 mm | 10 nos. |
| 53. | File flat bastard | 200 mm | 10 nos. |
| 54. | File flat bastard. | 300 mm | 10 nos. |
| 55. | File Swiss type needle | Set of 12, Length = 150 mm | 2 sets |
| 56. | File half round second cut. | 250 mm | 10 nos. |
| 57. | File half round bastard. | 250 mm | 10 nos. |

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| 58. | File round bastard. | 250 mm | 10 nos. |
| 59. | File hand second cut. | 150 mm | 10 nos. |
| 60. | File card./Wire Brush | 3"x5" size, brass or steel wire | 10 nos. |
| 61. | Oil Can | 250 ml | 2 nos. |
| 62. | Pliers combination insulated | 150 mm | 2 nos. |
| 63. | Wooden handle forged Soldering Iron copper bit. | 230V, 250 W, 350 gm | 2 nos. |
| 64. | Blow Lamp | 0.5 litre | 2 nos. |
| 65. | Spanner- Double Ended | 6x7, 8x9, 10x11, 12x13, 14x15, 16x17, 18x19, 20x22 | 1 set each |
| 66. | Spanner adjustable | 150 mm | 2 nos. |
| 67. | Interchangeable ratchet socket set | 12 mm driver, sized10-32 mm set of 18 socket & attachments. | 1 set |
| 68. | Double Ended tubular Box spanner set with Tommy bar. | A/F 6-25 mm set of 10 Tommy Bar Dia. 6, 8, 10, 12, 14, 16 | 1 set |
| 69. | Glass magnifying | 75 mm | 2 nos. |
| 70. | Clamp toolmaker | 5 cm and 7.5 cm set of 2. | 2 nos. |
| 71. | Clamp "C" | 100 mm | 2 nos. |
| 72. | Clamp "C" | 200 mm | 2 nos. |
| 73. | Hand Reamer set (Taper pin straight flute) | Nominal Dia. 6, 8, 10, 12, 16mm | 1 set |
| 74. | Machine Reamer parallel (Helical flute) | 12 - 16mm set of 5. | 1 no. |
| 75. | Scraper flat | 150 mm | 10 nos. |
| 76. | Scraper triangular | 150 mm | 10 nos. |
| 77. | Scraper half round | 150 mm | 10 nos. |
| 78. | Chisel cold crosscut& diamond point. | 9 mm X 150 mm | 10 each |
| 79. | Chisel cold flat | 9 mm X 100 mm | 10 nos. |
| 80. | Chisel cold round nose | 9 mm X 100 mm | 10 nos. |
| 81. | Drill chuck with key | 12 mm. | 1 no. |
| 82. | Pipe wrench | 400 mm | 1 no. |
| 83. | Pipe vice | 100 mm | 1 no. |
| 84. | Adjustable pipe die set BSP | cover pipe size 1" or 3/4" | 1 Set |
| 85. | Wheel dresser (One for 4 units) Star/Dresser with Holder | Length 150 mm, diamond point | 1 no. |
| 86. | Machine vice - Swivel Base | 100 mm | 1 no. |
| 87. | Machine vice - Swivel Base | 125 mm | 1 no. |
| 88. | Sleeve drill Morse | No. 0 - 1, 1 - 2, 2 - 3, 3 - 4, 4 - 5 | 1 Set |

