



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

COMPETENCY BASED CURRICULUM

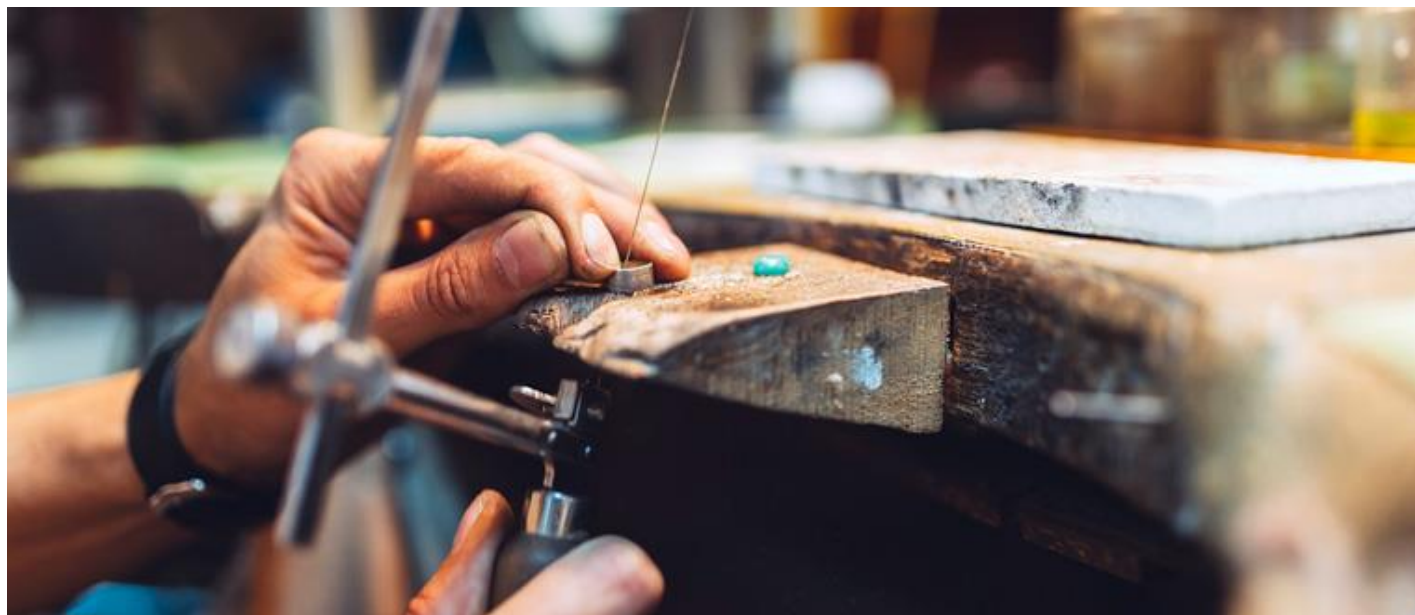
INDUSTRIAL FITTER

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi-MoU)

NSQFLEVEL- 4



SECTOR – CAPITAL GOODS AND MANUFACTURING



Directorate General of Training

INDUSTRIAL FITTER

CRAFTSMEN TRAINING SCHEME (CTS)

Under Flexi-MoU

NSQF LEVEL- 4

(Designed in 2024)

Developed By

MEDHAVI SKILLS UNIVERSITY, Sikkim

and

Government of India

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

Flexi-MoU is one of the pioneer programmes under DGT on the basis of the MoU in between DGT and Industrial Training Partner (ITP) for propagating vocational training to allow industries to take advantage of various schemes for conducting training programme in higher employment potential courses according to needs of industries. The concept of Flexi- MoUs was introduced in June-July 2014. DGT and MSU have decided to sign this memorandum of understanding to provide an opportunity to the youth to acquire skills related to Industrial Fitter through specially designed "Learn and Earn" approach consisting a mix of theoretical and On-the-Job Training (OJT) components and hence improve their employability potential and to contribute in the overall growth of Steel industry by creating a pool of skilled resources.

During the two years' duration of the programme, a candidate is trained on professional skills and knowledge, Engineering Drawing, Workshop Calculation and Science and Employability skill related to job role. In addition to this a candidate is entrusted to undertake project work and extra curricula activities to build up confidence. The broad components covered during the course are given below:

During the two-year duration a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science and 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 and simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The broad components covered under Professional Skill subject areas below:

FIRST YEAR:

The training program for this year prioritizes safety, both for humans and the machines involved. The trainee is trained to use various hand tools and precision tools to ensure accuracy, proper fit, and clearance. They are taught basic fitting operations, which include sawing, filing, marking, chipping, measurement, riveting, soldering, brazing, drilling, and complying with safety guidelines. The trainee's accuracy in performing these operations is closely monitored, with a tolerance level of ± 0.04 mm and angular accuracy up to 30 minutes. The program also emphasizes multi-skilling, covering welding (arc), electrical and electronic systems/devices troubleshooting and repair, basic CNC machine maintenance, and handling and troubleshooting of pneumatic and hydraulic machines. Additionally, the trainee learns to read drawings, identify various machining processes, and create machine charts.

SECOND YEAR:

The training program for this year includes instruction in power tool operation, complex assembling and fitting, fastening, lapping, gauge making, pipe works and pipe joints, valve dismantling, overhaul, and assembly. Trainees are expected to achieve an accuracy level of ± 0.02 mm and 10 minutes. They learn to make drill jigs, critical components, templates, and complex gauges, as well as to identify various pneumatic and hydraulic components and construct circuits, and perform machinery repair and maintenance. Practical training also covers bearing practice and working with finished surfaces, such as aluminum, duralumin, and stainless steel. The theoretical part covers non-ferrous metals and methods of lubrication. Trainees are also taught how to maintain overhead cranes and security systems (central alarm and CCTV). Finally, the program exposes the trainee to sensor technology and cloud technology, which they can use to fetch reports from the machine.

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development and Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/labor market. DGT is futuristic in preparing the prospective Indian workforce in building skills and capabilities as per the needs of the industry. In this quest, it has changed the paradigm of growth to a job-oriented training by partnering with industry to be an enabler of responsible, sustainable and inclusive growth. Towards this objective, DGT signed this MOU with Industrial Training Partner (ITP).

Industrial Fitter trade under CTS (Flexi-MoU) is of two years' duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory and Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skill, knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by DGT under Flexi-MoU which is recognized worldwide.

Industrial Training Partner (ITP) shall conduct courses at the Industry Partner's location. On the job training will be conducted inside the Plant premises. It will also ensure the eligible trainees take up Apprenticeship / higher education in suitable streams and shall also guide the students to become Entrepreneurs. Industrial Training Partner (ITP) will strictly follow the policy guidelines for Flexi-MoU as in place from time to time. No deviation for the same would be permitted. Admission and Exam for trades run under Flexi-MoU at training locations of Industrial Training Partner. Theory content is provisioned to be 25% and practical content is provisioned to be 75%.

Trainees broadly need to demonstrate that they are able to:

- Read and interpret technical parameters/documents, 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 and 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 Fitter and will progress further as Senior Fitter, Supervisor and can rise up 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 period of two-years:

S No.	Course Element	Notional Training Hours	
		1 st Year	2 nd Year
1	Professional Skill (Trade Practical)	270	330
2	Professional Knowledge (Trade Theory)	300	300
3	Employability Skills	120	60
4	On Job Training	750	750
5	Industry specific module	150	150
	Total	1590	1590

2.4 ASSESSMENT AND 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. 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 is 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% and for all other subjects is 33%. There will be no grace marks.

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 scrap/ wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE (Occupational Safety and Health Environment) and self-learning attitude are to be considered while assessing competencies.

