



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

COMPETENCY BASED CURRICULUM

MANUFACTURING PROCESS CONTROL AND AUTOMATION

(Duration: One Year)
Revised in July 2022

**CRAFTSMEN TRAINING SCHEME (CTS)
NSQF LEVEL –3**



SECTOR – CAPITAL GOODS & MANUFACTURING



Directorate General of Training

MANUFACTURING PROCESS CONTROL AND AUTOMATION

(Engineering Trade)

(Revised in July 2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL –3

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091
www.cstaricalcutta.gov.in

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1. COURSE INFORMATION

The one-year course of **Manufacturing Process Control and Automation** trade is designed to provide training to students with professional Skills & Knowledge regarding industrial automation and Employability Skill related to job role. In addition to this, the candidate entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered in one-year duration are as below:

Manufacturing Process Control and Automation Sets up Industrial automation, responsible to develop the industrial automated process through PLC, HMI and SCADA and help to develop industry Automation using different components, equipment.

Manufacturing Process Control and Automation technician able to create Industrial Automation Systems like Fixed Automation System, Programmable Automation System, flexible Automation System and Integrated Automation System using PLC, HMI and SCADA. The industrial automation technician can work in Automobile process control, Automation, baker, Confectionery Agriculture, Production, Manufacturing, Fruit, Vegetable Processing, Network Technician, Plastic processing and more.

The Automation Technician will provide routine diagnostic checks for all equipment in automation industries, repair and maintain instruments, electrical wiring, and control systems. They are fluent in cases, have certified knowledge of electronics, mechanics and programmable logic controllers.

Manufacturing Process Control and Automation technician is able to perform operation and programming of programmable logic control PLC. System implementation and high-level process for supervisory management, control and data Complete understanding.

2. TRAINING SYSTEM

2.1 GENERAL

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

CTScoursesaredeliverednationwidethroughnetworkofITIs.Thecourse‘Manufacturing Process Control and Automation’ is of one-year duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory and Trade 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 program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Trainee broadly needs to demonstrate that they are able to:

- Read and interpret technical parameters/ documentation, plan and organize work processes, identify necessary materials and tools.
- Perform tasks with due consideration to safety rules, accident prevention regulations and environmental protection stipulations.
- Apply professional knowledge & employability skills while performing the job and modification & maintenance work.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join Apprenticeship Programmes in different types of industries leading to a National Apprenticeship Certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming an instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSESTRUCTURE

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

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	840
2	Professional Knowledge (Trade Theory)	240
5	Employability Skills	120
	Total	1200

In addition, every year 150 hours of mandatory on the job training (OJT) in the industry, if nearby industry is not available then group project will be mandatory.

On the Job Training (OJT)/ Group Project	150
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Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10th/ 12th class certificate along with ITI certification, or, add on short term courses.

2.4 ASSESSMENT & CERTIFICATION

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

a) The **Continuous Assessment** (Internal) during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in

b) The final assessment will be in the form of summative assessment. 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% & for all other subjects is 33%.

2.4.2 ASSESSMENTGUIDELINE

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 the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

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

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

Performance Level	Evidence
(a) Marks in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and	<ul style="list-style-type: none"> • Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while

<p>due regard for safety procedures and practices</p>	<p>undertaking different work with those demanded by the component/job.</p> <ul style="list-style-type: none"> • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
<p>(b) Marks in the range of 75%-90% to be allotted during assessment</p>	
<p>Forth is 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</p>	<ul style="list-style-type: none"> • 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.
<p>(c) Marks in the range of more than 90% to be allotted during assessment</p>	
<p>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.</p>	<ul style="list-style-type: none"> • 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.

3. JOB ROLE

Manufacturing Process Control and Automation Sets up for the one-year of duration, Industrial automation technician able to develop the industrial automated process through PLC, HMI, SCADA and develop different components, equipment.

The role of this job starts from Technician and at advanced stage chance for PLC Programmer. IT related things like data management, process control. Familiar about different type of job role like electrical, IT and mechanical. Understanding about the working process of assembly line, Error detection through sensor. There are various industries job roles – Automation technician, Automation trainer, Assistant technician etc. All these opportunity are available in industry like Automobile, baker, Agriculture, Production and Manufacturing, Textile, Fruit, Vegetable Processing Network Technician, Pharma, Plastic processing and more. Understanding about pick to light system, which is very accurate and efficient. Robotics is also one of the opportunity. Program testing, installation, technical support. All these things you will learn and perform various practical task. Gain practical knowledge about testing and modification. Coordination between different department like Design engineer, production and purchase. Opportunity to learn about management skill, time and cost reduction and various operation. Automation process provide real time data which is very important for monitor and manage inventory, so inventory management also cover in this course. This is vast system with multiple opportunity and the demand of Manufacturing Process Control and Automation will increase day by day in larger as well as small scale industry. In addition, communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Automation Specialist Individuals at this job are responsible for providing support to production operations through maintenance of process control systems installed at shop floor for various manufacturing processes.

Reference NCO-2015: 7412.0101 - Automation Specialist.

Reference NOS: -- ASC/N9439 ASC/N9440 ASC/N9441 ASC/N9442 ASC/N9443 ASC/N9444
ASC/N9445 ASC/N9446 ASC/N9447 ASC/N9448 ASC/N9449 ASC/N9450 ASC/N9451 ASC/N9452
ASC/N9453 ASC/N9454 ASC/N9455 ASC/N9456 ASC/N9457 ASC/N9458 ASC/N9401 ASC/N9402

4. GENERAL INFORMATION

Name of the Trade	MANUFACTURING PROCESS CONTROL AND AUTOMATION
Trade Code	DGT/2021
NCO – 2015	7412.0101
NOS Covered	ASC/N9439 ASC/N9440 ASC/N9441 ASC/N9442 ASC/N9443 ASC/N9444 ASC/N9445 ASC/N9446 ASC/N9447 ASC/N9448 ASC/N9449 ASC/N9450 ASC/N9451 ASC/N9452 ASC/N9453 ASC/N9454 ASC/N9455 ASC/N9456 ASC/N9457 ASC/N9458 ASC/N9401 ASC/N9402
NSQF Level	Level 3
Duration of Craftsmen Training	One Year (1200 Hrs. + 150 hours OJT/Group Project)
Entry Qualification	Passed 10 th class examination
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, CP, LC, DW, AA, LV, DEAF, AUTISM, MD
Unit Strength (No. Of Student)	20 (There is no separate provision of supernumerary seats)
Space Norms	120 Sq. m
Power Norms	3 KW (extended battery backup mandatory)
Instructors Qualification for	
(i) Manufacturing Process Control and Automation	<p>B.Voc/Degree in Mechanical/Industrial Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Electronics /Industrial Engineering from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>NTC/NAC passed in the trade of "Manufacturing Process Control and Automation" with three years' experience in the relevant field.</p> <p>Essential Qualification:</p>