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| 89. | Vice bench | 150 mm | 20 nos. |
| 90. | Bench working. | 2400 x 1200 x 900 mm | 4 nos. |
| 91. | Almirah. | 1800 x 900 x 450 mm | 2 nos. |
| 92. | Lockers with 8 drawers (standard size). | One locker for each trainee | 3 nos. |
| 93. | Metal rack | 1820 x 1820 x 450 cm | 1 no. |
| 94. | Instructor Table | | |
| 95. | Instructor Chair | | |
| 96. | Black board with easel. | | |
| 97. | Fire extinguisher (For 4 Units) | CO2 type, 3 kg capacity | |
| 98. | Fire buckets. | | |
| 99. | Machine vice. | 100mm | 2 nos. |
| 100. | Wing compass. | 254 mm or 300 mm | 2 nos. |
| 101. | Hand hammer with handle. | 1000 gm | 1 nos. |
| 102. | Torque wrench (Standard/Ratchet type) | 14 to 68 Nm | 1 no. |
| 103. | Power tools for fastening | Capacity 10-18mm | 1 No. |
| 104. | Different Profile gauges (Plate type) - For demonstration | Metric standard | 4 nos. |
| 105. | Knurling tool (Diamond, straight & Diagonal) | | 1 each |
| 106. | Indexable boring bar with inserts | 1" shank | 4 nos. |
| 107. | Machine maintenance manual for Lathe, Pedestal grinder, Drill machine, Power saw | | 1 |
| 108. | Temperature gauge | Range 0 - 150°C | 1 each |
| 109. | Dowel pin (straight) | Dia. -1” Length -4" (Mat: Stainless Steel) | 1 each |
| 110. | Standard Tap screws | M3, M4, M5, M6, M8, M10, M12, M14, M16 | 1 each |
| 111. | Lapping plate | Dia. -6" | 2 each |
| 112. | Medium carbon Heat treated alloy steel Metric Studs and bolts along with nuts (for display) of standard length (May be manufactured in-house) | M6, M8, M10, M12, M14, M16 (Standard) | 2 each |
| 113. | Caps screws | M6, M8, M10, M12 | 2 each |
| 114. | Drill gauges | Letter drill gauge (A to Z), Number drill gauge (1 to 60), Metric drill gauge (1.5mm to 12.5mm, 30 holes) | 2 nos. |
| 115. | Cast Iron Globe Valve (Flanged type) | 150NB, Class# 150 Flange: ANSI125-B16.1 | 2 nos. |
| 116. | C.I. Sluice / Gate valve (flanged type) | 150NB, Class# 150 Flange: | 2 nos. |

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| | | ANSI125-B16.1 | |
| 117. | Stop cock | 25NB (2-way, Threaded end) | 2 nos. |
| 118. | M.S. Pipe | 150NB, Sch.40, ERW, IS:1239 | as required |
| 119. | G.I. Pipe | 25mm, Sch.40, ERW | as required |
| 120. | Slip-on Forged steel Flange | 150NB, ANSI-B16.5, Class#150 | 4 nos. |
| 121. | Bolt & Nut with washer (May be manufactured in-house) | M20x2.5x90Long (part thread - Hex. Head) | 20 nos. |
| 122. | Pipe threading die with handle | Ratchet type Die head of 1/2”, 3/4" and 1" | 2 nos. |
| 123. | Jigs & Fixture (sample)-For demonstration (May be manufactured in-house) | | 1 no. |
| 124. | Pulleys (for V-belt or Flat belt) | to fit on 50mm dia. Shaft with key slot | 1 no. |
| 125. | Steel keys (May be manufactured in-house) | to fit with key slot of shaft & pulley | 2 nos. |
| 126. | Damaged old spur gear | to fit 50mm dia. Shaft | 2 nos. |
| 127. | V-belt and Flat belt | to fit on pulley | 1 each |
| 128. | Packing gasket | PTFE gasket roll small size | 1 no. |
| 129. | Washer, clutch, keys, jib, cotter &circlip | minimum 25mm size, carbon steel material | 2 each |
| 130. | Hollow punch | Straight Shank Hollow Punch Sets 5-12mm | 1 set |
| 131. | Drill Drift (May be manufactured in-house) | 200mm hardened and black finish | 2 nos. |
| 132. | Bearing different types | each type of diameter 25mm (min.) | 1 each |
| 133. | Lifting sling | 8mm Nominal Dia. Single leg sling | 2 nos. |
| 134. | Bearing extractor | Universal gear puller 2 or 3 jaws adjustable | 1 no. |
| 135. | Pulley extractor | - do - | 1 no. |
| **C. TOOLS FOR ALLIED TRADE - SHEET METAL WORKER (Note: - Those additional items are to be provided for the Allied Trade Training where the Sheet Metal trade does not exist.)** | | | |
| 136. | Trammel | 300 mm | 1 no. |
| 137. | Pocker | | 2 nos. |
| 138. | Prick punch | 100 mm | 2 nos. |
| 139. | Mallet. | Dia. 100 mm X 150 mm | 2 nos. |
| 140. | Aviation Snips straight Cut | 300 mm | 2 nos. |
| 141. | Flat headed hammers with handle. | | 2 nos. |

