



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

COMPETENCY BASED CURRICULUM

INDUSTRIAL ROBOTICS & DIGITAL MANUFACTURING TECHNICIAN

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL – 4



SECTOR – CAPITAL GOODS & MANUFACTURING



Directorate General of Training

INDUSTRIAL ROBOTICS AND DIGITAL MANUFACTURING TECHNICIAN

(Engineering Trade)

(Designed in 2021)

Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL –4

Developed By

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1. COURSE INFORMATION

During the one-year duration of Industrial Robotics and Digital Manufacturing Technician trade a candidate is trained on professional Skill, professional Knowledge, Workshop Calculation & Science and Employability Skill related to job role. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered in one-year duration are as below:

The trainee learns about safety and environment, use of fire extinguishers, artificial respiratory resuscitation to begin with. Trainee gets the idea about the automation in Manufacturing Industry. This includes the understanding the robotic cell its different components i.e. safety sensors operational equipment and application tools. Working with robots as operator to feed the unfinished parts to the robotic cell by inserting them into the Fixture and taking out the finished product. Learning the robot programming skills by getting familiar with the coordinate system, motion programming parameters, application based dedicated commands. Optimizing the process of robot operation. After developing the programming skills trainee will be able to Set up the and Make the cell Robotic cell ready Power ON and check the status of Robotic cell, adjusting the application parameters of the desired application done by robot. Taking care sequence of Operation, ensuring the location of process points on components, fixtures accuracy in mounting the components. Troubleshooting the automation and production problems in Robotic cells. Applying the Knowledge of Automation theory and Procedures, application-based tools, to understand the Process of Manufacturing in current robotic cell and safety norms.

Optimizing the application parameters, optimizing the cycle time of carrying out the task with robot programs. Making sure of inclusion of all the safety sensors, Inputs and outputs to avoid any type of accident in Workshop. Making dry runs of robots at different speeds to ensure if the robot is following the same path to avoid any kind safety issues to avoid any type of accidents and for insurance of smooth production.

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.

CTS courses are delivered nationwide through network of ITIs. The course 'Industrial Robotics and Digital Manufacturing Technician' 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 (Workshop calculation & science and 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 Robotic 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.
- Can take admission in diploma course in notified branches of Engineering by lateral entry.

2.3 COURSE STRUCTURE

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)	1000
2	Professional Knowledge (Trade Theory)	280
3	Workshop Calculation & Science	80
4	Engineering Drawing	80
5	Employability Skills	160
	Total	1600

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%. 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 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 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

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	<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 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 75%-90% to be allotted during assessment	
For this grade, a candidate should produce	<ul style="list-style-type: none"> • Good skill levels in the use of hand tools,

<p>work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices</p>	<p>machine tools and workshop equipment.</p> <ul style="list-style-type: none"> • 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) Weightage 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

The Job role in Industrial Robotics Includes the as Operator to feed the unfinished parts to the robotic cell by inserting them into the Fixture and taking out the Finished product while taking the safety measures in consideration. Troubleshooting the automation and production problems in Robotic cells. Applying the Knowledge of Automation theory and Procedures, application-based tools, to understand the Process of Manufacturing in current robotic cell and safety norms, setting up the and Making the cell Robotic cell ready Power ON and check the status of Robotic cell, adjusting the application parameters of the desired application done by robot to improve the quality of the finished product.

Second Job role includes the Programming of robot for manufacturing the desired component with required application. Taking care sequence of Operation, ensuring the location of process points on components, fixtures accuracy in mounting the components for manufacturing with different joining processes, optimizing the Robot programs, setting up communication with other peripheral devices in robotic cell by integrating with the external automation controllers, Optimizing the application parameters, optimizing the cycle time of carrying out the task with robot programs.

Making sure of inclusion of all the safety sensors, Inputs and outputs to avoid any type of accident in Workshop. Making dry runs of robots at different speeds to ensure if the robot is following the same path to avoid any kind safety issues and for insurance of smooth production. Taking Backup of robot's time to time. Applying the simulation software knowledge in virtually validating the process. Robot simulation software can help in optimizing the robotic cell structure and reduce the cost in procuring the cell components and rework installing the robotic cell and also it helps in optimizing and improving the programs of robot.

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

Robotic Machine Operator; sets up and operates industrial robots to drill, countersink, and counter bore metallic and non-metallic work pieces used to manufacture aircraft parts or tooling, according to specifications and preprogrammed machine control instructions: Reads work order and specifications to determine prescribed setup and operation. Mounts and positions work piece on locating pins of holding fixture adjacent to a robot, manually or using hoist, and aligns and secures work piece on holding fixture, using template, bolts, hand tools, and power tools. Installs specified type and size of drill bits in end effectors and place send

effectors in holding station adjacent to a robot. Loads cassette tape of machine instructions into machine controller or enters commands to retrieve preprogrammed instructions from the mainframe computer. Pushes a button or enters commands to activate a robot that automatically retrieves and secures designated end effectors on robot arm and positions arm for drilling. Operates robots to drill holes in test specimen and measures holes for conformance to specifications, using measuring instruments. Enters commands to start robot, observes robotic operation, and monitors screen of machine controller for malfunctions and error messages. Changes worn drill bits or adjusts machine according to error message instructions. Inspects finished work piece for conformance to specifications. Cleans parts, tools, and fixtures, using solvents and rags. May set up and operate robot to perform additional machine operations, such as sealing and fastener installation, to join component parts into complete assembly.