	<p>Relevant National Craft Instructor Certificate (NCIC) in any of the variants under DGT.</p> <p>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.</p> <p><i>Faculty to be trained for 10 days by the machine manufacturer on the usages.</i></p>
(iv) Employability Skill	<p>MBA/BBA/Any Graduate/Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills.</p> <p>(Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)</p> <p style="text-align: center;">OR</p> <p>Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills.</p>
(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.

5.1 LEARNING OUTCOMES (TRADE SPECIFIC)

1. Adhere to safe working practices, environment regulation and housekeeping. (Nos:ASC/N9439)
2. Plan and perform Manufacturing processes, process control & automation. (Nos:ASC/N9440)
3. Demonstrate Batch, Discrete, Continuous Manufacturing processes. (Nos:ASC/N9441)
4. Apply the knowledge of numbering systems in PLC. (Nos:ASC/N9442)
5. Perform Memory organization in PLC and programming Devices. (Nos:ASC/N9443)
6. Demonstrate Programmable logic control and its application, Selection criteria and types. (Nos:ASC/N9444)
7. Execute Input and output module for programmable logic control. (Nos:ASC/N9445)
8. Execute Input and output module for programmable logic control. (Nos:ASC/N9446)
9. Operate the variable frequency drive VFD. (Nos:ASC/N9447)
10. Install wiring of PLC based control panel. (Nos:ASC/N9448)
11. Construct PLC programming ladder diagram and relay instructions. (Nos:ASC/N9449)
12. Apply Advance Instruction use in PLC ladder diagram Timer and counter. (Nos:ASC/N9450)
13. Perform interfacing of PLC and HMI. (Nos:ASC/N9451)
14. Install and configure HMI Application software. (Nos:ASC/N9452)
15. Operate Supervisory data control and acquisition system (SCADA). (Nos:ASC/N9453)
16. Perform interfacing of SCADA with PLC. (Nos:ASC/N9454)
17. Apply the Communication network for SCADA. (Nos:ASC/N9455)
18. Enumerate the difference between SCADA and HMI. (Nos:ASC/N9456)
19. Develop SCADA Architecture. (Nos:ASC/N9457)
20. Plan and execute SCADA with PLC Simulation Example. (Nos:ASC/N9458)
21. Read and apply engineering drawing for different application in the field of work. (Nos:ASC/N9401)
22. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Nos:ASC/N9402)

6. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
1. Adhere to safe working practices, environment regulation and housekeeping. (Nos:ASC/N9439)	Understand the Importance of trade training, List of tools used in the trade.
	Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	Identify basic first aid and use them under different Circumstances.
	Recognize and report all unsafe situations according to site policy.
	Avoid waste and dispose waste as per procedure.
	Hazard identification and avoidance.
	Identify Different Safety signs for Danger, Warning, caution & personal safety message.
	Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	Preventive measures for electrical accidents & steps to be taken in such accidents.
	Identify safety alarms accurately.
	Identify and observe site evacuation procedures according to site policy.
	Identify different fire extinguisher and use the same as per requirement.
	Avoid waste and dispose waste as per procedure.
	Understand the basics of computer file and folder systems.
	Recognize different components of 5S and apply the same in the working environment.
	Understand the basics of computer file and folder systems.
Recognize different components of 5S and apply the same in the working environment.	
2. Plan and perform Manufacturing processes, process control & automation. (Nos:ASC/N9440)	Understand the use of different component in process.
	Understand the working of process control system.
	Understand the various automation processes.
	Elaborate the closed loop feedback system with different application.
3. Demonstrate BatchDiscrete, Continuous &Manufacturing processes.	Explain the batch manufacturing in industries.
	Explain the Discrete manufacturing in industries.
	Explain the continuous manufacturing in industries.
	Comparison of Batch Discrete, Continuous &Manufacturing processes.

(Nos:ASC/N9441)	
4. Apply the knowledge of numbering systems in PLC. (Nos:ASC/N9442)	<p>Understand the Decimal systems.</p> <p>Understand the Binary system.</p> <p>Understand the Octal systems.</p> <p>Understand the Hexadecimal system.</p> <p>Contrast the differences from the above numbering systems in PLC programming.</p>
5. Perform Memory organization in PLC and programming Devices. (Nos:ASC/N9443)	<p>Understand how memory organization is used in the PLC.</p> <p>Understand the bits and words.</p> <p>Detail the relationship between a logical and a physical address.</p> <p>Define the term “rack”.</p> <p>Detail the structure of a typical PLC-5 address format.</p> <p>Define and compare the various programming devices available.</p> <p>Spell out the advantages of programming and monitoring PLCs remotely from a centrally located PC.</p>
6. Demonstrate Programmable logic control and its application, election criteria and types. (Nos:ASC/N9444)	<p>Understand the Basic of Programmable logic device and different terminal and their uses.</p> <p>Understand the how to mount the PLC in control panel.</p> <p>Explain the communication port in PLC.</p> <p>Understand the power supply requirements of PLC.</p> <p>Complete understanding of PLC applications.</p>
7. Execute Input and output module for programmable logic control. (Nos:ASC/N9445)	<p>Working principle input and output module and their uses.</p> <p>Understand the Input output module connection.</p> <p>Demonstration of how to connect input and output devices to input output module.</p> <p>Understand the Input output module configuration in PLC rack.</p> <p>The I/O intersection of a PLC connects it to external field devices.</p>
8. Perform operation of Input output devices of programmable logic control. (Nos:ASC/N9446)	<p>Details understanding of Input devices Push buttons, normally open (NO), Normally closed, Proximity Sensor (NC), Selector Switch, Limit Switches, Sensors, Temperature Limit Switch, Temperature Limit Switch, Level Limit Switch etc.</p> <p>Details understanding Output devices indicators/alarms, Pilot Lights, Buzzer, Actuators, Solenoids Motors, DC motor's, brushless DC motor and Stepper motors etc.</p> <p>Explain different type Addressing in PLC.</p> <p>Explain the connection Between input and output devices.</p>
9. Operate the variable	Understanding of Variable Frequency Drive.