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| 142. | Planishing hammer. | | 2 nos. |
| 143. | Snip bent Left Cut | 250 mm | 2 nos. |
| 144. | Stake hatchet with Leg. | 300 X 200 X 20 mm | 2 nos. |
| 145. | Stake grooving. | 100 X 100 X 300 mm | 2 nos. |
| **D. MODIFIED LIST OF TOOLS FOR THE 2ND YEAR FOR FITTER TRADE** | | | |
| **INSTRUMENT** | | | |
| 146. | Slip Gauge as Johnson metric set. | 87 Pieces Set | 1 Set |
| 147. | Gauge snap Go and Not Go | 25 to 50 mm by 5 mm, Set of 6 pieces | 1 Set |
| 148. | Gauge plug | Single ended 5 to 55 by 5 mm. Set of 11 pcs. | 1 Set |
| 149. | Gauge telescopic set. | 8 - 150 mm | 1 no. |
| 150. | Dial test indicator on stand | 0.01 mm least count | 1 no. |
| 151. | Sine bar | 125 mm | 1 no. |
| 152. | Dial Vernier caliper. (Universal type) | 0 - 300 mm, LC 0.05 mm | 1 no. |
| 153. | Screw thread micrometer with interchangeable. Pitch anvils for checking metric threads 60. | 0 - 25 mm LC 0.01 mm | 1 no. |
| 154. | Depth micrometer. 0-25 mm | Accuracy 0.01 mm with standard set of extension rods up to 200 mm | 1 no. |
| 155. | Digital vernier caliper. | 0 - 150 mm with least count 0.02mm | 1 no. |
| 156. | Digital Micrometer outside. | 0 - 25 mm L.C. 0.001 mm. | 1 no. |
| 157. | Comparators Gauge - Dial Indication with Stand and Bracket. | LC 0.01mm | 1 no. |
| 158. | Engineer's try square (knife-edge) | 150 mm Blade | 1 no. |
| 159. | Surface roughness comparison plates | N1 - N12 Grade | 1 Set |
| 160. | Digital Vernier caliper | 0 - 200 mm L.C. 0.01 mm (Optional) | 1no. |
| 161. | Vernier Bevel protector | Range 360deg, LC. : 5min(150mm blade) | 1no. |
| **GENERAL SHOP OUTFIT** | | | |
| 162. | Carbide Wear Block. | 1 mm - 2 mm | 2 each |
| 163. | Lathe tools H.S.S. tipped set. | | 2 nos. |
| 164. | Lathe tools bit. | 6 mm x 75 mm HSS/Carbide | 2 nos. |
| 165. | Lathe tools bit. | 8 mm x 75 mm HSS/Carbide | 2 nos. |
| 166. | Lathe tools bit. | 10 mm x 75 mm HSS/Carbide | 2 nos. |
| 167. | Arm strong type tool bit holder. | Right hand | 2 nos. |
| 168. | Arm strong type tool bit holder. | Left hand | 2 nos. |

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| 169. | Arm strong type tool bit holder. | Straight | 2 nos. |
| 170. | Stilson wrenches/pipe wrerch | 250 mm | 2 nos. |
| 171. | Pipe cutter wheel type. | 6 mm to 25 mm | 1 no. |
| 172. | Pipe bender machine spool type with stand manually operated. | up to 25 mm cold bending | 1 no. |
| 173. | Adjustable pipe chain tonge to take pipes | up to 300 mm | 1 no. |
| 174. | Adjustable spanner. | 380 mm long | 1 no. |
| **E. GENERAL MACHINERY INSTALLATION** | | | |
| 175. | SS and SC centre lathe (all geared) with minimum specification | 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. |
| 176. | Pillar Type Drilling machine | Sensitive 0-20 mm cap. with swivel table motorized with chuck & key. | 1 no. |
| 177. | Drilling machine bench | Sensitive 0-12 mm cap motorized with chuck and key. | 2 nos. |
| 178. | D.E. pedestal Grinding machine with wheels rough and smooth | 2 H.P.-3Phase-415V, 1500 rpm,250 dia. wheel | 1 no. |
| **F. LIST OF ADDITIONAL TOOLS FOR ALLIED TRADE IN WELDING (Note: - Those additional items are to be provided for the Allied Trade Training where the Welder trade does not exist.)** | | | |
| 179. | Transformer welding set - continuous welding current, with all accessories and electrode holder 60% Duty Cycle with Standard Accessories | 300 A, OCV 60 - 100 V, | 1 Set |
| 180. | Welder cable | Able to carry 300 amps. With flexible rubber cover | 20 Meter |
| 181. | Lugs for cable | | 12 Nos. |
| 182. | Earth clamps. | | 2 Nos. |
| 183. | Arc welding table (all metal top) with positioner. | 1200 X 1200 X 750 mm | 1 No. |
| 184. | Oxy - acetylene gas welding set equipment with hoses, Oxygen & Acetylene cylinders, regulator and other accessories. | | 1 Set. |