Programmer, Engineering and Scientific; converts scientific, engineering, and other technical problem formulations to format that can be processed by a computer: Resolves symbolic formulations, prepares flow charts and block diagrams, and encodes resultant equations for processing by applying extensive knowledge of branch of science, engineering, or advanced mathematics, such as differential equations or numerical analysis, and understanding of capabilities and limitations of computer. Confers with other engineering and technical personnel to resolve problems of intent, inaccuracy, or feasibility of computer processing. Enters the program into a computer system. Reviews results of computer runs with the concerned personnel to determine necessity for modifications or reruns. Develops new subroutines or expands program to simplify statement, programming, or coding of future problems. May direct and co-ordinate activities of COMPUTER PROGRAMMERS working as part of the project team.

Metal Inert Gas/Metal Active Gas/Gas Metal Arc Welder (MIG/MAG/GMAW); perform manual (semi-automatic) MIG/ MAG (GMAW) welding for a range of standard welding job requirements and weld different materials (carbon steel, aluminium and stainless steel) in various positions. The welder can prepare various joints including corner, butt, fillet and tee. Set-up and prepare for operations interpreting the right information from the WPS.

Pick and Place Operator; operates the automated pick-and-place machine for assembling components on the printed circuit board (PCB). The individual on the job, programs, operates and maintains the automated pick-and-place machine for placing different types of components on the surface of PCBs for soldering.

Modeller; is broadly responsible for visualization of the final product; develop clay model from the design, transforming the sketch into digital data i.e., three-dimensional shape and building mock-up which is as close as possible to the real object. A modeller's working characteristics

include rapid generation of styling ideas, flexibility in combining existing alternatives and creating aesthetically appealing representations.

Application Maintenance Engineer; is responsible for ensuring the availability of an application or product for end users. Such roles provide on-going/ad-hoc support for software products or customized applications aimed towards correction of faults/bugs or improvement of performance.

Reference NCO-2015:

- a) 3139.1400 - Robotic Machine Operator
- b) 2512.0800 - Programmer, Engineering and Scientific/System Programmer
- c) 7212.0303 - Arc Welder (MIG/MAG/GMAW)
- d) 8212.1603 - Pick and Place Assembly Operator
- e) 2144.0802 - Modeller
- f) 2512.0701 - Application Maintenance Engineer

4. GENERAL INFORMATION

Name of the Trade	INDUSTRIAL ROBOTICS AND DIGITAL MANUFACTURING TECHNICIAN
Trade Code	DGT/2024
NCO – 2015	3139.1400, 2512.0800, 7212.0303, 8212.1603, 2144.0802, 2512.0701
NSQF Level	Level 4
Duration of Craftsmen Training	One Year (1600 Hours)
Entry Qualification	Class X Pass plus simultaneously enrolled for class XII through NIOS or Class XII pass or ITI plus class X
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) Industrial Robotics and Digital Manufacturing Technician	<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 "Industrial Robotics and Digital Manufacturing Technician" with three years' experience in the relevant field.</p> <p>Essential Qualification: 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</p>

	<p>qualifications. However, both of them must possess NCIC in any of its variants.</p> <p>Faculty to be trained for 10 days by the machine manufacturer on the usages.</p>
<p>(ii) Workshop Calculation & Science</p>	<p>B.Voc/Degree in 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 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 in any one of the engineering trades with three years' experience.</p> <p><u>Essential Qualification:</u></p> <p>National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;">OR</p> <p>NCIC in RoDA or any of its variants under DGT</p>
<p>(iii) Engineering Drawing</p>	<p>B.Voc / Degree in 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 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 in any one of the Electrical trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience.</p> <p><u>Essential Qualification:</u></p> <p>National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;">OR</p> <p>NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.</p>
<p>(iv) Employability Skill</p>	<p>MBA/BBA/Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills from DGT institutes.</p> <p>(Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)</p>

	OR				
	Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills from DGT institutes.				
(v) Minimum Age for Instructor	21 Years				
List of Tools and Equipment	As per Annexure – I				
	Distribution of training on Hourly basis: (Indicative only)				
Total Hrs. /week	Trade Practical	Trade Theory	Workshop Cal. & Sc.	Engineering Drawing	Employability Skills
40 Hours	25 Hours	7 Hours	2 Hours	2 Hours	4 Hours