Assessment will be evidence based, comprising the following:

- Job carried out in labs/workshop
- Record book/daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and Punctuality
- Assignment

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 while assessing:

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

FITTER- MECHANICAL FABRICATION

1. Study of drawing
2. Material management for the required assembly
3. Marking of the required dimensions on the material
4. Gas cutting and grinding
5. Drilling of the required hole size
6. Assembly by tacking
7. Alignment of the fabrication part
8. Stress balancing
9. Welding in different positions
10. Nut and bolt tightening in all the required places

2. FITTER – MECHANICAL ASSEMBLY

1. Knowledge of equipment, materials and consumables to meet the required specification
2. Perform basic machining, fitting and assembly activities of machinery to produce machinery of features as per given specifications
3. Carry out fitting and assembly activities with an understanding of the types of equipment used, the manufacturing techniques, and the operating and safety procedures that are required
4. Use of tools and equipment to mark out the material for the features to be produced
5. Use of hand tools, portable power tools, manually operated machine tools and shaping, fitting and assembly techniques
6. Hand sawing, filing, drilling, tapping, reaming, surface grinding and assembly

3. FITTER - MACHINE MAINTENANCE

1. Ability to dismantle, overhaul and assembling of different gear boxes
2. Measurement with the help of a micrometer and vernier of different parts of crane items
3. Drilling and trapping knowledge
4. Cutting of packing material to the size
5. Marking on work piece for different operations like drilling
6. Jacking of assembly for the dismantling of parts welding, assembly etc.
7. Oiling, greasing and lubrication of different assemblies and system
8. Break adjustment of cranes
9. Nut bolt fitting in case of breakdown
10. Alignment of the different parts for assembly
11. Changing of mechanical parts
12. Inspection of crane limit, switches, break assembly, and oil level in gear box.

4. FITTER – LEVELING, ALIGNMENT and BALANCING

1. Alignment of moving parts (e.g., pumps, blower fans, etc.)
2. Checking the vibration of moving parts (blower fan, pumps, motor gear box etc.) and balancing of equipment shafts (input and output).
3. Conduct routine maintenance or rectify the problem
4. Prepare spares, materials required for operation
5. Check leveling, alignment and balancing (static and dynamic)
6. Monitor and record the temperature and vibration · Conduct tests to ensure fitness

5. PIPE FITTER

1. Lays, repairs and maintains, pipes for supply of water, gas, oil or steam according to drawings or instructions.
2. Examines drawings and other specifications or receives relevant instructions.
3. Cuts passage holes for laying pipes in walls and floors.
4. Cuts reams, threads and bends pipes according to specifications
5. Lays pipes in cut passage and assembles pipe sections with couplings, sockets, Tee's elbows etc.
6. Levels position of pipes using spirit level for gravitational flow.
7. Caulks joints, tests them for leakage with pneumatic or hydraulic pressure and secures pipe line to structure with clamps, brackets, and hangers.
8. Fits water meters, taps etc. to pipe where necessary.
9. Repairs and replaces leaky pipe lines, taps and joints and provides connections to overhead water tanks.
10. May join pipe sections and fittings.

6. FITTER- SHIFT WORKING

1. Opening of assembly with recognized tools and tackles
2. Changing of worm and part/ broken part with new/repared part
3. Alignment of the new/part with the original assembly
4. Packing up of the assembly with new packing material/seal/ropes etc
5. Tightening of rope of different systems in case of loosening
6. Changing of broken volumes of pneumatic, hydraulic or water supply system
7. Changing of pipe in case of brake down
8. Lubrication of different systems in case of low lubrication
9. Lubrication the jam assemblies for free movement
10. Changing fitters of different systems
11. Hammering activities in different repair job

7. 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 equipment's 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 scribe, 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 centers, 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 a drill, cuts threads with taps and dies ensuring that they are square or at required angle to base. Measures finished article with a 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 a complete unit according to drawing. Dismantles or removes worn out, broken or defective parts using hand tools or power tools and replaces them with repaired or new ones. Performs repairing and maintenance work (including preventive maintenance) of simple machines, dismantles and replaces different components to construct circuits of Pneumatics and Hydraulics. Tests completed article/assembly to ensure correct performance. May do the 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.

Reference NCO 2015:

- i) 7126.0301 – Pipe Fitter
- ii) 7126.9900 – Plumbers and Pipe Fitters
- iii) 7224.0102 – Fitter – Fabrication
- iv) 7233.0101 – Maintenance Fitter –Mechanical
- v) 7233.0121 – Fitter Levelling, Alignment and Balancing
- vi) 7233.2901 – Fitter: Hydraulic and Pneumatic System
- vii) 7233.9900 – Machinery Mechanics and Fitters, Other
- viii) 7412.0202 – Mechanical Fitter
- ix) 7233.0100 – Fitter, General

Reference NOS: CSC/N9511, CSC/N9590, CSC/N9591, CSC/N9592, CSC/N9593, CSC/N9594, CSC/N9595, CSC/N9596, CSC/N9597, CSC/N9598, CSC/N9599, CSC/N9600, CSC/N9601, CSC/N9401, CSC/N9402, CSC/N9602, CSC/N9603, CSC/N9604, CSC/N9605, CSC/N9606, CSC/N9607, CSC/N9608, CSC/N9609, CSC/N9610, CSC/N9611, CSC/N9612

4. GENERAL INFORMATION

Name of the Trade	INDUSTRIAL FITTER
NCO–2015	7126.0301, 7126.9900, 7224.0102, 7233.0101, 7233.0121, 7233.2901, 7233.9900, 7412.0202, 7233.0100
Mapped NOS	CSC/N9511, CSC/N9590, CSC/N9591, CSC/N9592, CSC/N9593, CSC/N9594, CSC/N9595, CSC/N9596, CSC/N9597, CSC/N9598, CSC/N9599, CSC/N9600, CSC/N9601, CSC/N9401, CSC/N9402, CSC/N9602, CSC/N9603, CSC/N9604, CSC/N9605, CSC/N9606, CSC/N9607, CSC/N9608, CSC/N9609, CSC/N9610, CSC/N9611, CSC/N9612
NSQF Level	Level-4
Duration of Craftsmen Training (Instructional Hours)	Two year (3180 Hours)
Entry Qualification	Passed 10 th class examination
Minimum Age	18 years as on first day of academic session.
Unit Strength (No. Of Student)	20
Space Norms	88 Sq.m.
Power Norms	3.51 KW
Instructors Qualification for	
(i) Industrial Fitter Trade	B.Voc/Degree in Mechanical Engineering from AICTE/UGC recognized Engineering College/university with one-year experience in the relevant field. OR 03 years Diploma in Mechanical Engineering from AICTE/recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. OR Ex-serviceman from Indian Armed Forces with 15 years of service in related fields as per equivalency through DGR. Candidates should have undergone methods of Instruction of course with minimum 02 years of experience in technical training institute of Indian Armed Forces. OR NTC/NAC passed in the Trade of "Fitter" With three years'

	experience in the relevant field. Essential Qualification: Relevant National Craft Instructor Certificate (NCIC) in any of the variants under DGT. <i>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.</i>
(ii) Workshop Calculation and Science	B.Voc./Degree in Engineering from AICTE/UGC recognized Engineering College/University with one-year experience in the relevant field. OR 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. OR NTC/NAC in any one of the engineering trades with three years' experience. <u>Essential Qualification:</u> National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT
(iii) Engineering Drawing	B.Voc./Degree in Engineering from AICTE/UGC recognized Engineering College/University with one-year experience in the relevant field. OR 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. OR NTC/NAC in any one of the engineering/ Draughtsman group of trades with three years' experience. <u>Essential Qualification:</u> National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT

(iv) Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) OR Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills.
(v) 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.