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| 185. | Gas welding table with positioner with Fire Bricks | 900 X 600 X 750 mm | 1 No |
| 186. | Welding torch tips of different sizes for Oxy - acetylene gas welding | To fit nozzle no. 1, 2, & 3 | 1 Set |
| 187. | Gas lighter. | | 2 Nos. |
| 188. | Trolley for gas cylinders. | | 1 No |
| 189. | Chipping hammer. | | 2 Nos. |
| 190. | Gloves (Leather) | | 2 Pairs |
| 191. | Leather apron. | | 2 Nos. |
| 192. | Spindle key for cylinder valve. | | 2 Nos. |
| 193. | Welding torches. | Nozzles no. 1, 2, & 3 | 1 Set. |
| 194. | Welding goggles | | 4 Pairs. |
| 195. | Welding helmet with coloured flame retardant glass | | 2 Nos. |
| 196. | Tip cleaner | | 5 Sets. |
| **#G. LIST OF TOOLS & ACCESSORIES FOR PNEUMATICS AND HYDRAULICS** | | | |
| 197. | Compressor unit | suitable for Pressure: 8 bar, Delivery: 50 lpm (or more), Reservoir capacity: 24 Litres (or more), 230V, 50 Hz, with pressure regulator and water separator | 1 No. |
| 198. | Pneumatic Trainer Kit, each consisting of the following matching components and accessories: | | 01 sets |
| | I. Single acting cylinder | Max. stroke length 50 mm, Bore dia. 20 mm | 1 No |
| | II. Double acting cylinder | Max. stroke length 100 mm, Bore dia 20 mm, magnetic type | 1 No |
| | III. 3/2-way valve | manually-actuated, Normally Closed | 2 Nos. |
| | IV. 3/2-way valve | pneumatically-actuated, spring return | 1 No |
| | V. One-way flow control valve | | 2 Nos. |
| | VI. 5/2-way valve | with manually-operated switch | 1 No |
| | VII. 5/2-way valve | pneumatically-actuated, spring return | 1 No |
| | VIII. 5/2-way pneumatic actuated valve | double pilot | 1 No |
| | IX. 3/2-way roller lever valve | direct actuation Normally | 2 Nos. |

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| | | | Closed | |
| | X. | Shuttle valve (OR) | | 1 No |
| | XI. | Two-pressure valve (AND) | | 1 No |
| | XII. | Pressure gauge | 0-16 bar | 1 Nos. |
| | XIII. | Manifold with self-closing | NRV, 6-way | 1 No |
| | XIV. | Pushbutton station for electrical signal input | with 3 illuminated momentary-contact switches (1 NO + 1 NC) and 1 illuminated maintained-contact switch (1 NO + 1 NC), Contact load 2A | 1 No |
| | XV. | Relay station | with 3 relays each with 4 contact sets (3NO+1NC or Change-over type), 5 A | 1 No |
| | XVI. | 3/2-way single solenoid valve | with LED | 1 No |
| | XVII. | 5/2-way single solenoid valve | with manual override and LED | 1 No |
| | XVIII. | 5/2-way double solenoid valve | with manual override and LED | 1 No |
| | XIX. | Power supply unit, | Input voltage 85 – 265 V AC, Output voltage: 24 V DC, Output current: max. 4.5 A, short-circuit-proof. | 1 No |
| | XX. | Profile plate, Anodised Aluminium | 1100x700 mm, with carriers, mounting frames and mounting accessories (To be fitted onto the pneumatic workstation) | 1 set |
| 199. | Pneumatic Workstation with 40 square mm aluminium profile legs, wooden work surface, and one pedestal drawer unit having 5 drawers, each with handles and individual locks, on metallic full panel drawer slide: | | (1) Worktable – Size (Approx.) L1200mmXW900mmXH900 mm, with four castor wheels including two lockable wheels at the front side, (2) Drawer – Size (Approx.) – L460mmxW495mm xH158mm each, and overall size of Drawer unit (Approx.) - L470mmxW495mmxH825mm and (3) Drawer slide height (Approx.) 85mm. | 1 No |