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. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Identify the customer needs & Product specifications.
3. Apply the knowledge of industrial engineering drawing & requirements.
4. Identify and explain various types of Industrial Robots and perform their configuration.
5. Identify the Robotic Cell Components & Application tools.
6. Perform installation check of robot mechanically and Electrically.
7. Power on the Robot and making the cell Healthy for programming.
8. Run operations with Teach Pendant key functions & user interface for teach pendant.
9. Identify the Industrial Robot simulation tool/ software.
10. Apply the knowledge of robotic Coordinate system.
11. Perform Jogging of the industrial robot using virtual programming pendant.
12. Demonstrate the need of add on assembly and perform as per application.
13. Perform work on application based components used in robotic cells and understanding their parameters. (e.g. Welding system, component holder gripper, external auto operation set up, etc.)
14. Identify architecture of welding robot system, establish communication with PLC and assemble welding torch for operation.
15. Perform Interfacing of work piece holding Grippers in Robot.
16. Perform Importing, Exporting & Selection of robotic program.
17. Read existing program & execution techniques.
18. Perform Operation of industrial robot.
19. Program the Robot following the Safety procedure for Programmer.
20. Explain the industrial need of robotic programming Simulation.
21. Create a program with the help of Robotic Simulation software.
22. Perform remote monitoring and connectivity of Industrial Robot.

23. Carry out Preventive Maintenance & Basic troubleshooting.

6. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
1. Recognize & comply safe working practices, environment regulation and housekeeping.	Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE).
	First Aid Method and basic training
	Practice and understand precautions to be followed while working.
	Safe use of tools and equipment used in the trade.
2. Identify the customer needs & Product specifications.	Create check List of customer needs.
	Define product specifications.
	Familiarize with product design & development process.
3. Apply the knowledge of industrial engineering drawing & requirements.	Reading of industrial drawing.
	Create a check list of dimensions.
	Define Customer specific requirements.
4. Identify and explain various types of Industrial Robots and perform their configuration.	List out application of industrial robot.
	Identify the various types of robots.
	Identify different configurations of robots.
5. Identify the Robotic Cell Components & Application tools Cell Components.	Identify the Robotic Cell Components.
	Identify the mechanical installation of robot.
	Familiarize with the working of the peripheral devices.
6. Perform installation check of robot mechanically and Electrically.	Check the safety measures and safety sensors are installed properly.
	Check hydraulic, pneumatic connection.
7. Power on the Robot and making the cell Healthy for programming.	Standard robot on–off operating procedure.
	Verification of Robotic cell health (Mechanical, Electrical & Safety) checkpoints.
8. Run operations with Teach Pendant key functions & user interface for teach pendant.	Familiarize with the function of the front and back of the teach pendant.
	Familiarize with the user interface of the teach pendant.
	Working with different touch pendant function keys.

9. Identify the Industrial Robot simulation tool/software.	Identify the Robots components.
	Identify the position variation in robots.
	Perform Robot axis movements.
10. Apply the knowledge of robotic Coordinate system.	Verifying co-ordinate system by multiple motion movements.
	Learning the basics of the coordinate system.
	Demonstrate different types of coordinate system.
11. Perform Jogging of the industrial robot using virtual programming pendant.	Jogging using virtual programming pendant.
	Jogging of robot in axis mode (joint mode).
	Practice on fixture for Jogging robot with different coordinate systems.
12. Demonstrate the need of add	Explain the different application tools & their respective components.
	Define add on assembly tools as per application case studies.
13. Perform work on Application based components used in robotic cells and understanding their parameters. (e.g. Welding system, component holder gripper, external auto operation setup, etc.)	Assembling of gripper to manipulator.
	Resolve the incorporate programming pendent & alarm resolution.
	Parameters setting of application based controllers.
14. Identify architecture of welding robot system, establish communication with PLC and assemble welding torch for operation.	Identify the PLC and robot communication for communicate with HMI.
	Verify Loop control instructions.
	Power source connection with robot controller. Working using ARCON, ARCOFF. Working using WEAVON, WEAVOFF
15. Perform Interfacing of work piece holding Grippers in Robot.	Performing the different connections of grippers (Electric, Pneumatic etc.)
	Create a program of pick and place with the help of gripper.
16. Perform Importing, Exporting & Selection of robotic	Select existing programmer from system file location & execute the program in manual mode.

program.	Importing programming file from external source and execute the program manual mode.
	Export the existing program in external device.
17. Read existing program & execution techniques.	Explain Teach table or fixture for all move commands.
	Execute the program with different modes. (Manual, moderate speed & auto)
18. Perform Operation of industrial robot.	Explain Teach table or fixture for all motion commands.
	Operating of existing welding program in auto mode with material loading and unloading from jig.
	Operating of existing gripper (Pick and place) program in auto mode.
19. Program the Robot following the Safety procedure for Programmer.	Create the table reading Program
	Create a program of Pick & place.
	Create a program of advance fixture welding.
20. Explain the industrial need of robotic programming Simulation.	Calculate the cycle time
	Identify the importance of tool path optimization techniques.
21. Create a program with the help of Robotic Simulation software.	Creating Virtual field and understanding cube.
	Create a program with the help of simulation software & compare the tool path with manual program.
	Create the welding program in simulation software.
	Create pick and place program in the simulation software.
22. Perform remote monitoring and connectivity of Industrial Robot.	Remote Monitoring and connectivity of Industrial Robot.
	Understanding the concept & goals of industry 4.0
23. Carry out Preventive Maintenance & Basic troubleshooting.	Prepare preventive maintenance plan
	Conduct the preventive maintenance as per standard operating procedure.