LEARNING OUTCOME

FIRST YEAR

1. Read and apply human safety and machine safety. (NOS: CSC/N9511)
2. Perform basic fitting operation and check for dimensional accuracy following safety precautions. (NOS: CSC/N9590)
3. Recognize the use of Precision tools for accuracy, fit and clearance. (NOS: CSC/N9591)
4. Construct basic sheet metal products in accordance with the design instructions and connect them by means of soldering, brazing, and riveting. (NOS: CSC/N9592)
5. Assemble metal parts using standard riveting techniques in adherence to established procedures. (NOS: CSC/N9593)
6. Identify, check and manage different Electrical, Electronic systems devices. (NOS: CSC/N9594)
7. Plan and perform the maintenance of CNC: basic Preventive maintenance and scheduled maintenance. (NOS: CSC/N9595)
8. Identify and check basic pneumatic systems and circuits. (NOS: CSC/N9596)
9. Plan, design, install and troubleshoot the basic hydraulic system and elements. (NOS: CSC/N9597)
10. Plan and perform work on the existing jig and fixture and carry out maintenance activities. (NOS: CSC/N9598)
11. Execute simple repairs and maintenance on different machines, while verifying proper functionality through rigorous testing. (NOS: CSC/N9599)
12. Join metal component using arc welding following standard procedure. (NOS: CSC/N9600)
13. Join and separate metal components by utilizing oxy-acetylene gas welding techniques in adherence to established procedures. (NOS: CSC/N9601)
14. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)

SECOND YEAR

16. Create and assemble components with varying mating surfaces using different surface finishing techniques, a range of fastening components and tools, and perform functionality tests. (NOS: CSC/N9602)
17. Produce various gauges through the use of standard tools and equipment while ensuring that the required accuracy is achieved. (NOS: CSC/N9603)
18. Plan and perform basic day-to-day preventive maintenance, repairing and checking functionality. (NOS: CSC/N9604)
19. Prepare joints and bending for hydraulic and pneumatic pipelines. (NOS: CSC/N9605)
20. Perform troubleshooting and fault finding in conveyor belt operation, roller belt operation, chain drive system, repairing of the mechanical- breakdown parts. (NOS: CSC/N9606)
21. Plan, erect simple machine and test machine tool accuracy. (NOS: CSC/N9607)
22. Identify and select types of sensors and sensor-based technology. (NOS: CSC/N9608)
23. Generate operation reports from the CNC machine. (NOS: CSC/N9609)
24. Carry out operation and fault detection in overhead crane. (NOS: CSC/N9610)
25. Execute testing and maintenance of security systems. (NOS: CSC/N9611)
26. Perform solar Panel Installation and maintenance. (NOS: CSC/N9612)
27. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
28. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)

6. ASSESSMENT CRITERIA

Learning Outcome	Assessment Criteria
FIRST YEAR	
1. Read and apply human safety and machine safety. (NOS: CSC/N9511)	Wear appropriate PPEs.
	Demonstrate preventive measures to avoid electrical accidents and steps to be taken in such accidents.
	Demonstrate the use of fire extinguishers.
	Follow safety measures while working in fitting jobs.
	Demonstrate safe use of tools and equipment used in the trade.
2. Perform basic fitting operation and check for dimensional accuracy following safety precautions. (NOS: CSC/N9590)	Plan & Identify tools, instruments and equipment for marking and make this available for use in a timely manner.
	Select raw material and visually 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, chiseling, 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.
3. Recognize the use of precision tools for accuracy, fit and clearance. (NOS: CSC/N9591)	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.
	Recognize general concept of Limits, Fits and tolerance 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.
4. Construct basic sheet metal products in accordance with the design instructions and connect them by means of soldering, brazing, and riveting. (NOS: CSC/N9592)	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.
5. Assemble metal parts using standard riveting techniques in adherence to established procedures. (NOS: CSC/N9593)	Identify Tools and equipment for riveting and make these 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.

6. Identify, check and manage different electrical, electronic systems devices. (NOS: CSC/N9594)	Identify the phase in the given circuit using the neon tester.
	Identify faults in the power circuit such as fuse blown, MCB tripped, control fuse blown.
	Troubleshoot loose contacts in the control panel wirings using the voltmeter.
	Troubleshoot the AC motor starter and find its starting current.
	Perform the earthing.
	Identify different low-voltage switch gears.
7. Plan and perform the maintenance of CNC: basic preventive maintenance and scheduled maintenance (coolant, dry-run, alarm, jog, auto). (NOS: CSC/N9595)	Execute maintenance activities as per TPM (Total Productive Maintenance) chart.
	Perform the use of the right tools, fixtures, equipment and spares.
	Verify the accuracy class of bearing, grade of oil and their correct specifications.
	Perform the maintenance of the machine tools by studying the manuals, and circuit diagram supplied by the machine manufacturers.
	Execute the process to be followed in case of coolant low-level alarm.
	Perform a dry run on the CNC machine.
8. Identify and check basic pneumatic systems and circuits. (NOS: CSC/N9596)	Identify various parts of the pneumatic system.
	Execute the selection process for pneumatic elements for a circuit.
	Measure the pneumatic pressure, temperature, and flow level of the pneumatic system.
	Check the appropriate air compressor and receiver for application.
	Make a routine for the pneumatic pipelines.
9. Plan, design, install and troubleshoot the basic hydraulic system and elements. (NOS: CSC/N9597)	Carry out the operation of speed control of the hydraulic cylinder through the throttle valve.
	Make the meter-in and meter-out circuits and check the functionality of the flow control valve in it.
	Check the function of cartridge valves in the lubrication system.
	Make electro hydraulic circuit for speed and pressure control of a double-acting cylinder for the hydraulic press.

	Execute hydraulic-based control circuit for operation of the double-acting cylinder through 5/2 solenoid.
10. Plan and perform work on the existing jig and fixture and carry out maintenance activities. (NOS: CSC/N9598)	Perform cleaning and oiling of the jig and fixture after the use of the machine.
	Make a list of factors considered for designing a jig and fixture.
	Design a fixture for the given machine operation.
	Design a jig for a given machine operation.
11. Execute simple repairs and maintenance on different machines, while verifying proper functionality through rigorous testing. (NOS: CSC/N9599)	Ascertain and select tools and materials for the repair, overhauling and make this available for use in a timely manner.
	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.
12. Join metal component using arc welding following standard procedure. (NOS: CSC/N9600)	Identify different components/parts of the arc welding machine, collect desired information.
	Set each component/part as per standard procedure.
	Observe safety/precautions during the welding operation.
	Use appropriate materials and plan for arc welding.
	Weld the metal parts / mechanical components as per specification observing standard procedure.
	Check joined part portion to ascertain proper welding.
13. Join and separate metal components by utilizing oxy-acetylene gas welding techniques in adherence to established procedures. (NOS: CSC/N9601)	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
14. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	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.
15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study
SECOND YEAR	
16. Create and assemble components with varying mating surfaces using different surface finishing techniques, a range of fastening components and tools, and perform functionality tests. (NOS: CSC/N9602)	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 with appropriate instruments observing standard procedure.
	Assemble different components using different fastening components, tools and check the functionality.
17. Produce various gauges through the use of standard	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.

tools and equipment while ensuring that the required accuracy is achieved. (NOS: CSC/N9603)	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.
18. Plan and perform basic day-to-day preventive maintenance, repairing and checking functionality. (NOS: CSC/N9604)	Simple repair of machinery: making of packing gaskets.
	Check washers, gaskets, clutch, keys, jibs, cotter, circlip, etc. and replace/repair.
	Use hollow punches, extractors, drifts, various types of hammers and spanners, etc. for repair work.
	Perform dismantling, and assembling of different types of bearing and check for Functionality.
19. Prepare joints and bending for hydraulic and pneumatic pipelines. (NOS: CSC/N9605)	Perform flaring of pipes and pipe joints.
	Make cutting and threading of pipe length.
	Dismantle valves and fittings in pipes by applying a range of skills and checking for defects as per the standard procedure.
	Fitting of pipes as per sketch observing conditions used for pipe work.
	Prepare setting up workplace/ assembly location with due consideration to operational stipulation.
	Assemble valves and various pipe fittings using a range of skills and observing standard procedures.
	Test for leakage and appropriate functioning of valves.
20. Perform troubleshooting and fault finding in conveyor belt operation, roller belt operation, chain drive system, repairing of the mechanical-breakdown parts and hydraulic & pneumatic components. (NOS: CSC/N9606)	Perform dismantling of the conveyor belt and list down the parts.
	Perform the maintenance of the chain drive.
	Perform the adjusting of the slip in the conveyor belt assembly.
	Execute scheduled maintenance of the power transmission devices with a tag.
	Perform the maintenance Vee-belts drive and their advantages and disadvantages with the belt drive.