frequency drive VFD. (Nos:ASC/N9447)	Explain how to Mount of Variable Frequency Drive.
	Understand Connection of Variable Frequency Drive with PLC and motor.
	Demonstrate How to operate Variable Frequency Drive. Set and control speed of motor by VFD.
10. Install wiring of PLC based control panel. (Nos:ASC/N9448)	Elaborate the all tool that requires for making the PLC control panel.
	Explain the Different component use in control panel and mounting.
	Understand the Interfacing of all input and output devices to control panel.
	Explain the Different component use in control panel and mounting.
	Understand the connection diagram of PLC ,SMPS, Drives, connector, transformer, contactor ,DIN rail, indicator lamp, selector switch, push buttons ,cooling fan, MCB and relays etc.
	Understand the power supply requirements for different equipment.
	Selection criteria Single or multi door Panel Box, Power switches and Harding connector.
	Check the all connection and Power on the control panel.
11. Construct PLC programming ladder diagram and relay instructions. (Nos:ASC/N9449)	Demonstration of how to open PLC programming software and basic commands.
	Use of Different ladder diagram instruction.
	Explain Basic communication method uses in PLC.
	Understand to Create simple ladder diagram in PLC programming software.
	Explain the Addressing input output in ladder diagram.
	Connect input and output devices as per ladder that diagrams to PLC via input output module.
	Compile the PLC ladder diagram in software and see result.
	Connect the programming device to PLC and check the connection status of PLC and laptop or PC.
	Upload the PLC program from PLC.
	Create ladder diagrams for all logic gate and compile and check result.
	Create ladder diagrams for small applications with basic instruction and check the result as per ladder logic.
12. Apply Advance Instruction use in PLC ladder diagram Timer and counters.	Identify and interpret Timers and Counters. Interpret internal instructions.
	Identify and define the basic PLC Timer.
	Compare the differences between a TON and a TOF PLC Timer.

(Nos:ASC/N9450)	Explain the purpose of a PLC Timer and counter.
	Define terms commonly used with a PLC Timer and Counter.
	Compare the differences between an Up-Counter and Down-Counter.
	Explain the Advantages of utilizing a PLC Counter and Timers
	Offline and Online edit the PLC Program.
13. Perform Interfacing of PLC and HMI. (Nos:ASC/N9451)	Explain connection between PLC to HMI.
	Understand the Communication protocol for HMI and PLC communication.
	Demonstration the different HMI programming software.
14. Install and configure HMI Application software. (Nos:ASC/N9452)	Create new project in for HMI.
	Create new basics application project for HMI.
15. Operate Supervisory data control and acquisition system (SCADA). (Nos:ASC/N9453)	Introduction to SCADA.
	SCADA Software Introduction.
	Simple Digital System implementation in SCADA software.
	Simple analog System implementation in SCADA software.
	Create SCADA Animation In SCADA software.
Conveyor Animation Example.	
16. Perform Interfacing of SCADA with PLC. (Nos:ASC/N9454)	Understand the Interfacing of SCADA with PLC.
	How to Control PLC Program from SCADA.
	Understanding of Digital Alarms Interfacing with PLC.
	Understanding Analog Alarms Virtual Simulation.
	Explain Analog Alarms Interfacing with PLC.
Basic Report Generation.	
17. Apply the Communication Network for SCADA. (Nos:ASC/N9455)	Import and Export SCADA Project using CSV File.
	Open Database Connectivity (ODBC).
	Understanding of Language Switching, Recipe, Script in SCADA.
	Archive and Retrieve Project.
Simple Heat Exchanger Example.	
18. Enumerate the difference between SCADA and HMI. (Nos:ASC/N9456)	Demonstrate the difference between SCADA and HMI system.
19. Develop SCADA architecture. (Nos:ASC/N9457)	Explain the Hardware Architecture of SCADA.
	Explain the software Architecture of SCADA.
	Explain the different layer of SCADA client layer and Data layer

20. Plan and execute SCADA with PLC Simulation Example. (Nos:ASC/N9458)	Perform all SCADA with PLC Simulation Example
21. Read and apply engineering drawing for different application in the field of work. (Nos:ASC/N9401)	<p>Read & interpret the information on drawings and apply in executing practical work.</p> <p>Read & analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.</p> <p>Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.</p>
22. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Nos:ASC/N9402)	<p>Solve different mathematical problems</p> <p>Explain concept of basic science related to the field of study</p>

SYLLABUS FOR PROCESS CONTROL AND AUTOMATION TRADE			
DURATION: ONE YEAR			
Duration	Reference Learning outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Professional Skill 36 Hrs.; Professional Knowledge 08 Hrs.	Adhere to safe working practices, environment regulation and housekeeping. (Map Nos:ASC/N9439)	<ol style="list-style-type: none"> 1. Importance of trade training, List of tools used in the trade. (02hrs) 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE) such as use of gloves and goggles. (02hrs) 3. First Aid Method and basic training. (02hrs) 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (02hrs) 5. Hazard identification and avoidance. (02hrs) 6. Safety signs for Danger, Warning, caution & personal safety message. (02hrs) 7. Preventive measures for electrical accidents & steps to be taken in such accidents. (03 hrs) 8. Use of Fire extinguishers. (03 hrs) 9. Practice and understand precautions to be followed while working in fitting 	<p>All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures.</p> <p>Soft Skills, its importance and Job area after completion of training.</p> <p>Importance of safety and general precautions observed in the in the industry/shop floor.</p> <p>Introduction of First aid.</p> <p>Operation of electrical mains and electrical safety. Introduction of PPEs.</p> <p>Response to emergencies e.g.; power failure, fire, and system failure.</p> <p>Importance of housekeeping & good shop floor practices.</p> <p>Introduction to 5S concept & its application.</p> <p>Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable.</p> <p>Basic understanding on Hot work, confined space work and material handling equipment.</p>