SYLLABUS FOR INDUSTRIAL ROBOTICS AND DIGITAL MANUFACTURING TRADE			
DURATION: ONE YEAR			
Duration	Reference Learning outcome	Professional Skills (Trade Practical) With Notional hours	Professional Knowledge (Trade Theory)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 1-2)	Recognize & comply safe working practices, environment regulation and housekeeping.	<ol style="list-style-type: none"> 1. Importance of trade training, List of tools & Machinery used in the trade. (05 Hrs) 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (05 Hrs) 3. First Aid Method and basic training. (04 Hrs) 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (06 Hrs) 5. Hazard identification and avoidance. (06 Hrs) 6. Safety signs for Danger, Warning, caution & personal safety message. (04 Hrs) 7. Preventive measures for electrical accidents & steps to be taken in such accidents. (04 Hrs) 8. Use of Fire extinguishers. (09 Hrs) 9. Practice and understand precautions to be followed while working in fitting jobs. 	All necessary guidance to be provided to the newcomers to Become familiar with the working of Industrial Training Institute system Including stores procedures. Soft Skills, its importance and Job area after completion of training. Importance of safety and general precautions observed in the industry /shop floor. Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. Response to emergencies e.g.; power failure, fire and system failure. Importance of housekeeping & good shop floor practices. Introduction to 5S concept & its application. Occupational Safety & Health: Health, Safety and Environment legislations & regulations as applicable. Basic understanding on Hot work, confined space work and material handling equipment.

		(03 Hrs) 10. Safe use of tools and equipment's used in the trade. (04 Hrs)	
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 3-4)	Identify the customer needs & Product specifications.	11. Familiarize with product design & development process. (12 Hrs) 12. Prepare checklist of customer needs. (26 Hrs) 13. Define product specifications. (12 Hrs)	Introduction to product design and development. Customer needs & specification. Importance of customer relationship management.
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 5-6)	Apply the knowledge of industrial engineering drawing & requirements.	14. Applying GD & Symbol on drawing to understand the importance & intent of component in assembly of final product. (15 Hrs) 15. Reading of industrial drawing. (15 Hrs) 16. Create a checklist of dimensions & customer specific requirements. (20 Hrs)	Introduction to engineering drawing. Concept of limits fits & tolerances & symbols. Importance of interchangeability & ISO standards. Understand industrial engineering special characteristic symbol, Customer specific standards drawing a notation, geometrical dimensions & tolerance. Symbols used in Industrial machining drawing like surface finish, machining operation, surface treatment, GD&T, etc.)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 7-8)	Identify and explain various types of Industrial Robots and perform their configuration.	17. List down the industrial application of industrial robot. (20 Hrs) 18. Identify the various types of robots. (20 Hrs) 19. Identify different configuration of robots. (10 Hrs)	Introduction of Robots & Its Importance in Manufacturing and Production. Types of robots. Applications of robots in manufacturing. Different configurations of robots.
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 9-10)	Identify the Robotic Cell Components & Application tools.	20. Identify the Robotic Cell Components & Application tools Cell Components. (50 Hrs)	Introduction to the Robotic Cell Components. Customizing the industrial robot as per application. Industrial case studies of customization & trending application of robots in industry.

<p>Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 11-12)</p>	<p>Perform installation check of robot mechanically and Electrically.</p>	<p>21. Check the safety measures and safety sensors are installed properly. (20 Hrs) 22. Checking of Physical grouting of robot and other peripheral devices (cable trays, fences, fixtures, electric boxes etc.). Check the electric connections Earthing cable, power cable, Pneumatic pipes etc. (30 Hrs)</p>	<p>Introduction to safety measures of industrial robot. Types of sensor used in industrial robot & their application. Guidelines to ensure safe working practice for industrial robot. Install and inspect the Mechanical components of robotic cell. Install and inspect the electrical connections.</p>
<p>Professional Skill 25 Hrs; Professional Knowledge 07 Hrs (Week 13)</p>	<p>Power on the Robot and making the cell Healthy for programming.</p>	<p>23. Structure and Function of complete Robotics Work cell and its different components. (07 Hrs) 24. Starting Up and Shutdown Steps Robot. (04 Hrs) 25. Turning in the main supply to robot, turn on the stabilizers, electric box, Robot Controller. Turning on the air compressor. Check the Booting of the teach pendent. Check the pneumatic clamps in fixtures, Grippers on robots. (10 Hrs) 26. Checking complete cell health. (04 Hrs)</p>	<p>Introduction to robots Structure and functions of robot System (Basic Package) and additional Equipment. Standard robot on – off operating procedure. Concept of Robotic cell health.</p>
<p>Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 14-15)</p>	<p>Run operations with Teach Pendant key functions & user interface for teach pendant.</p>	<p>27. Run Teach mode: Play mode, Remote mode. (06 Hrs) 28. Run Steps to define Tool coordinate system. (10 Hrs) 29. Run TCP (Tool center point definition). (06 Hrs) 30. Creating user defined work objects. (12 Hrs) 31. Create Box, circle, triangle</p>	<p>Introduction to Teach pendant. Tool/ work object definition and their calibration.</p>