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| 200. | Carrier for mounting components, such as PB & relay boxes. | | 1 No |
| 201. | Cut section model for pneumatic components | | 1 set |
| 202. | Hydraulic Trainer Kit, each consisting of the following matching components and accessories: | | 01 set |
| | I. Hydraulic Power pack | with (1) external gear pump having a delivery rate of 2.5 lpm, (approx.) @ 1400 rpm operating pressure 60 bar, coupled to a single-phase AC motor (230 V AC) having start capacitor and ON/OFF switch and overload protection, (2) pressure relief valve adjustable from 0 – 60 bar, (3) oil reservoir, ≥5 litres capacity having sight glass, drain screw, air filter, and P and T ports. | 1 No. |
| | II. Pressure relief valve | pilot-operated | 1 No |
| | III. Drip tray, steel | size 1160 mm x 760 mm. | 1 No. |
| | IV. Pressure Gauge | Glycerin-damped, Indication range of: 0 – 100 bars | 1 No. |
| | V. Four-Way distributor | with five ports, equipped with a pressure gauge | 1 No. |
| | VI. Double acting hydraulic cylinder | with a control cam, Piston diameter16 mm, Piston rod diameter10 mm, Stroke length 200 mm. | 1 No. |
| | VII. Suitable Weight | for vertical loading of hydraulic cylinder | 1 No. |
| | VIII. Mounting kit for weight | for realizing pulling and pushing load. | 1 No. |
| | IX. 3/2-way directional control valve | with hand lever actuation. | 1 No. |
| | X. 4/2-way directional control valve | with hand lever actuation. | 1 No. |
| | XI. 4/3-way directional control valve | closed-centre position, with hand lever actuation. | 1 No. |
| | XII. Non-return valve. | | 1 No. |
| | XIII. Pilot-operated check valve | Pilotto open. | 1 No. |
| | XIV. One-way flow control valve | Withintegrated check valve. | 1 No. |
| | XV. T-Connector with self-sealing | | 2 Nos. |

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| | coupling nipples (2 Nos.) and quick coupling socket (1 No.). | | |
| | XVI. Profile plate, | Anodised Aluminium, 1100x700 mm, with carriers, mounting frames and mounting accessories (To be fitted onto the Hydraulic workstation) | 1 set |
| 203. | Hydraulic Workstation with 40 square mm aluminium profile legs, wooden work surface, and one pedestal drawer unit having 5 drawers, each with handles and individual locks, on metallic full panel drawer slide: | (1) Worktable – Size (Approx.) L1200mmXW900mmXH900 mm, with four castor wheels including two lockable wheels at the front side, (2) Drawer – Size (Approx.) – L460mmxW495mm xH158mm each, and overall size of Drawer unit (Approx.) L470mmxW495mmxH825mm and (3) Drawer slide height (Approx.) 85mm. | 1 No |
| 204. | Cut-section models for hydraulic components | | 1 set |

***Note: -***

1. *All the tools and equipment are to be procured as per BIS specification.*
2. *For items under #G (List of Tools & Accessories for Pneumatics and Hydraulics), may be installed in the existing workshop for units up to 8 (4+4). For units beyond 8(4+4), separate room (having area: 20 sq. m) for installation of these items is essential.*
3. *Internet facility is desired to be provided in the classroom.*
4. ***All the electrical items should be purchased with "Star rating" as available in market. So that the power consumption may be reduced.***

## ABBREVIATIONS

| | |
|---|---|
| CTS | Craftsmen Training Scheme |
| ATS | Apprenticeship Training Scheme |
| CITS | Craft Instructor Training Scheme |
| DGT | Directorate General of Training |
| MSDE | Ministry of Skill Development and Entrepreneurship |
| NTC | National Trade Certificate |
| NAC | National Apprenticeship Certificate |
| NCIC | National Craft Instructor Certificate |
| LD | Locomotor Disability |
| CP | Cerebral Palsy |
| MD | Multiple Disabilities |
| LV | Low Vision |
| HH | Hard of Hearing |
| ID | Intellectual Disabilities |
| LC | Leprosy Cured |
| SLD | Specific Learning Disabilities |
| DW | Dwarfism |
| MI | Mental Illness |
| AA | Acid Attack |
| PwD | Person with disabilities |


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