	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.
21. Plan, erect simple machine and test machine tool accuracy. (NOS: CSC/N9607)	Monitor the factor of machine tools such as alignment and levelling.
	Make accuracy testing of machine tools such as geometrical parameters.
	Make various knots, correct loading of slings, correct and safe removal of parts.
	Check the foundation and erect the base of a simple machine.
22. Introduction to types of sensors and sensor-based technology. (NOS: CSC/N9608)	Identify and list the sensor with specification.
	Perform the sensor connection as per the datasheet provided.
	Create a sensor -using IR led and TSOP sensor (optional - relay for the application).
	Repair and maintenance of the given sensor.
	Assemble different components.
	Specify the need before choosing sensors.
	Identify the difference between the sensor and transducer.
23. Generate operation reports from CNC machine. (NOS: CSC/N9609)	Prepare a block diagram presentation to explain the data extraction process and data fetching process in cloud technology.
	Concept of data transmission from a classic CNC machine to cloud and generation of data using block diagram.
	Monitor on cloud data fetching application.
	Monitor the machine gateways and internet protocol.
24. Carry out operation and fault detection in overhead crane. (NOS: CSC/N9610)	Read and interpret a pre-loading environment with all the necessary symbols.
	Operate load travel in vertical and horizontal movement.
	Prepare a maintenance checklist of overhead cranes.

	Perform scheduled maintenance activities.
25. Execute testing and maintenance of the security systems. (NOS: CSC/N9611)	Perform the false or testing of the alarm system
	Prepare the checklist of sensor and control panels with proper tagging
	Explain the types of fire alarm systems in use today: Non – Addressable, Addressable and Hybrid
	Identify the different types of cameras used in your industry
	Perform and plan the wiring layout and routing for the camera to DVR
	Identify the alarm in the DVR and troubleshoot as per the given instruction
	Perform the changing of the batteries in the DVR
	Perform the cleaning of the BNC connector and power connector in the CCTV installation
26. Perform solar panel Installation and maintenance. (NOS: CSC/N9612)	Perform the cleaning and maintenance of the rooftop solar panel
	Explain the concept of solar panels and charge controllers using a block diagram
	Explain the Installation procedure of solar panels and the working of the inverter with batteries
	Perform the setting of the solar panel angle of the panel for more efficiency.
27. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	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.
28. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study

SYLLABUS – INDUSTRIAL FITTER (FLEXI MoU)			
FIRST YEAR			
Duration	Reference Learning Outcomes	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Professional Skill 05 Hrs. Professional Knowledge 12 Hrs. On the Job Training 13 Hrs.	Read and apply human safety and machine safety.	1. Wear appropriate PPEs 2. Demonstrate preventive measures to avoid electrical accidents and steps to be taken in such accidents. 3. Demonstrate use of fire extinguishers. 4. Follow safety measures while working in fitting jobs. 5. Demonstrate safe use of tools and equipment used in the trade. 6. Demonstration of the machine grading. 7. Inspection of the emergency stop in the machine. 8. Verify the barriers, signs and symbols for the restricted area on the shop floor. 9. Develop documents to implement the work procedure and emergency Procedures. 10. Establish machine-specific lockout and tagout (LOTO) Procedures.	Importance of safety and general precautions observed in the industry/shop floor. Hazard identification and avoidance. Introduction to PPEs Electrical safety Introduction of First aid. Response to emergencies e.g.; power failure, fire, and system failure. Introduction to the 5S concept and its application. Safety signs for danger, warning, caution and personal safety message. Occupational Safety and Health: Health, Safety and Environment guidelines, legislations and regulations as applicable. Basic understanding of hot work, confined space work and material handling equipment Appropriate Ventilation (local exhaust ventilation, dust collection systems) Guarding (fixed or interlocking) Devices to prevent body part contact (push stick, holding device, two-handed activation controls) Visible and accessible stopping mechanism (emergency stop)

			Barriers, sensors, signs and alarms (fixed area barriers, visible lights, signage on machines/area, horns and sirens, restricted space painted on floor) Preventative inspections/testing (pre-use testing and inspection, documented annual service/maintenance) Safe work procedures, LOTO PPE (safety footwear, eyewear, hand protection, face shields, hearing protection, respirators)
Professional Skill 10 Hrs. Professional Knowledge 18 Hrs. On the Job Training 32 Hrs.	Perform basic fitting operation and check for dimensional accuracy following safety precautions.	11. Identify the use of different types of files in the work area. 12. Identify the use of different types of hammers in your work area 13. Identify the use of different types of chisels and list the angle 14. Visual inspection of the previous reamed job 15. Plan the list of tools for the marking operation 16. Identify the use of dial indicator on the shop floor 17. Identify the tap and Die operation in the given material	Introduction to the hand tools Uses of hand tools Types of files and safety process of filing. Types of hacksaws, specification of the blade and its safe care Types of hammer specification and safe care Types of chisels and sharpening methods Reamer and threading tools (Hand reamer, machine reamer and expanding reamer) Types of taps (tapper tap, second tap and plug tap) Precaution and operation in the tapping Die (split die or button die) and die nut Precaution and operation of the die Uses of try square and light pass check. Clamping devices (vice) and their types Marking tools and their uses (surface plate, vee block angle

			plate, punch, spring divider and scriber) Marking media, marking blue, Prussian blue, red lead, chalk and their special application, description. Working and application of dial indicator.
Professional Skill 20 Hrs. Professional Knowledge 15 Hrs. On the Job Training 55 Hrs.	Recognize the use of Precision tools for accuracy, fit and clearance.	18. Identify the error in the vernier calliper 19. Identify the error in the micrometre 20. Verify the dimension of the given workpiece using a vernier calliper. 21. Verify the dimension of the given workpiece using the micrometre. 22. Make a marking on the given material using the height gauges. 23. Verify the internal diameter of the cylindrical job using pneumatic gauges. 24. Steel Rule: A steel rule is a straight-edged measuring tool that is used to take linear measurements. It is typically made of stainless steel and can measure up to several feet 25. Measure small gaps or clearance using feeler gauge to ensure proper fit and alignment of parts. 26. Determine the pitch or lead of screw threads to ensure proper thread engagement between two parts using thread gauge.	Linear measurements- its units; measuring standards (english, metric units), angular measurements Micrometre- outside and inside – principle, constructional features, parts graduation, reading, use and care. micrometre depth gauge, parts, graduation, reading, use and care, digital micrometre. Vernier callipers, principle, construction, LC, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial vernier calliper, digital vernier calliper. Vernier height gauge: material construction, parts, graduations (English and Metric), uses, care and maintenance Working and construction of the pneumatic gauges

		27. Check the flatness of a surface or the straightness of a part using surface plate	
Professional Skill 30 Hrs. Professional Knowledge 20 Hrs. On the Job Training 70 Hrs.	Construct basic sheet metal products in accordance with the design instructions and connect them by means of soldering, brazing, and riveting.	28. Obtain the drawing or specifications for the sheet metal item. 29. Select the appropriate sheet metal based on the material and thickness required for the item. 30. Cut the sheet metal according to the dimensions specified on the drawing, using a metal cutting tool such as a hacksaw, power shears, or a laser cutter. 31. Form the sheet metal into the desired shape using bending, folding, or rolling techniques. 32. Practice preparation of various joints such as Butt Joint, Lap Joint, T-Joint, Corner Joint etc. 33. Join the sheet metal by soldering, brazing, or riveting. 34. Soldering: Apply flux to the joint, heat the joint with a soldering iron or torch, and apply solder to the joint until it flows and fills the joint. 35. Brazing: Apply flux to the joint, heat the joint with a torch, and apply brazing rod to the joint until it melts and flows to fill the joint.	Types of grinding operation, grinding wheel, Material removal, cutting action, Heat generation, Surface finish, Grinding operations.