		work object definition). (10 Hrs) 32. Multi-mode selection in virtual programming pendant. (06 Hrs)	
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 16-17)	Identify the Industrial Robot simulation tool/software.	33. Identify the Robots components. (08 Hrs) 34. Introduction about Simulation software. Creating new model in Simulation Software. (12 Hrs) 35. Importing different types of robot. (10 Hrs) 36. Identify the position variation in robots. (08 Hrs) 37. Perform Robot axis movements. (12 Hrs)	Basic components of robots and understanding their respective functions. Introduction to Cycle time and its importance. Understanding the operator job in robot cell. Safety considerations.
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 18-19)	Apply the knowledge of robotic Coordinate system.	38. Co-ordinate selection: Joint co-ordinate system, Rectangular co-ordinate system, User or object co-ordinate system, Tool co-ordinate system. Steps to define user co-ordinate system. (20 Hrs) 39. Defining X, Y, Z co-ordinate system. (10 Hrs) 40. Verifying co-ordinate system by multiple motion movements. (20 Hrs)	Axis system of Robots, type of joints in robot, Understanding Coordinate system. Different coordinate systems in Robots.
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 20-21)	Perform Jogging of the industrial robot using virtual programming pendant.	41. Jogging using virtual programming pendant. (15 Hrs) 42. Practice on fixture for Jogging robot with different coordinate systems. (35 Hrs)	Modes of Jogging in Robot.
Professional	Demonstrate the need	43. Define the add on assembly	Introduction to Application

Skill 25 Hrs; Professional Knowledge 07 Hrs (Week 22)	of add	tools as per application case studies. (25 Hrs)	based components used in robotic cells and Industrial case studies of application based modification in robotic cell components.
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs (Week 23)	Perform work on Application based components used in robotic cells and understanding their parameters. (e.g. Welding system, component holder gripper, external auto operation setup, etc.)	44. Assembling of welding robot. (05 Hrs) 45. List out the end effectors and their functions. (05 Hrs) 46. Assembling of gripper to manipulator. (05 Hrs) 47. Resolve the incorporate programming pendent & alarm resolution. (05 Hrs) 48. Parameters setting of application based controllers. (05 Hrs)	Assembly guideline of application based tools, Parameters study of application based tools. Learning other peripheral devices and components in robotic cells. Selection of Welding tool for robot.
Professional Skill 75 Hrs; Professional Knowledge 21 Hrs (Week 24-26)	Identify architecture of welding robot system, establish communication with PLC and assemble welding torch for operation.	49. Identify the basic Program structure in robot with the help of teach pendent. (05 Hrs) 50. Identify the PLC and robot communication for communicate with HMI. (04 Hrs) 51. Build the conveyor system and its communication with PLC. (05 Hrs) 52. Assembling of welding torch to manipulator. (06 Hrs) 53. Selection of welding source programming file. (05 Hrs) 54. Adjust the Voltage and Amps rating. (04 Hrs) 55. Start ending and main conditions. (05 Hrs) 56. Identify architecture of welding robot system. (05 Hrs)	Programming with advance level instructions Loop control instructions Arithmetic and Logical Instructions Shift instructions Methods to create fencing and safety equipment's Steps to work with two different types of Robot at same project.

		<p>57. Power source connection with robot controller. Working using ARCON, ARCOFF. Working using WEAVON, WEAVOFF. (06 Hrs)</p> <p>58. Practical application demo using interpolation. (05 Hrs)</p> <p>59. Quality check of welding and improvement with changing weld parameters. (04 Hrs)</p> <p>60. Verify Loop control instructions. (05 Hrs)</p> <p>61. Arithmetic and Logical instructions. (04 Hrs)</p> <p>62. Verifying the Shift instructions. (04 Hrs)</p> <p>63. Create fencing and safety equipment's. (08 Hrs)</p>	
<p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p> <p>(Week 27-28)</p>	<p>Perform Interfacing of work piece holding Grippers in Robot.</p>	<p>64. Gripper mounting on Robot Flange. (04 Hrs)</p> <p>65. Performing the different connections of grippers (Electric, Pneumatic etc.). (04 Hrs)</p> <p>66. List out gripper application in robot program & develop machine setting to assign the operation. (04 Hrs)</p> <p>67. Interfacing Grippers to Robot using robot I/O.(04 Hrs)</p> <p>68. Interfacing Grippers to Robot using PLC. (04 Hrs)</p> <p>69. Use of Function Keys in Pendant. (04 Hrs)</p> <p>70. Creating a program of pick and place with the help of gripper. (03 Hrs)</p>	<p>Introduction to handling grippers. Understanding Handling Operation</p> <p>Understanding Major applications of handling Robot, Bin Picking, Part Transfer, Picking & Packing, and Palletizing.</p> <p>Understanding type of Grippers and differences between them: Pneumatic Gripper, Vacuum Gripper, Hydraulic Gripper, Servo-Electric Gripper Factors to be considered for Selecting and Designing a Gripper</p> <p>Understanding the Work function of Solenoid valve</p> <p>Understanding Differences between Single Solenoid, Double Solenoid, Proportional Valve and Servo valve. Path optimization</p>