		<p>jobs.(03hrs)</p> <p>10. Safe use of tools and equipment used in the trade by using tweezers for all purposes and handle scrappers. (03 hrs)</p>	
		<p>11. Demonstrate of the equipment in lab. (03hrs)</p> <p>12. Perform Computer operation:</p> <p>(i) Create newfolder,</p> <p>(ii) Add subfolders,</p> <p>(iii) create applicationfiles,</p> <p>(iv) Change appearance of windows,</p> <p>(v) Search forfiles,</p> <p>(vi) Sortfiles,</p> <p>(vii) Copy files,</p> <p>(viii) Create shortcut folder,</p> <p>(ix) Create shortcut icon in desktop and taskbar</p> <p>(x) Move files to and from removable disk/ flash drive.</p> <p>(xi) Install a printer from driver software in operating system. (5 hrs)</p> <p>13. Create, save and print a document, worksheet and pdf (portable document format) files. (04hrs)</p>	<p>Introduction to manufacturing Process Control and automation</p> <p>Basic computer:</p> <p>Introduction to computer, Windows operating system, file management system.</p> <p>Computer hardware and software specification.</p> <p>Knowledge of installation of application software.</p>
<p>Professional Skill 40 Hrs.;</p> <p>Professional Knowledge 08 Hrs.</p>	<p>Plan and perform Manufacturing processes, process control & automation. (Map Nos:ASC/N9440)</p>	<p>14. Demonstrate the different component use in process. (08 hrs)</p> <p>15. Demonstrate how process control system works.(08hrs)</p> <p>16. Demonstrate the various automation processes.</p>	<p>Process: -</p> <p>Process is a series of actions which are carried out in order to achieve a particular result.</p> <p>Process control: -</p> <p>Process control is the ability to monitor and adjust a process to give a desired output. It is used</p>

		<p>(12hrs)</p> <p>17. Demonstrate closed loop feedback system with different application. (12hrs)</p>	<p>in industry to maintain quality and improve performance. An example of simple process that is controlled is keeping the temperature of a room at a certain temperature using a heater and a thermostat.</p>
<p>Professional Skill 40Hrs.;</p> <p>Professional Knowledge 08 Hrs.</p>	<p>Demonstrate Batch, Discrete, Continuous Manufacturing processes. (Map Nos:ASC/N9441)</p>	<p>18. Demonstrate Discrete manufacturing process. (08hrs)</p> <p>19. Demonstrate contentious manufacturing process. (08hrs)</p> <p>20. Demonstrate batch manufacturing process. (12 hrs)</p> <p>21. Demonstrate comparison of Discrete, continues and Batch manufacturing's.(12hrs)</p>	<p>Discrete manufacturing: - is an industry term for the manufacturing of finished products that are distinct items capable of being easily counted, touched or seen.</p> <p>Continuous manufacturing: Continuous manufacturing concept originated from pig iron production using a blast furnace, where the process operates for multiple years without shutdown.</p> <p>Batch manufacturing: - Batch manufacturing involves multiple discrete steps. After each step in the process, production typically stops so samples can be tested offline for quality.</p>
<p>Professional Skill 48 Hrs.;</p> <p>Professional Knowledge 08 Hrs.</p>	<p>Apply the knowledge of numbering systems in PLC. (Map Nos:ASC/N9442)</p>	<p>22. Demonstrate using Decimal systems. (10hrs)</p> <p>23. Demonstrate using Binary system. (09hrs)</p> <p>24. Demonstrate using Octal systems. (10hrs)</p> <p>25. Demonstrate using Hexadecimal systems. (10hrs)</p> <p>26. Contrast the differences from the above numbering systems in PLC programming. (09hrs)</p>	<p>Number systems are the technique to represent numbers in the computer system architecture, every value that you are saving or getting into/from computer memory has a defined number system. Computer architecture supports following number systems. Binary number system, Octal number system, Decimal number system, Hexadecimal (hex) number system.</p>

<p>Professional Skill 48 Hrs.;</p> <p>Professional Knowledge 08 Hrs.</p>	<p>Perform Memory organization in PLC and programming Devices. (Map Nos:ASC/N9443)</p>	<p>27. Demonstrate how memory organization is used in the PLC. (10hrs)</p> <p>28. Demonstrate bits and words. (09hrs)</p> <p>29. Show Relationship between a logical and a physical address.(10hrs)</p> <p>30. Show structure of a typical PLC address format. (09hrs)</p> <p>31. Define programming device And Compare the various programming Devices. (10hrs)</p>	<p>Programming device:</p> <p>The programming device is used to enter the required program into the memory of the processor.</p> <p>The program is developed in the device and then transferred to the memory unit of the PLC.</p> <p>The memory unit is where the program is stored that is to be used for the control actions to be exercised by the microprocessor.</p>
<p>Professional Skill 50Hrs.;</p> <p>Professional Knowledge 07 Hrs.</p>	<p>Demonstrate Programmable logic control and its application, selection Criteria and types. (Map Nos:ASC/N9444)</p>	<p>32. Demonstrate programmable logic device and different terminal and their uses. (15 hrs)</p> <p>33. Demonstrate mounting of Programmable logic device and input power supply requirements.(15 hrs)</p> <p>34. Demonstrate communication port in PLC and their application.(20 hrs)</p>	<p>Programmable logic device: - PLC is a digital electronic device that uses a programmable memory to store instructions and to implement specific functions such as logic, sequence, timing, counting and arithmetic to control machines and process.</p> <p>Use a programmable memory to store the instructions and specific functions that include On/Off control, timing counting, sequencing, arithmetic and data handling.</p> <p>Block diagram of PLC.Working principle of PLC.</p>
<p>Professional Skill 47 Hrs.;</p> <p>Professional Knowledge 07 Hrs.</p>	<p>Execute Input and output module for programmable logic control. (Map Nos:ASC/N9445)</p>	<p>35. Demonstration of input output module.(10 hrs)</p> <p>36. Demonstration of how to connect input and output devices to input output module.(10 hrs)</p> <p>37. Demonstrate the mount and remove the input and output module in PLC</p>	<p>Input and Output Module: - Input and Output Module Provides signal conversion and isolation between the internal logic- level signals inside the PLC and the field's high level signal.</p> <p>The I/O intersection of a PLC connects it to external field devices.</p>