		36. Riveting: Drill holes in the sheet metal at the locations specified on the drawing, insert rivets into the holes, and use a riveting tool to secure the rivets in place. 37. Sand or file any rough edges or burrs, and apply any required surface finish, such as paint or powder coating.	
Professional Skill 25 Hrs. Professional Knowledge 20 Hrs. On the Job Training 45 Hrs.	Assemble metal parts using standard riveting techniques in adherence to established procedures.	38. Obtain the metal components to be joined, as well as the rivets and the appropriate rivet gun or tool for the job. 39. Use a drill to create holes in the metal components where the rivets will be inserted. The size and spacing of the holes should be consistent with the size and type of rivet being used. 40. Insert the rivet into the holes in the metal components, with the mandrel (the pin on the end of the rivet) pointing towards the rivet gun. 41. Hold the rivet in place and squeeze the handles of the rivet gun or tool to apply pressure to the mandrel. 42. Use file or sandpaper to smooth out any rough edges or burrs left behind by the drilling and riveting process.	Introduction of rivets, shape and form of heads, Rivets types, sizes, and selection for various works. Riveting tools description and uses. Method of riveting, The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.

Professional Skill 30 Hrs. Professional Knowledge 15 Hrs. On the Job Training 75 Hrs.	Identify, check and manage different Electrical, Electronic systems devices.	43. Identify the phase in the given circuit using the neon tester. 44. Locating faults in the power circuit such as fuse blown, MCB Tripped, control fuse blown etc. 45. General checking of loose contacts in the control panel wirings using the voltmeter. 46. Verify and Service a circuit breaker. 47. Perform Service and troubleshoot the AC motor starter and find its starting current. 48. Maintain, Service, and troubleshoot AC Machine.	Introduction to power sources Difference between AC and DC Difference between single-phase and three phase Use of multimeter (voltmeter, ammeter, resistance and continuity) Use of neon tester and its application Low voltage switch Gears Definition, use, types and applications of circuit breakers such as MCB (Miniature Circuit Breaker), MCCB (Moulded Case Circuit Breakers), ELCB (Earth-leakage Circuit Breaker), ACB (Air Circuit Breaker), SF6 circuit breaker, VCB (Vacuum Circuit Breaker), Flameproof switchgear specification Overview of the Power distribution system
Professional Skill 30 Hrs. Professional Knowledge 30 Hrs. On the Job Training 105 Hrs.	Plan and perform the maintenance of CNC: basic Preventive maintenance and scheduled maintenance.	49. Execute maintenance activities as per TPM (Total Productive Maintenance) Chart. 50. Plan and verify the Use of the Right tools, fixtures, equipment and spares. 51. Verify the accuracy class of bearing, grade of oil and their correct specifications. 52. Perform the working of the machine tools by studying the manuals, and circle diagram supplied by the machine manufacturers.	Different types of machine maintenance. maintenance practices followed by CNC machines. Tools and accessories used in CNC machine tools maintenance work. Problems related to the mechanical system in CNC machines The meaning of the term "Backlash", is how to identify and measure Backlash. Causes of failure of an electronic system in CNC machines and precautions to be observed. How to check the pneumatic system in CNC machines.

		53. Perform and plan the flow chart/cause and defect diagrams 54. Perform a dry run on the CNC machine 55. Plan the process for coolant low-level alarm.	Causes of excessive noise in CNC Machines and how to eliminate it.
Professional Skill 20 Hrs. Professional Knowledge 15 Hrs. On the Job Training 25 Hrs.	Identify and check basic pneumatic systems and circuits.	56. Identify various parts of the pneumatic system. 57. Practice the selection of pneumatic element a for a given circuit. 58. Practice preparing pneumatic circuit. 59. Measure pneumatic pressure, temperature, and flow level of the pneumatic system. 60. Select the appropriate air compressor and receiver for the given application. 61. Use and maintain of FRL unit in pneumatics. 62. Identify the different pneumatic and hydraulic components that need to be repaired or replaced. 63. Dismantle the components carefully and systematically. 64. Follow the manufacturer's guidelines or standard procedures to dismantle the components to avoid damage. 65. Inspect the components for any damaged or worn-out parts. 66. Replace the damaged or worn-out parts with new ones that meet the	Definition and history of Pneumatic Basic pneumatic system. Types, construction, working, specifications and selection criteria of following air preparation and conditioning elements Routing of the pneumatic pipelines Directional control valves, Flow control valves, Pressure control valves, Special valves- quick exhaust valve, time delay valve, Logic valves- shuttle valve Electro-pneumatic circuits control switches, relays, solenoids and timers.

		manufacturer's specifications. 67. Reassemble the components carefully and systematically. 68. Follow the manufacturer's guidelines or standard procedures to reassemble the components to ensure that they are properly fitted and functional. 69. Test the components for functionality and check for any leaks or malfunctions. 70. Use appropriate testing equipment and tools to test the components and ensure that they are functioning correctly. 71. Make a final check of the components to ensure that they are working correctly and there are no leaks or malfunctions.	
Professional Skill 15 Hrs. Professional Knowledge 20 Hrs. On the Job Training 70 Hrs.	Plan, design, install and troubleshoot the basic hydraulic system and elements.	72. Construct and operate the Speed control of the Hydraulic cylinder through the Throttle valve. 73. Construct and verify the functionality of the Flow control valve in the Meter-in and Meter-out circuits. 74. Construct and check the function of cartridge valves in the Lubrication system. 75. Construct Electro Hydraulic circuit –Speed and Pressure control of double-acting cylinder for hydraulic Press.	Definition and history of hydraulic Basic hydraulic system Identification of different types of hose pipe and their application Construction, Types and working of: Directional Control Valves, Pressure Control Valves, Flow Control Valves, Pressure Intensifiers, Accumulators, Cartridge Valves Cylinder and Relief Valve

		76. Construct a control-based hydraulic circuit for the operation of the double-acting cylinder through 5/2 solenoid.	
Professional Skill 15 Hrs. Professional Knowledge 20 Hrs. On the Job Training 70 Hrs.	Plan and perform work on the existing jig and fixture and carry out maintenance activities.	77. Plan and perform cleaning and oiling of the jig and fixture after the use of the machine 78. Plan and list down the factor consider for designing a jig and fixture 79. Plan and design a fixture for the given machine operation 80. Plan and design a jig for a given machine operation. 81. Create a design for the drill jig that will hold the component securely and in the correct position for drilling. 82. Choose appropriate materials for the drill jig, such as aluminum, steel or plastic. 83. Use standard tools and equipment to cut and shape the drill jig to the required dimensions and shape. 84. Check the accuracy of the drill jig using measuring tools, such as micrometers and calipers, and make any necessary adjustments. 85. Secure the drill jig to the drill press table using clamps or bolts. 86. Place the component into	Introduction to jig and fixture Working on the boring jig vies jaw fixture Difference between the jig and fixture Advantages of jig and fixture Fundamental of jig and fixture design Feature of jig and fixture The general concept for designing a jig and fixture and the material used for manufacturing it.

		the drill jig and adjust its position to ensure correct alignment. 87. Drill the required holes in the component using the drill press, ensuring that the drill bit is correctly sized for the hole and material. 88. Check the accuracy of the drilled holes using measuring tools, such as gauges and calipers, and make any necessary adjustments. 89. Remove the component from the drill jig and inspect it for quality and accuracy.	
Professional Skill 10 Hrs. Professional Knowledge 15 Hrs. On the Job Training 50 Hrs.	Execute simple repairs and maintenance on different machines, while verifying proper functionality through rigorous testing.	90. Identify the problem causing the machine to malfunction. 91. Plan the repair based on the identified problem, plan the necessary repairs. 92. Identify and select tools and parts are needed and create a checklist of steps to follow during the repair. 93. Gather all the necessary parts and tools. 94. Ensure the correct parts and they are compatible with the machine. 95. Perform the repair by following the steps outlined in the repair plan to perform the necessary repairs.	Maintenance -Total productive maintenance -Autonomous maintenance -Routine maintenance -Maintenance schedule -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 color coding. Revision, simple estimation of materials, use of Hand books and reference table. Possible causes for assembly failures and remedies. Installation, maintenance and overhaul of machinery and engineering equipment.