		<p>71. Understanding HAND INSTRUCTIONS in Robot. (04 Hrs)</p> <p>72. Understanding HANDLING WINDOW in Robot. (04 Hrs)</p> <p>73. Low Air Pressure Interlock. (04 Hrs)</p> <p>74. Creating the program with gripper application. (04 Hrs)</p> <p>75. Practice for program creation with gripper application. (07 Hrs)</p>	for smooth robot movement and cycle time.
<p>Professional Skill 25 Hrs;</p> <p>Professional Knowledge 07 Hrs</p> <p>(Week 29)</p>	Perform Importing, Exporting & Selection of robotic program.	<p>76. Select existing programmer from system file location & execute the program in manual mode. (8 Hrs)</p> <p>77. Importing programming file from external source and execute the program manual mode. (08 Hrs)</p> <p>78. Export the existing program in external device. (09 Hrs)</p>	Concept of Importing & exporting of robotic program.
<p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p> <p>(Week 30-31)</p>	Read existing program & execution techniques.	<p>79. Identify the program motion command movements. (25 Hrs)</p> <p>80. Practice on Teach table or fixture for all move commands. (25 Hrs)</p>	<p>Understanding Robot Program Structure. Different Motion Types used in Programming (PTP, Linear, Circular, Spline). Via Point and Process Points.</p> <p>Understanding Different Motion Parameters used in Program Point Recording.</p>
<p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p> <p>(Week 32-33)</p>	Perform Operation of industrial robot.	<p>81. Follow Safety procedure for an Operator. (06 Hrs)</p> <p>82. Run the existing program with manual mode. (06 Hrs)</p> <p>83. Run the existing program with moderate speed mode.(06 Hrs)</p> <p>84. Run the existing program with auto mode. (06 Hrs)</p>	<p>Standard robot operating procedure. Safety guidelines of robot operation.</p> <p>Understanding the robotic running mode (speed & automation). Understanding types of welding & their industrial applications.</p> <p>Identification of defects in</p>

		<p>85. Operating of existing welding program in auto mode with material loading and unloading from jig. (06Hrs)</p> <p>86. Inspect the welding quality by measuring instruments. (06 Hrs)</p> <p>87. Identification of defects in welding & basic correction in program & machine setup with weld feed wire control. (06Hrs)</p> <p>88. Operating of existing gripper (Pick and place) program in auto mode. (08 Hrs)</p>	welding.
<p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p> <p>(Week 34-35)</p>	<p>Program the Robot following the Safety procedure for Programmer.</p>	<p>89. Follow Safety procedure for Programmer. (06 Hrs)</p> <p>90. Move J(Joint), Move L(Linear), Move C (Circular), Move S (Spline). (09 Hrs)</p> <p>91. Working with Welding Torch. (04 Hrs)</p> <p>92. Create the table reading Program. (08 Hrs)</p> <p>93. Basic programming using move commands. (06 Hrs)</p> <p>94. Programming with advance level instructions. (06 Hrs)</p> <p>95. Create a program of Pick & place. (04 Hrs)</p> <p>96. Create a program of advance fixture welding. (07 Hrs)</p>	<p>Understanding Safety procedure for Programmer Concept and understanding of Program creation. Path optimization for smooth robot movement and cycle time. Arc Welding Application commands used in Welding and weld Parameters settings.</p>
<p>Professional Skill 25 Hrs;</p> <p>Professional Knowledge</p>	<p>Explain the industrial need of robotic programming Simulation.</p>	<p>97. Calculate the cycle time. (08 Hrs)</p> <p>98. Calculate the productivity (06 Hrs)</p> <p>99. Calculate the machining</p>	<p>Concept of tool path optimization. Concept of cycle time & total productivity.</p>

07 Hrs (Week 36)		cost for operation. (06 Hrs) 100. Identify the importance of tool path optimization techniques. (05 Hrs)	
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs (Week 37-38)	Create a program with the help of Robotic Simulation software.	101. Creating Virtual field and understanding cube. (06 Hrs) 102. Practice of handling programs. (07 Hrs) 103. Importing files from some other format to Robot simulation software in to robot. (07 Hrs) 104. Various types communication interface available in Robot simulation software. (07 Hrs) 105. Follow Steps to control real time robot using Robot simulation software. (06 Hrs) 106. Create a program with the help of simulation software & compare the 107. Tool path with manual program. (07 Hrs) 108. Create the welding program in simulation software. (07 Hrs) 109. Create pick and place program in the simulation software. (03 Hrs)	Importing Files from some other format to Robot simulation software Various types communication interface available in Robot simulation software Steps to control real time robot using Robot simulation software.
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs (Week 39)	Perform remote monitoring and connectivity of Industrial Robot.	110. Remote Monitoring and connectivity of Industrial Robot. (25 Hrs)	Concept of industry 4.0 Remote Monitoring and connectivity of Industrial Robot.
Professional	Carry out Preventive	111. Prepare preventive	Use of tool kit used for robotics