		<p>rack.(15 hrs)</p> <p>38. Input output module configuration in PLC rack.(12 hrs)</p>	<p>The main purpose of the I/O interface is to condition the various signals received from or sent to the external input and output devices.</p> <p>Input modules converts signals from discrete or analog input devices to logic levels acceptable to PLC's processor.</p> <p>Output modules converts signal from the processor to levels capable of driving the connected discrete or analog output module</p> <p>Types of Input output module: - DC input module. AC input module. AC/DC output module. Sinking and sourcing</p>
<p>Professional Skill 45Hrs.;</p> <p>Professional Knowledge 08 Hrs.</p>	<p>Perform operation of Input output devices of programmable logic control. (Map Nos:ASC/N9446)</p>	<p>39. Demonstration of all input output devices like sensor and motors. (10 hrs)</p> <p>40. Explain the specification of all demonstrate input output devices.(10 hrs)</p> <p>41. Demonstrate the mount and remove the input and output devices and their connection. (12 hrs)</p> <p>42. Addressing Input output devices in PLC.(13 hrs)</p>	<p>The I/O section communicates between the I/O sections and the CPU to carry out programmed functions.</p> <p>Input Devices: - Push buttons, Normally open push buttons, Normally closed push buttons, Selector Switch, Limit Switches, Sensors etc.</p> <p>Output Devices: - indicators/alarms, Pilot Lights, Buzzer, Actuators, Solenoids</p> <p>Motors: -DC motor's, brushless DC motor and Stepper motors etc.</p>
<p>Professional Skill 42Hrs.;</p> <p>Professional Knowledge 10 Hrs.</p>	<p>Operate the variable frequency drive VFD.(Map Nos:ASC/N9447)</p>	<p>43. Demonstration of Variable Frequency Drive.(08 hrs)</p> <p>44. Mounting of Variable Frequency Drive.(08 hrs)</p> <p>45. Connection of Variable Frequency Drive with PLC and motor.(09 hrs)</p>	<p>VARIABLE FREQUENCY DRIVE VFD: - AC motor speed is controlled in two ways – either by controlling the voltage or frequency. Frequency controlling gives better control due to constant</p>

		<p>46. Operate Variable Frequency Drive. Set and control speed of motor by VFD. (09 hrs)</p> <p>47. Demonstrate Small PLC program for VFD operation. (08 hrs)</p>	<p>flux density than voltage control. This is where the working of VFDs comes to play. It is a power conversion device that converts the fixed voltage, fixed frequency of the input power to the variable voltage, the variable frequency output to control AC induction motors.</p> <p>It consists of power electronic devices (like IGBT, MOSFET), high speed central controlling unit (such as a microprocessor, DSP), and optional sensing devices depending on the application used.</p> <p>Working of VFDs</p>
<p>Professional Skill 45Hrs.;</p> <p>Professional Knowledge 10 Hrs.</p>	<p>Install wiring of PLC based control panel. (Map Nos:ASC/N9448)</p>	<p>48. Demonstrate all tool that requires for making the PLC control panel.(04 hrs)</p> <p>49. Cut DIN rail as per our requirements and fixed in control panel.(04 hrs)</p> <p>50. Mount different devices on DIN rail.(06 hrs)</p> <p>51. Connect all equipment's by different types of cables.(07 hrs)</p> <p>52. Check all connection before power on the control panel by millimeter.(08 hrs)</p> <p>53. Demonstration of SMPS and their connections.(08 hrs)</p> <p>54. Power on the control panel.(08 hrs)</p>	<p>Programmable Logic Controller Panel: -</p> <p>It consists of DIN rail for equipment mounting Cable channel, Terminal for wire connection, VFD, PLC, Power supply SMPS, Relay, Contactor, Fan, Connectors, Input outputs module, Power sockets, Transformer, HMI, Selector switch, Push button, Indicating lamp etc.</p>
<p>Professional Skill 80Hrs.;</p> <p>Professional Knowledge</p>	<p>Construct PLC programming ladder diagram and relay instructions. (Map Nos:ASC/N9449)</p>	<p>55. Demonstration of how to open PLC programming software and basic commands. (03 hrs)</p> <p>56. Use of Different ladder</p>	<p>PLC Programming: -</p> <p>PLC program consists of a set of instructions either in textual or graphical form, which represents the logic that governs the</p>

<p>10 Hrs.</p>		<p>diagram instruction. (03 hrs)</p> <p>57. Basic communication method uses in PLC.(03 hrs)</p> <p>58. Create simple ladder diagram in PLC programming software.(08 hrs)</p> <p>59. Address the input output in ladder diagram.(08 hrs)</p> <p>60. Connect input and output devices as per ladder that diagrams to PLC via input output module.(09 hrs)</p> <p>61. Compile the PLC ladder diagram in software and see result.(09 hrs)</p> <p>62. Connect the programming device to PLC and check the connection status of PLC and laptop or PC.(09 hrs)</p> <p>63. Download the ladder diagram program in PLC memory card and check result. (08 hrs)</p> <p>64. Upload the PLC program from PLC.(03 hrs)</p> <p>65. Create ladder diagrams for all logic gate and compile and check result.(03 hrs)</p> <p>66. Create ladder diagrams for small applications with basic instruction and check the result as per ladder logic.(07 hrs)</p> <p>67. Example: -A signal lamp is required to be switched on if a pump is running and the pressure is satisfactory, or if the lamp test switch is closed. In this application, if</p>	<p>process the PLC is controlling.</p> <p>There are two main classifications of PLC programming languages which are further divided into many sub-classified types.</p> <p>Textual Language Instruction list Structured text Graphical Form Ladder Diagrams (LD) (i.e. Ladder Logic) Function Block Diagram (FBD) Sequential Function Chart (SFC) Ladder Logic: - Ladder logic is the simplest form of PLC programming. It is also known as “relay logic”. The relay contacts used in relay controlled systems are represented using ladder logic.</p> <p>Construct basic PLC programming instructions Identify and define XIC and XIO output instructions Identify and interpret Timers and Counters. Interpret internal instructions.</p>
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<p>Professional Skill 40Hrs.; Professional Knowledge 10 Hrs.</p>	<p>Apply Advance Instruction use in PLC ladder diagram Timer and counter. (Map Nos:ASC/N9450)</p>	<p>68. Create ladder diagram with different type of timer and counter and check the output result.(08 hrs) 69. Application base on Timer instruction.(08 hrs) 70. Application base on counter instruction.(08 hrs) 71. Online edit the plc Program.(08 hrs) 72. Offline edit the plc Program.(08 hrs)</p>	<p>PLC Programming Instruction Timer and Counter: - PLC timers are instructions that provide the same functions as on-delay and off-delay mechanical and electronic timing relays. In general, there are three types of PLC timer delays, ON-delay timer, OFF-delay timer and retentive timer on. The terms represented in the timer block in the PLC are a Preset value which means the delay period of the timer, an Accumulated value which is the current delay of the timer. TON timer or ON delay timer TOFF timer or OFF delay timer: COUNERT A counter is a PLC instruction that either increments (counts up) or decrements (counts down) an integer number value when prompted by the transition of a bit from 0 to 1 (“false” to “true”). Counter instructions come in three basic types: Up counters, Down counters, and Up/Down counters. Both “Up” and “Down” counter instructions have single inputs for triggering counts, whereas</p>