		96. Follow safety procedures when working on the machine. 97. Test the machine to ensure that it is functioning properly. 98. Check for any signs of overheating, unusual noises, or other issues. 99. Perform overhauling of the machine by disassembling and cleaning each component, replacing any worn out or damaged parts, and reassembling the machine. 100. Test the machine to ensure that it is functioning properly after overhauling. 101. For specific machines: 102. Drill machine: 103. Check the drill bit: Ensure that the drill bit is sharp and properly secured in the chuck. 104. Check the belt: Inspect the belt for any signs of wear or damage. 105. Check the motor: Ensure that the motor is functioning properly and not overheating. 106. Power saw: 107. Check the blade: Ensure that the blade is sharp and properly secured.	
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		108. Check the belt: Inspect the belt for any signs of wear or damage. 109. Check the motor: Ensure that the motor is functioning properly and not overheating. 110. Bench grinder: 111. Check the wheels: Ensure that the grinding wheels are properly secured and not cracked. 112. Check the belt: Inspect the belt for any signs of wear or damage. 113. Check the motor: Ensure that the motor is functioning properly and not overheating. 114. Lathe: 115. Check the cutting tool: Ensure that the cutting tool is properly secured and sharp. 116. Check the belt: Inspect the belt for any signs of wear or damage. 117. Check the motor: Ensure that the motor is functioning properly and not overheating.	
Professional Skill 30 Hrs. Professional Knowledge 20 Hrs. On the Job Training 70 Hrs.	Join metal component using arc welding following standard procedure.	118. Identify and select the metal components to be joined, as well as the appropriate welding equipment, including an arc welder, welding electrode, welding helmet, welding gloves, and protective clothing.	Introduction of Welding and safety precautions observed in a welding shop. Introduction to safety equipment and their uses. Machines and accessories, welding transformer, welding generators.

		119. Clean the metal using a wire brush or grinder to remove any surface rust or paint from the metal. 120. Position the metal using clamps or by securing them to a workbench or welding table. 121. Set up the arc welder according to the type of metal and the thickness of the metal components. 122. Follow the manufacturer's instructions for the specific welding electrode being used. 123. Start the arc and hold the welding electrode at a 90-degree angle to the metal surface and strike an arc by touching the electrode to the metal and then quickly pulling it away. 124. Continue welding until the joint is fully filled and the two metal components are fused together. 125. Use wire brush or grinder to smooth out any rough edges or weld spatter left behind by the welding process.	
Professional Skill 30 Hrs.	Join and separate metal components by utilizing oxy-acetylene gas welding techniques	126. Identify and select components to be cut and joined, as well as the appropriate equipment.	Welding hand tools: Hammers, welding description, types and uses, description, principle, method of operating, carbon dioxide welding. H.P.

Professional Knowledge 20 Hrs. On the Job Training 70 Hrs.	in adherence to established procedures.	127. Connect the hoses and regulators to the gas cylinders, and adjust the flow rates to achieve the desired flame intensity. 128. Follow the manufacturer's instructions for the specific equipment being used. 129. Clean the metal by using wire brush or grinder to remove any surface rust or paint from the metal. 130. Position the oxy-acetylene torch at a 45-degree angle to the metal surface and adjust the flame to the appropriate intensity for the thickness of the metal. 131. Move the torch along the cut line, applying heat until the metal is sufficiently hot and then applying the cutting oxygen to sever the metal. 132. Continue moving the torch along the cut line until the metal is fully cut. 133. Position the metal components to be joined together and adjust the flame intensity to the appropriate level for the thickness of the metal. 134. Apply heat to the metal until it is sufficiently hot, and then add filler	Welding equipment: description, principle, method of operating L.P. welding equipment: description, principle, method of operating. Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses.
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		metal as necessary to create a strong joint. 135. Use a welding rod or filler wire made of the same material as the metal components being joined. 136. Use a wire brush or grinder to smooth out any rough edges or weld spatter left behind by the process.	
ENGINEERING DRAWING			
Professional Knowledge 30 Hrs.	Read and apply engineering drawing for different application in the field of work. (Mapped NOS: CSC/N9401)	Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Lines- Types and applications in drawing Free hand drawing of – • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the freehand sketches. • Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. • Lettering & Numbering–Single Stroke. Dimensioning • Types of arrow head • Leader line with text • Position of dimensioning (Unidirectional, Aligned) Symbolic representation– • Different symbols used in the related trades. Concept and reading of Drawing in • Concept of axesplane and quadrant • Concept of Orthographic and Isometric projections • Method of first angle and third angle projections (definition and difference) Reading of Job drawing of related trades.	
WORKSHOP CALCULATION AND SCIENCE			

Professional Knowledge 30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Mapped NOS: CSC/N9402)	Unit, Fractions Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems Fractions - Addition, subtraction, multiplication & division Decimal fractions - Addition, subtraction, multiplication & division Solving problems by using calculator Square root, Ratio and Proportions, Percentage Square and square root Simple problems using calculator Applications of Pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Percentage - Changing percentage to decimal and fraction Mass, Weight, Volume and Density Mass, volume, density, weight and specific gravity Related problems for mass, volume, density, weight and specific gravity Speed and Velocity, Work, Power and Energy Work, power, energy, HP, IHP, BHP and efficiency Heat & Temperature and Pressure Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure Basic Electricity Introduction and uses of electricity, electric current AC, DC their comparison, voltage, resistance and their units Mensuration Area and perimeter of square, rectangle and parallelogram Area and perimeter of Triangles Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder 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 Simple machines - Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relationship between efficiency, velocity ratio and mechanical advantage Trigonometry Measurement of angles Trigonometrical ratios Trigonometrical tables
MANDATORY OJT/GROUP PROJECT (150 Hrs.)		
Note: The duration of Professional skills (Trade practical) and Professional knowledge (Trade theory) are indicative only. The Training Institute has the flexibility to adopt suitable training duration for effective training.		

MANDATORY OJT/GROUP PROJECT (150 HOURS) – FIRST YEAR		
Duration	Reference Learning outcome	Professional Skills (Trade Practical)
Professional Skills 75 Hrs.	Demonstrate CAD software commands and operational features of CNC machine using CNC codes (G & M codes) and programming.	- CAD software commands and using different menu of CAD. - Draw on absolute and incremental Co-ordinate Systems.
		- Identify the different parts & function of CNC Machines. - Identify Personal Protective Equipment used and safety measurements taken while working on a CNC Machine. - Make part programming and practice on simulation software.
		- Prepare G-Codes and M-Codes for different operations. - Practice of X, Y and Z offsetting on CNC Milling and Lathe Machine - Tool alignment & Tool height setting on Turret and ATC on CNC Lathe and Milling machine. - Set work piece reference with edge finder & dial test indicator on rectangular and circular workpiece on CNC Milling Machine. - Edit the facing & straight turning program and make a job. - Make a job on step turning, taper & fillet. - Practice of drilling Operations on CNC Lathe. - Perform facing operation on a work-piece in CNC Milling Machine.
Professional Skills 45 Hrs.	Demonstrate basic knowledge and skills on Moulding and Casting Process.	- Identify the parts and work on Injection Moulding Machine and Blow Moulding Machine. - Identify Personal Protective Equipment used and safety measurements taken while working on a Moulding Machine and handling hot moulds. - Process resins of Polypropylene, Nylon, LDPE, HDPE for injection process. - Work on Blow Moulding process for making bottles, containers and tanks. - Work on Sand Casting and Die casting process for making products with single and multi-cavity moulds. - Interpret the function and usage of an investment casting process. - Process moulded products to a semi-finished and finished state.
Professional Skills 30 Hrs.	Demonstrate basic knowledge and skills on Press Tool Operations.	- Identify parts and functions of a hydraulic press machines and maintain safety precautions during the press operations. - Identify Personal Protective Equipment used and safety measurements taken while working on Hydraulic Press Machine. - Work on simple and compound press tools. - Process sheet metals for various press tool operations such as shearing, bending, drawing and squeezing operations. - Process semi-finished products by deburring and snipping extra materials.