<p>Skill 25 Hrs; Professional Knowledge 07 Hrs (Week 40)</p>	<p>Maintenance & Basic troubleshooting.</p>	<p>maintenance plan. (04 Hrs) 112. Check & top up lubrication oil. (02 Hrs) 113. Inspect weld wire & replacing of weld wire. (04 Hrs) 114. Verifying the welding gas. (03 Hrs) 115. Verifying the pneumatic leakages for operating fixtures. (03 Hrs) 116. Verify all the safety sensors. (05 Hrs) 117. Conduct the preventive maintenance as per standard operating procedure. (04 Hrs)</p>	<p>preventive maintenance & basic troubleshoot.</p>
<p>Project work / Industrial visit: - Project work involving the mounting of application tools on robot, programming the robot and operating the robot for provided Part Components in Robotic cell.</p>			

SYLLABUS FOR CORE SKILLS
1. Workshop Calculation & Science (Common for one year course) (80 hours)
2. Engineering Drawing (80 hours)
3. Employability Skills (Common for all CTS trades) (160 hours)

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

List of Tools & Equipment			
Industrial Robotics and Digital Manufacturing Technician (For batch of 20 Candidates)			
S No.	Name of the Tools and Equipment	Specification	Quantity
A. Equipment			
1.	RobotAR1440orequivalent	Robot12 kg Payload,6 Axis	1 No.
2.	Robot GP12orequivalent,	Robot 12kg Payload, 6 Axis for Handling	1 No.
3.	Robot Controller for welding robot		1 No.
4.	Robot Controller for Handling Robot		1 No.
5.	Welding Power Source	Arc welding package	1 No.
6.	Welding Power Source (MotoPAC-WR100)with arc welding package	350ampsshortarcPowerSource	1 No.
7.	Programming Pendant for welding robot and Handling robot	Touch screen pendant with Windows CE operating system and full color 5.7”LCD touch-screen display	1 No.
8.	Standard welding cell with safety fence, fixture, HMI		1 No.
9.	Isolation transformer		1 No.
10.	PLC Panel		1 No.
11.	Welding Table		1 No.
12.	Pick and Place table		1 No.
13.	Input conveyor for palletizing		1 No.
14.	Earthing Cable	6mm Sq.1core Copper cable	1 No.
15.	Robot Power Wiring	10mmSq.4 Core copper cable	1 No.
16.	Robot Power Wiring	4mm Sq.3core copper cable	1 No.
17.	Welding wire, gas hose and gas regulator		1 No.
18.	Piping/Hose pipe up to robot gripper		1 No.
19.	Air Compressor (ELGI or Equivalent)	7.5 Hp	1 No.
20.	Steel rule	30 cm & 60 cm graduated both in English & Metric units	20 Nos.
21.	Micrometer Outside	0 – 50 mm outside	10 Nos.
22.	Vernier Caliper	0- 15 cm	10 Nos.
23.	Micrometer Inside	up to 20 mm	10 Nos.



24.	Hand Gloves	—	10 Nos.
25.	Safety Shoes	—	10 Nos.
26.	Helmet	—	10 Nos.
C. TOOLS & GENERAL SHOP OUTFIT			
27.	“V” block	V-Block pair 7 cm with clamps	10 Nos.
28.	“V” block	V-Block 15 cm with clamps	10 Nos.
29.	Metal L	Metal - L - 15cm	10 Nos.
30.	Metal L	Metal - L - 30cm	10 Nos.
31.	Angle Plate	10 x 20 cm.	10 Nos.
32.	Spirit Level	15 cm metal	10 Nos.
33.	File warding	15 cm smooth	10 Nos.
34.	File knife edge	15 cm smooth	10 Nos.
35.	File cut saw	15 cm smooth	10 Nos.
36.	File feather edge	15 cm smooth	10 Nos.
37.	File triangular	15 cm smooth	10 Nos.
38.	File round	20 cm second cut	10 Nos.
39.	File square	15 cm second cut	10 Nos.
40.	File square	25 cm second cut	10 Nos.
41.	File triangular	20 cm second cut.	10 Nos.
42.	File flat	30 cm second cut.	10 Nos.
43.	File flat	20 cm bastard	10 Nos.
44.	File flat	30 cm bastard.	10 Nos.
45.	File Swiss type	Needle set of 12.	10 Nos.
46.	File half round	25 cm second cut.	10 Nos.
47.	File half round	25 cm bastard.	10 Nos.
48.	File round	30 cm bastard.	10 Nos.
49.	File hand	15 cm second cut.	10 Nos.
50.	Card file.	----	10 Nos.
51.	Oil Stone	15 cm x 5 cm x 2.5 cm	10 Nos.
52.	Pliers combination	15 cm	10 Nos.
53.	Blow Lamp	0.50 liters.	10 Nos.
54.	Spanner	D.E. 6 -26 mm set of 10 pcs.	10 Nos.
55.	Spanner adjustable	15 cm	10 Nos.
56.	Box spanner	Set 6-25 mm set of 8 with Tommy bar.	10 Nos.
57.	Glass magnifying	7 cm	10 Nos.
58.	Clamp toolmaker	5 cm and 7.5 cm set of 2.	10 Nos.
59.	Clamp “C”	5 cm	10 Nos.