			“up/down” counters have two trigger inputs: one to make the counter increment and one to make the counter decrement.
Professional Skill 25Hrs. Professional Knowledge 05 Hrs.	Perform interfacing of PLC and HMI. (Map Nos:ASC/N9451)	73. To connect PLC to HMI. (08hrs) 74. Communication protocol for HMI and PLC communication. (08hrs) 75. Demonstration of HMI programming software. (09 hrs)	INTERFACING OF PLC AND HMI: - The PLC and HMI is connected through the different types of communication cable. Most industrial HMI panels come equipped with touch-sensitive screens, allowing operators to press their fingertips on displayed objects to change screens, view details on portions of the process, etc.
Professional Skill 25hrs. Professional Knowledge 05Hrs.	Install and configure HMI Application software. (Map Nos:ASC/N9452)	76. To create HMI Application in HMI design Software. (10 hrs) 77. Upload and download the Program in HMI. (15 hrs)	Understanding HMI Application. Different type of HMI screen.
Professional Skill 25Hrs.; Professional Knowledge 05 Hrs.	Operate Supervisory data control and acquisition system (SCADA). (Map Nos:ASC/N9453)	78. SCADA Software Introduction. (02hrs) 79. Simple Digital System implementation in SCADA software.(03 hrs) 80. Simple analog System implementation in SCADA software.(05 hrs) 81. Create SCADA Animation In SCADA software. (05 hrs) 82. Conveyor Animation Example in SCADA. (05 hrs) 83. Visibility Concept in SCADA. (05 hrs)	SCADA stands for “Supervisory Control and Data Acquisition”. SCADA is a type of process control system architecture that uses computers, networked data communications and graphical Human Machine Interfaces (HMIs) to enable a high-level process supervisory management and control. SCADA systems communicate with other devices such as programmable logic controllers (PLCs) and PID controllers to interact with industrial process plant and equipment. SCADA systems form a large part of control systems engineering.

			<p>SCADA systems gather pieces of information and data from a process that is analyzed in real-time (the “DA” in SCADA). It records and logs the data, as well as representing the collected data on various HMIs.</p>
<p>Professional Skill 45Hrs.;</p> <p>Professional Knowledge 10 Hrs.</p>	<p>Perform interfacing of SCADA with PLC. (Map Nos:ASC/N9454)</p>	<p>84. Interfacing of SCADA with PLC.(08 hrs)</p> <p>85. Control PLC Program from SCADA.(08 hrs)</p> <p>86. Digital Alarms Interfacing with PLC.(09 hrs)</p> <p>87. Analog Alarms Virtual Simulation.(10 hrs)</p> <p>88. Analog Alarms Interfacing with PLC Basic Report Generation.(10 hrs)</p>	<p>Master Terminal Unit (MTU) MTU is the core of the SCADA system. It comprises a computer, PLC and a network server that helps MTU to communicate with the RTUs. MTU begins communication, collects and saves data, helps to interface with operators and to communicate data to other systems.</p> <p>Remote Terminal Unit (RTU) Being employed in the field sites, each Remote Terminal Unit (RTU) is connected with sensors and actuators. RTU is used to collect information from these sensors and further sends the data to MTU. RTUs have the storage capacity facility. So, it stores the data and transmits the data when MTU sends the corresponding command.</p>
<p>Professional Skill 38Hrs.;</p> <p>Professional Knowledge 12 Hrs.</p>	<p>Apply the Communication network for SCADA. (Map Nos:ASC/N9455)</p>	<p>89. Import and Export SCADA Project using CSV File. (4hrs)</p> <p>90. Open Database Connectivity (ODBC).(04 hrs)</p> <p>91. To create Report.(04 hrs)</p> <p>92. To use Script.(04 hrs)</p> <p>93. Language Switching. (04 hrs)</p> <p>94. Archive and Retrieve Project. (04 hrs)</p>	<p>Data Communication The SCADA system uses a wired network to communicate between users and devices. Real-time applications use a lot of sensors and components which should be controlled remotely. The SCADA system uses internet communications. All information is transmitted through the</p>

		<p>95. Simple Heat Exchanger. (07 hrs)</p> <p>96. Chemical Reactor.(07 hrs)</p>	<p>internet using specific protocols. Sensors and relays are not able to communicate with the network protocols so RTUs used to communicate sensors and network interfaces.</p> <p>Information/Data Presentation The normal circuit networks have some indicators which can be visible to control but in the real-time SCADA system, there are thousands of sensors and alarm which are impossible to be handled simultaneously. The SCADA system uses the human-machine interface (HMI) to provide all of the information gathered from the various sensors.</p> <p>Monitoring/Control The SCADA system uses different switches to operate each device and displays the status of the control area. Any part of the process can be turned ON/OFF from the control station using these switches. SCADA system is implemented to work automatically without human intervention but in critical situations, it is handled by manpower.</p>
<p>Professional Skill 25Hrs.</p> <p>Professional Knowledge 05 hrs.</p> <p>(Week 26)</p>	<p>Enumerate the difference between SCADA and HMI. (Map Nos:ASC/N9456)</p>	<p>97. SCADA Application 1.(12hrs)</p> <p>98. SCADA Application 2. (13hrs)</p>	<p>A HMI is just like a SCADA a monitoring device which displays the status of the machine. The main difference is that SCADA is a remote monitoring system, whereas HMI is local to machine. A HMI for example, would be placed on the control panel near</p>