SYLLABUS – INDUSTRIAL FITTER (FLEXI MoU)			
SECOND YEAR			
Duration	Reference Learning Outcomes	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Professional Skill 15 Hrs. Professional Knowledge 18 Hrs. On the Job Training 57 Hrs.	Create and assemble components with varying mating surfaces using different surface finishing techniques, a range of fastening components and tools, and perform functionality tests.	1. Read and understand the engineering drawing and specifications of the components to be made and assembled. 2. Select the appropriate raw material and machine the rough components to the required dimensions using lathe, milling machine, or other suitable machines. 3. Perform different surface finishing operations such as scraping, lapping, and honing on mating surfaces to achieve the desired fit and finish. 4. Make the necessary holes, grooves, and other features for fastening components such as dowel pins, screws, bolts, keys, and cotters. 5. Select the appropriate fastening components and use hand-operated or power tools to fasten the components together. 6. Check the functionality of the assembled components by testing them under different load conditions. 7. Make necessary adjustments to achieve the desired fit and functionality for making and assembling components of different mating	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. Power tools: its constructional features, uses & maintenance. Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use. Various types of keys, allowable clearances & tapers, types, uses of key pullers. Special files: types (pillar, Dread naught, Barrow, warding) description & their uses. Templates and Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance. 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.

		surfaces with dovetail fitting, radius fitting, and combined fitting: For dovetail fitting: 8. Machine the mating surfaces to the required angle and depth of the dovetail. 9. Use hand-operated or power tools to fasten the components using dovetail keys or other suitable fastening components. 10. Check the functionality of the assembled components by testing them under different load conditions. For radius fitting: 11. Machine the mating surfaces to the required radius using lathe, milling machine, or other suitable machines. 12. Perform lapping or honing operations to achieve the desired fit and finish. 13. Use hand-operated or power tools to fasten the components using screws, bolts, or other suitable fastening components. 14. Check the functionality of the assembled components by testing them under different load conditions. For combined fitting: 15. Machine the mating surfaces to the required dimensions and shapes using lathe, milling machine, or other suitable	Application of slip gauges for measuring, Sine Bar-Principle, application & specification. Procedure to check adherence to specification and quality standards.
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		machines. Perform scraping, lapping, or honing operations to achieve the desired fit and finish. 16. Use hand-operated or power tools to fasten the components using dowel pins, screws, bolts, keys, or cotters as required. 17. Check the functionality of the assembled components by testing them under different load conditions.	
Professional Skill 25 Hrs. Professional Knowledge 27 Hrs. On the Job Training 98 Hrs.	Produce various gauges through the use of standard tools and equipment while ensuring that the required accuracy is achieved.	18. Determine the required dimensions for the snap gauge and select appropriate gauge blocks to set up the micrometer to those dimensions. 19. Cut the gauge jaws from a block of high-quality tool steel using a hacksaw or bandsaw. 20. Use a bench grinder to shape the gauge jaws to the desired shape and size. 21. Use a hand file or scraper to remove any rough edges or burrs from the gauge jaws. 22. Drill a hole in one of the gauge jaws and tap it to accept a screw. 23. Attach the other gauge jaw to the first one using the screw and nut. 24. Use a micrometer to check the dimensions of the snap gauge and adjust it as necessary until it meets the required tolerance of $\pm 0.02\text{mm}$.	Gauges and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization. Roller and needle bearings: Types of roller bearing. Description & use of each. Method of fitting ball and roller bearings

Professional Skill 40 Hrs. Professional Knowledge 27 Hrs. On the Job Training 83 Hrs.	Plan and perform basic day-to-day preventive maintenance, repairing and checking functionality.	25. Simple repair of machinery: - Making of packing gaskets. 26. Check washers, gasket, clutch, keys, jibs, cotter, Circlip, etc. and replace/repair if needed. 27. Use hollow punches, extractor, drifts, various types of hammers and spanners, etc. for repair work. 28. Dismantling, assembling of different types of bearing and check for functionality. 29. Perform routine check of machine and do replenish as per requirement.	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. Clutch: Type, positive clutch (straight tooth type, angular tooth type). Washers-Types and calculation of washer sizes. The making of joints and fitting packing. Chains, wire ropes and clutches for power transmission. Their types and a brief description
Professional Skill 40 Hrs. Professional Knowledge 24 Hrs. On the Job Training 86 Hrs.	Preparation of joints and bending for hydraulic and pneumatic pipelines.	30. Perform flaring of pipes and pipe joints. 31. Perform cutting and Threading of pipe length. 32. Fitting of pipes as per sketch observing conditions used for pipe work. 33. Perform bending of pipes-cold and hot. 34. Perform dismantling and assembling-globe valves, sluice valves, stopcocks, seat valves and non-return valves. 35. Make fit and assemble pipes, and valves and test for leakage and functionality of valves. 36. Perform visual inspection for visual defects e.g., dents, and surface finish.	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. Standard pipe fitting-Methods of fitting or replacing the above fitting, repairs and erection on rain water drainage pipes and household taps and pipe work. Inspection and quality control -Basic SPC -Visual Inspection.
Professional Skill 40 Hrs.	Perform troubleshooting and fault finding in conveyor belt	37. Plan and visit the different conveyors in your work area.	Power transmission elements. The object of belts, their sizes and specifications,

Professional Knowledge 24 Hrs. On the Job Training 86 Hrs.	operation, roller belt operation, chain drive system and repairing of the mechanical-breakdown parts.	38. Perform dismantling of the conveyor belt and list down the parts. 39. Perform and execute the maintenance of the chain drive. 40. Perform the slip assembly of the conveyor belt and adjust. 41. Execute scheduled maintenance of the power transmission devices with tag 42. Assess the damage to the pulley and determine whether it needs to be repaired or replaced. 43. Plan the repair process and gather the necessary tools and materials. 44. Remove the pulley from the machine and disassemble it to inspect the damage more closely. 45. Clean any dirt or debris from the components. 46. Repair the pulley by welding or brazing. 47. Replace any worn or damaged components such as bearings or bushings. 48. Reassemble the pulley. 49. Reinstall the pulley onto the machine and tighten any bolts or set screws to the specified torque. 50. Check the alignment of the pulley with other components and adjust if necessary. 51. Assess the damage to the	materials of which the belts are made, and selection of the type of belts with the consideration of weather, load and tension methods of joining leather belts. Vee belts and their advantages and disadvantages, use of commercial belts, dressing and resin creep and slipping, calculation. Power transmissions-coupling types-flange coupling, Hooks coupling-universal coupling and their different uses. Pulleys-types-solid, split and 'V' belt pulleys, the standard calculation for determining size crowning off aces-loose and fast pulleys-jockey pulley. Types of drives-open and cross belt drives. The geometrical explanation of the belt drivers at an angle.
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		gear and determine whether it needs to be repaired or replaced. 52. Plan the repair process and gather the necessary tools and materials. 53. Remove the gear from the machine and disassemble it to inspect the damage more closely. 54. Clean any dirt or debris from the components. 55. Repair the gear by welding or brazing. 56. Replace any worn or damaged teeth or bearings. 57. Reinstall the gear onto the machine and tighten any bolts or set screws to the specified torque. 58. Check the alignment of the gear with other components and adjust if necessary 59. Assess the damage to the keys and jibs and determine whether they need to be repaired or replaced. 60. Plan the repair process and gather the necessary tools and materials. 61. Remove the damaged keys and jibs from the machine and clean any dirt or debris from the components. 62. Repair the keys and jibs by welding or brazing. 63. Replace any worn or damaged components. 64. Reinstall the repaired or replaced keys and jibs onto	
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		the machine and tighten any bolts or set screws to the specified torque.	
Professional Skill 30 Hrs. Professional Knowledge 18 Hrs. On the Job Training 42 Hrs.	Plan, erect simple machine and test machine tool accuracy.	65. Inspection of Machine tools such as alignment, and levelling. 66. Perform accuracy testing of Machine tools such as geometrical parameters. 67. Practicing, making various knots, correct loading of slings, and correct and safe removal of parts. 68. Perform leveling simple machines base.	Lubrication and lubricants- the purpose of using different types, description and uses of each type. Method of lubrication. In a good lubricant, the viscosity of the lubricant is the Main property of the lubricant. How a film of oil is formed in journal Bearings. Foundation bolt: types (Lewis's cotter bolt) description of each erection tool, pulley block, crowbar, spirit level, Plumb bob, wire rope, manila rope, wooden block. The use of lifting appliances, extractor presses and their use. A practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts
Professional Skill 25 Hrs. Professional Knowledge 18 Hrs. On the Job Training 77 Hrs.	Introduction to types of sensors and sensor-based technology.	69. Identify and list the sensor with specifications in the given machine. 70. Carry and draw out the sensor connection as per the datasheet provided. 71. Create a sensor -using IR led and TSOP sensor (optional-relay for the application). 72. Repair and maintenance of the given sensor.	Overview of sensor Types of sensors used in the industry (Motion sensor, pressure sensor, temperature sensor accelerometer sensor, photo sensor, ultrasonic sensor and magnetic field sensor) Difference between sensor and transducer Active and passive sensor