60.	Clamp "C"	10 cm	10 Nos.
61.	Scraper flat	15 cm.	10 Nos.
62.	Scraper triangular	15 cm	10 Nos.
63.	Scraper half round	15cm	10 Nos.
64.	Chisel	cold 9 mm cross cut 9 mm diamond.	10 Nos.
65.	Chisel	cold 19 mm flat	10 Nos.
66.	Chisel	cold 9 mm round noze.	10 Nos.
67.	Motorized +Tennon Saw	----	10 Nos.
68.	Hand hammer	1 kg. with handle Ball Peen	10 Nos.
69.	Hacksaw	frame fixed 30 cm.	10 Nos.
70.	Mallets Wooden	----	10 Nos.
71.	V-Block, Files, mallets, screwdrivers, chisels, etc.	----	10 Nos.
72.	Hand Drilling Machine	Rated input power: 600W, Power output: 301W, Rated torque: 1.8 Nm	10 Nos.
73.	Metal Saw	No-Load Speed: 3,800 rpm, Saw blade diameter 355 mm, Saw blade bore 25.4 mm	10 Nos.
74.	Straight Grinder HEAVY DUTY with attachments	No-Load Speed: 10000 – 30000 rpm, Rated power output: 380W	10 Nos.
75.	Professional Air Blower	Power consumption: 820 W, No-load speed: 16000rpm, Flow rate: 0-4.5 m ³ /s	10 Nos.
76.	Jig Saw Portable	Input Power: 900W, No-load speed: 11,000 rpm, Disc Diameter: 100	10 Nos.
77.	Hammer Drill Wired	Drill type: hammer, optimum power transfer	10 Nos.
78.	Hand Held Sander / Polisher	No Load Speed: 11000 rpm	10 Nos.
79.	Digital Dial Torque Wrench	Range: 20 to 280 Nm	10 Nos.
80.	Lifting Tackle/Sling	1 Ton×2mtr	10 Nos.
81.	Impact Wrench	1/2 inch drive	10 Nos.
82.	Laser Light Pen	---	10 Nos.
83.	Surface Plate	Cast iron	10 Nos.
84.	Digital Screw Pitch Gauge	Working voltage: 3.0 V / DC, Measure precision: 0.1 degree	10 Nos.
85.	Laser Distance Measurement Instrument	Levelling Accuracy (Vial): +/- 0.2degree, Measuring Accuracy Typical: +/- 1/16 inch (1.5 mm)	10 Nos.
86.	Palm Scale	Capacity-500gms, Least Count-0.1g	10 Nos.
87.	Allen Screwdriver Wrench Tool	6Pcs T Handle Ball Ended Hex Key	10 Nos.
88.	Universal Quick Adjustable Multi-	Range: 6-32mm	10 Nos.



	function Wrench Spanner		
89.	Double Ended Wrench Hex Socket Spanner	8 In 1, Range: 6-32mm	10 Nos.
Note: - Internet facility is desired to be provided in the class room.			

ANNEXURE- II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in creating the curriculum.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

List of Expert members contributed/ participated for finalizing the course curriculum of Industrial Robotics and Digital Manufacturing Technician.			
S. No.	Name & Designation Sh./Mr./Ms	Organization	Remarks
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2.	Sahil Singla	Tata technologies Ltd, Pune	Industry Expert
3.	Rahul Patki	Tata technologies Ltd	Industry Expert
4.	Gunesh Dhar	Tata technologies Ltd	Industry Expert
5.	Jahir Khatib	Tata technologies Ltd	Industry Expert
6.	Shivanand Nafade	Tata technologies Ltd	Industry Expert
7.	Akshay Narayankar	Tata technologies Ltd	Industry Expert
8.	Tushar Chaudhary	Tata technologies Ltd	Industry Expert
9.	Shiva KrishnaJ	India Pvt. Ltd	Industry Expert
10.	Vijay B Hiremath, Senior Manager	Badve Engineering Ltd., Komal Plast Tech., Plot No. 163/A, Belur Industrial Area, Dharwad- 580011	Industry Expert
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12.	Sunil J, Partner	Modtech Engineering, Plot No. 95, Behind Omex Auto, Bommasandra Jiganl Link Road, Jigini Post, Bengaluru-562105, Karnataka	Industry Expert
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16.	A. Rarhi, DDT	CSTARI, Kolkata	Member
17.	B. Biswas, Training Officer	CSTARI, Kolkata	Member
18.	P.K. Bairagi, TO	CSTARI, Kolkata	Member
19.	R.N. Manna, TO	CSTARI, Kolkata	Member
20.	Bharat Kumar Nigam, TO	CSTARI, Kolkata	Member
21.	K.V.S. Narayana, TO	CSTARI, Kolkata	Member
22.	Himanshu, ADT	CSTARI, Kolkata	Member
23.	B. Sharanappa, ADT	CSTARI, Kolkata	Member
24.	Bhagat Singh, ADT	CSTARI, Kolkata	Member
25.	Vijay Kumar, ADT	CSTARI, Kolkata	Coordinator

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