			<p>a part of a machine, whereas SCADA would be set up in a control room, far away from the machine itself.</p> <p>Okay, so now we understand that HMI and SCADA are more likely just interfaces. However, the question ‘What is the difference between a DCS and a PLC?’ still remains. The answer isn’t simple as a PLC/HMI combination can do a lot of the same things a DCS does.</p> <p>PLCs are inserted type controllers of ladder logic with set-points of programmable parameter for a control function of automation. Commonly, HMI is a PC based interface with frequently configurable software and broader functionality. ... It will all base on the HMI/software functionality that you have for the FBD.</p>
<p>Professional Skill 40Hrs.;</p> <p>Professional Knowledge 10 hrs.</p>	<p>Develop SCADA architecture. (Map Nos:ASC/N9457)</p>	<p>99. SCADA Application 3. (20hrs)</p> <p>100. SCADA Application 4. (20hrs)</p>	<p>Hardware Architecture</p> <p>The generally SCADA system can be classified into two parts:</p> <p>Client layer</p> <p>Data server layer</p> <p>The Clint layer caters to the man-machine interaction.</p> <p>The data server layer handles most of the process of data activities.</p> <p>Software Architecture</p> <p>Most of the servers are used for multitasking and real-time database. The servers are responsible for data gathering and handling. The SCADA system</p>

			consists of a software program to provide trending, diagnostic data, and manage information such as scheduled maintenance procedures, logistic information.
Professional Skill 56 Hrs.; Professional Knowledge 10 hrs.	Plan and execute SCADA with PLC Simulation Example. (Map Nos:ASC/N9458)	<p>101. SCADA with PLC Simulation Example 04. (10 hrs)</p> <p>102. SCADA with PLC Simulation Example 05. (10 hrs)</p> <p>103. SCADA with PLC Simulation Example 07. (18 hrs)</p> <p>104. SCADA with PLC Simulation Example 08. (18 hrs)</p>	SCADA with PLC Simulation Example
Engineering Drawing: 40 Hrs.			
Professional Knowledge ED -40 hrs.	Read and apply engineering drawing for different application in the field of work. (Map Nos:ASC/N9401)	<p><u>ENGINEERING DRAWING:</u></p> <p>Introduction to Engineering Drawing and Drawing Instruments –</p> <ul style="list-style-type: none"> • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument <p>Lines- Types and applications in drawing</p> <p>Free hand drawing of –</p> <ul style="list-style-type: none"> • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Free hand drawing of hand tools and measuring tools. <p>Drawing of Geometrical figures:</p> <ul style="list-style-type: none"> • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. • Lettering & Numbering – Single Stroke. <p>Dimensioning</p> <ul style="list-style-type: none"> • Types of arrowhead • Leader line with text • Position of dimensioning (Unidirectional, Aligned) <p>Symbolic representation –</p> <ul style="list-style-type: none"> • Different symbols used in the related trades. <p>Concept and reading of Drawing in</p> <ul style="list-style-type: none"> • Concept of axes plane and quadrant 	

		<ul style="list-style-type: none"> • Concept of Orthographic and Isometric projections • Method of first angle and third angle projections (definition and difference) <p>Reading of Job drawing related to trades.</p>
Workshop Calculation & Science: 36 Hrs.		
<p>Professional Knowledge</p> <p>WC- 36 Hrs</p>	<p>Demonstrate basic mathematical concept and principles to perform practical operations.</p> <p>Understand and explain basic science in the field of study. (Map Nos:ASC/N9402)</p>	<p><u>WORKSHOP CALCULATION & SCIENCE:</u></p> <p>Unit, Fractions</p> <ul style="list-style-type: none"> • 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 <p>Square root, Ratio and Proportions, Percentage</p> <ul style="list-style-type: none"> • 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 <p>Material Science</p> <ul style="list-style-type: none"> • Types metals, types of ferrous and non ferrous metals • Introduction of iron and cast iron <p>Mass, Weight, Volume and Density</p> <ul style="list-style-type: none"> • Specific gravity <p>Speed and Velocity, Work, Power and Energy</p> <ul style="list-style-type: none"> • Speed and velocity - Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation • Speed and velocity - Related problems on speed & velocity • Work, power, energy, HP, IHP, BHP and efficiency <p>Heat & Temperature and Pressure</p> <ul style="list-style-type: none"> • Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals • Scales of temperature, celsius, fahrenheit, kelvin and conversion between scales of temperature. <p>Basic Electricity</p> <ul style="list-style-type: none"> • Introduction and uses of electricity, electric current AC,DC their comparison, voltage, resistance and their units. • Conductor, insulator, types of connections - series and parallel.

		<ul style="list-style-type: none">• Ohm's law, relation between V.I.R & related problems.• Electrical power, energy and their units, calculation with assignments.• Magnetic induction, self and mutual inductance and EMF generation• Electrical power, HP, energy and units of electrical energy Trigonometry <ul style="list-style-type: none">• Measurement of angles• Trigonometrical ratios
Project work / Industrial visit: - Process control using PLC, HMI and SCADA and Industrial visit to Automation industries. Create new basics project in for HMI		
Revision & Examination		

SYLLABUS FOR CORE SKILLS

Employability Skills (Common for all CTS trades) (120 hrs.)

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

List of Tools & Equipment			
Manufacturing Process Control and Automation (For batch of 20 Candidates)			
S No.	Name of the Tools and Equipment	Specification	Quantity
A. Trainees Tool kit			
1.	Industrial Workstation (Computer)(Common to other trades)	Latest version compatible for running CAD software, preloaded with latest configurations and Internet connection with standard operating system	20 Nos.
2.	UPS (Common to other trades)	3 KVA With Battery & Trolley	1 No.
3.	Server with rack - Intel Xeon Silver (Common to other trades)	4114 2.2G, 10C/20T, 9.6GT/s, 14M Cache, Turbo, HT (85W) DDR4-2400, 600GB x 5Nos. 10K RPM SAS, 12Gbps 512n 2.5in Hot plug Hard Drive.	1 No.
4.	PLC Software		As required
5.	AC Drives		As required
6.	Energy Meters		As required
7.	Sensors		As required
8.	Electrical wiring and Accessories		As required
9.	Mounting kit		As required
10.	Network accessories and cables		As required
11.	System Set up and integration with Design.		As required
12.	SCADA Software		As required
B. DRAWING AND CAD LAB TOOLS			
7.	Steel rule	30 cm & 60 cm graduated both in English & Metric units	20 Nos.
8.	Micrometer Outside	0-50 mm outside	10 Nos.
9.	Vernier Caliper	0-15 cm	10 Nos.
10.	Micrometer Inside	up to 20 mm	10 Nos.
11.	Hand Gloves		10 Nos.
12.	Safety Shoes		10 Nos.
13.	Helmet		10 Nos.
C. TOOLS & GENERAL SHOP OUTFIT			
1.	"V " block	V-Block pair 7 cm with clamps	10 Nos.
2.	"V " block	V-Block 15 cm with clamps	10 Nos.



3.	Metal L	Metal - L - 15cm	10 Nos.
4.	Metal L	Metal - L - 30cm	10 Nos.
5.	Angle Plate	10 x 20 cm.	10 Nos.
6.	Spirit Level	15 cm metal	10 Nos.
7.	File warding	15 cm smooth	10 Nos.
8.	File knife edge	15 cm smooth	10 Nos.
9.	File cut saw	15 cm smooth	10 Nos.
10.	File feather edge	15 cm smooth	10 Nos.
11.	File triangular	15 cm smooth	10 Nos.
12.	File round	20 cm second cut	10 Nos.
13.	File square	15 cm second cut	10 Nos.
14.	File square	25 cm second cut	10 Nos.
15.	File triangular	20 cm second cut.	10 Nos.
16.	File flat	30 cm second cut.	10 Nos.
17.	File flat	20 cm bastard	10 Nos.
18.	File flat	30 cm bastard.	10 Nos.
19.	File Swiss type	Needle set of 12.	10 Nos.
20.	File half round	25 cm second cut.	10 Nos.
21.	File half round	25 cm bastard.	10 Nos.
22.	File round	30 cm bastard.	10 Nos.
23.	File hand	15 cm second cut.	10 Nos.
24.	Card file.	----	10 Nos.
25.	Oil Stone	15 cm x 5 cm x 2.5 cm	10 Nos.
26.	Pliers combination	15 cm	10 Nos.
27.	Blow Lamp	0.50 liters.	10 Nos.
28.	Spanner	D.E. 6 -26 mm set of 10 pcs.	10 Nos.
29.	Spanner adjustable	15 cm	10 Nos.
30.	Box spanner	Set 6-25 mm set of 8 with Tommy bar.	10 Nos.
31.	Glass magnifying	7 cm	10 Nos.
32.	Clamp toolmaker	5 cm and 7.5 cm set of 2.	10 Nos.
33.	Clamp "C"	5 cm	10 Nos.
34.	Clamp "C"	10 cm	10 Nos.
35.	Scraper flat	15 cm.	10 Nos.
36.	Scraper triangular	15 cm	10 Nos.
37.	Scraper half round	15cm	10 Nos.
38.	Chisel	cold 9 mm cross cut 9 mm diamond.	10 Nos.
39.	Chisel	cold 19 mm flat	10 Nos.
40.	Chisel	cold 9 mm round noze.	10 Nos.



41.	Motorized +Tennon Saw	----	10 Nos.
42.	Hand hammer	1 kg. with handle Ball Peen	10 Nos.
43.	Hacksaw	frame fixed 30 cm.	10 Nos.
44.	Mallets Wooden	----	10 Nos.
45.	V-Block, Files, mallets, screwdrivers, chisels, etc.	----	10 Nos.
46.	Hand Drilling Machine	Rated input power: 600W, Power output: 301W, Rated torque: 1.8 Nm	10 Nos.
47.	Metal Saw	No-Load Speed: 3,800 rpm, Saw blade diameter 355 mm, Saw blade bore 25.4 mm	10 Nos.
48.	Straight Grinder HEAVY DUTY with attachments	No-Load Speed: 10000 – 30000 rpm, Rated power output: 380W	10 Nos.
49.	Professional Air Blower	Power consumption: 820 W, No-load speed: 16000rpm, Flow rate: 0-4.5 m ³ /s	10 Nos.
50.	Jig Saw Portable	Input Power: 900W, No-load speed: 11,000 rpm, Disc Diameter: 100	10 Nos.
51.	Hammer Drill Wired	Drill type: hammer, optimum power transfer	10 Nos.
52.	Hand Held Sander / Polisher	No Load Speed: 11000 rpm	10 Nos.
53.	Digital Dial Torque Wrench	Range: 20 to 280 Nm	10 Nos.
54.	Lifting Tackle/Sling	1 Ton×2mtr	10 Nos.
55.	Impact Wrench	1/2 inch drive	10 Nos.
56.	Laser Light Pen	---	10 Nos.
57.	Surface Plate	Cast iron	10 Nos.
58.	Digital Screw Pitch Gauge	Working voltage: 3.0 V / DC, Measure precision: 0.1 degree	10 Nos.
59.	Laser Distance Measurement Instrument	Levelling Accuracy (Vial): +/- 0.2degree, Measuring Accuracy Typical: +/- 1/16 inch (1.5 mm)	10 Nos.
60.	Palm Scale	Capacity-500gms, Least Count-0.1g	10 Nos.
61.	Allen Screwdriver Wrench Tool	6Pcs T Handle Ball Ended Hex Key	10 Nos.
62.	Universal Quick Adjustable Multi-function Wrench Spanner	Range: 6-32mm	10 Nos.
63.	Double Ended Wrench Hex Socket Spanner	8 In 1, Range: 6-32mm	10 Nos.
D. MEASURING INSTRUMENT			
64.	Steel Rue	60 cm.	10 Nos.
65.	Vernier Caliper	0- 15 cm	10 Nos.
66.	Micrometer outside.	0 – 50 mm	10 Nos.
67.	Micrometer Inside	0 to 20 mm	10 Nos.



ABBREVIATIONS:

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