			Working principle of thermocouple and its applications Need and choosing of sensors.
Professional Skill 25 Hrs. Professional Knowledge 18 Hrs. On the Job Training 77 Hrs.	Generate operation reports from the CNC machine.	73. Prepare a block diagram presentation to explain the data extraction process and data fetching process in the cloud.	Introduction to cloud Introduction to the gateways and internet protocol Concept of data transmission from a classic CNC machine to cloud and generation of data using block diagram Concept on cloud data fetching application
Professional Skill 30 Hrs. Professional Knowledge 18 Hrs. On the Job Training 42 Hrs.	Carry out operation and fault detection in overhead crane.	74. Understand and verify the pre-lifting procedures. 75. Create a Pre-loading environment with all the necessary symbols. 76. Operate load travel in vertical and horizontal movement. 77. Prepare a Maintenance checklist and perform scheduled maintenance activities.	Overview of overhead crane Types of overhead cranes and their component Six different over-head crane Commissioning and Installation of the overhead crane General maintenance of the overhead crane (Overload, tripping and overheating issues of the motor) Overview of the operator pendant Do and Don'ts while operating overhead crane lifting procedures, lifting operations, operation of controls, checks during lifting operations, general techniques, use and abuse of safety devices and Crane operations checklist
Professional Skill 25 Hrs. Professional Knowledge 24 Hrs.	Execute testing and maintenance of security systems.	78. Perform the false drill or testing of the alarm system. 79. Prepare the checklist of the sensor and control panel with proper tagging. 80. Visit and identify the different types of cameras	Overview of central alarm system Requirement of fire alarm system. Types of Fire Alarm Systems in use today Non – Addressable

On the Job Training 41 Hrs.		used in your industry. 81. Plan the wiring layout and routing for the camera to DVR. 82. Identify the alarm in the DVR and troubleshoot as per the given instruction. 83. Changing the battery of the DVR. 84. Cleaning of the BNC connector and power connector.	Addressable Ems Hybrid Maintenance Regular testing and Inspection regular testing and inspection False alarm management Common maintenance problems and troubleshooting Overview of the components used in the CCTV installation detail construction of the camera, detail construction of the DVR (digital video recorder). Types of cameras (bullet dome PTZ and IP camera Connection of the HDD to the DVR/NVR and set up the storage Connection of the camera with BNC connector and DC power source Demonstration on the general maintenance of the CCTV camera and connector Maintenance of the DC power source (DVR/NVR, cable connectors, dc power source and mic audio connectors)
Professional Skill 35 Hrs. Professional Knowledge 24 Hrs. On the Job Training 61 Hrs.	Perform solar Panel Installation and maintenance.	85. Cleaning and maintenance of the rooftop solar panel. 86. Maintenance of the charge controller and cleaning of the connectors. 87. Regular check-ups on the battery's health. 88. Setting the solar angle of the panel for more efficiency.	Overview of the solar energy Working on solar panel and block diagram Use of charge controller Working principle of inverter and batteries The installation procedure for solar panel General maintenance of the solar panel (Panel connector cleaning, charge controller testing, inverter testing, and batteries testing)

ENGINEERING DRAWING		
Professional Knowledge ED- 30 Hrs.	Read and apply engineering drawing for different application in the field of work. (Mapped NOS: CSC/N9401)	• Reading of drawing of nuts, bolt, screw thread, different types of locking devices e.g., Doublenut, Castlenut, Pin, etc. • Reading of foundation drawing • Reading of Rivetss and riveted joints, welded joints • Reading of drawing of pipes and pipe joints Reading of Job Drawing, Sectional View & Assembly view
WORKSHOP CALCULATION AND SCIENCE		
Professional Knowledge WCS- 30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Mapped NOS: CSC/N9402)	Friction Friction - Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction Friction - Lubrication Friction - Co- efficient of friction, application and effects of friction in workshop practice Centre of Gravity Centre of gravity - Centre of gravity and its practical application Area of cut out regular surfaces and area of irregular surfaces Area of cut out regular surfaces - circle, segment and sector of circle Related problems of area of cut out regular surfaces - circle, segment and sector of circle Area of irregular surfaces and application related to shop problems Elasticity Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus Elasticity - Ultimate stress and working stress Heat Treatment Heat treatment and advantages Heat treatment - Different heat treatment process – Hardening, tempering, annealing, normalising and case hardening Estimation and Costing Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade Estimation and costing - Problems on estimation and costing
MANDATORY OJT/GROUP PROJECT (150 Hrs.)		

MANDATORY OJT/GROUP PROJECT (150 HOURS) – SECOND YEAR		
Duration	Reference Learning Outcome	Professional Skills (Trade Practical)
Professional Skill 45 Hrs.	Demonstrate operations on machines and check components and its functioning. [Machines: - EDM, Gear Shaper, Gear Hubber, Jig Boring and Broaching].	- Demonstrate jig boring Machine using audio visual aids. - Practice demonstrations on Gear Shaper and Gear Hubber. - Demonstrations on broaching machine. - Perform demo on EDM using audio visual aids. - Plan & arrange an assembly job preparation combining different machining operations.
Professional Skill 45 Hrs.	Demonstrate operations on machines and check components and its functioning. [Machines: - Profile Projector and CMM].	- Demonstration of the Profile projector parts & their applications. - Measurement of linear and angular dimensions using profile projector. - To determine the diameters of the holes and the angle of bevel edge of the given specimen using profile projector. - Using the Profile Projector to measure dimensions of different specimens. - Practice on demonstrations of CMM operation using audio visual aids. - To identify the probe components & build a probing system. - Demonstrate size & geometric dimension and tolerance. - Demonstrate probe calibration. - Create an inspection plan.
Professional Skill 45 Hrs.;	Demonstrate basic knowledge and skills on Painting and Printing Process.	- Demonstration of Spray painting on Metal and Non-metal components. - Work on different types of painting processes such as Air Spray Painting, Airless Spray Painting, Electrostatic Spray Painting, Powder coating, etc. - Perform Pre and post treatment processes for painting operation. - Set up Spray Painting Booth for Painting Operation. - Able to work on mass printing and stickering for plastic and metallic components.
Professional Skill 15 Hrs.;	Demonstrate basic knowledge and skills on Conveyor systems and Packaging Process	- Work and operate any of the conveyor system such as Gravity and Motorized types of Screw Conveyor, Belt Conveyor, Roller Conveyor, etc. - Manage storage and buffering of materials while transporting through Conveyor. - Identify correct packaging material, then fill and assemble the final product before Transportation.

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

Learning outcomes, assessment criteria, syllabus and tool list of core skill subjects which are common for a group of trades, provided separately in www.bharatskills.gov.in / www.dgt.gov.in

INDUSTRIAL FITTER			
LIST OF TOOLS AND EQUIPMENT (For batch of 20 candidates)			
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.

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.
58.	File round bastard.	250 mm	10 nos.
59.	File hand second cut.	150 mm	10 nos.

Industrial Fitter (Flexi-MOU)

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, sized 10-32 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
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.

Industrial Fitter (Flexi-MOU)

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 no.
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: ANSI125-B16.1	2 nos.
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.
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

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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.
169.	Arm strong type tool bit holder.	Straight	2 nos.
170.	Stilson wrenches/pipe wrench	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 tong 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	2 Nos.

		attachment, motorized coolant system, lighting arrangement & standard accessories.	
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.
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 Closed	2 Nos.
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
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 diameter 16 mm, Piston rod diameter 10 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	With integrated check valve.	1 No.
	XV. T-Connector with self-sealing		2 Nos.
	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 fullpanel 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

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	Dwarfisms
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities