

CONTACT DETAILS OF THE BODY SUBMITTING THE QUALIFICATION FILE

Directorate General of Training (DGT)
Government of India, Ministry of Skill Development and Entrepreneurship,
1st and 2nd Floor, CIRTES Building
Next to Pusa ITI, Pusa Campus
New Delhi – 110012.

Name and address of submitting body:

Directorate General of Training (DGT)
Government of India, Ministry of Skill Development and Entrepreneurship,
1st and 2nd Floor, CIRTES Building
Next to Pusa ITI, Pusa Campus
New Delhi – 110012.

Name and contact details of individual dealing with the submission

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List of documents submitted in support of the Qualifications File

1. Competency-based curriculum with following details:

Model Curriculum to be added which will include the following:

1. Indicative list of tools/equipment to conduct the training: Enclosed with curriculum
2. Trainers qualification: Indicated in the curriculum
3. Lesson Plan: All DGT curricula are designed indicating specific practical to be carried out during training along with details of trade theory. Based on this the concerned instructor prepares the Lesson Plan and demonstration plan with support of IMPs developed by NIMI, DGT.
4. Distribution of training duration into theory/practical Indicated in the curriculum.

2. Curriculum for Core Skills (Employability Skills).

NSQC Approved

- SUMMARY

1	Qualification Title	'TECHNICIAN MECHATRONICS'
2	Qualification Code, if any	DGT/2001
3	NCO code and occupation	7233.0100 - Fitter, General 7233.0101 - General Maintenance Fitter-Mechanical 7412.0101 - Automation Specialist 7412.0201 - Fitter-Electrical and Electronic Assembly 7411.0100 - Electrician, General 7421.0300 - Electronics Mechanic
4	Nature and purpose of the qualification (Please specify whether qualification is short term or long term)	Prepare skilled Technician to undertake the job roles of Technician Mechatronics and will enable the trainee to assist design, development and engineering staff etc. to install, maintain, modify and repair Mechatronics systems, equipment and component parts in factories etc. It is a long term qualification.
5	Body/bodies which will award the qualification	Directorate General of Training (DGT).
6	Body which will accredit providers to offer courses leading to the qualification	Directorate General of Training (DGT) accredits the Training providers (ITIs/ NSTIs/ MSTIs/ BTCs/ BTPs / Industries / Establishments).
7	Whether accreditation/affiliation norms are already in place or not , if applicable (if yes, attach a copy)	Yes. The accreditation/ affiliation norms and any amendments made from time to time are available on DGT web portal.
8	Occupation(s) to which the qualification gives access	<ul style="list-style-type: none"> Fitter, General General Maintenance Fitter- Mechanical Automation Specialist Fitter-Electrical and Electronic Assembly Electrician, General Electronics Mechanic
9	Job description of the occupation	Technician Mechatronics will be able to fit and assemble parts and sub-assemblies, manufacture, install, modify, repair and fault-find hydraulic and pneumatic equipment and systems, Inspect machinery and make

NSQF QUALIFICATION FILE

Approved in 22th NSQC Meeting-NCVET-25th August 2022

Technician Mechatronics

		repairs. The learner is responsible to set up and adjust machines and equipment, operate machines to produce parts and components etc.																										
10	Licensing requirements	NOT REQUIRED																										
11	Statutory and Regulatory requirement of the relevant sector (documentary evidence to be provided)	NOT APPLICABLE																										
12	Level of the qualification in the NSQF	Level 4																										
13	Anticipated volume of training/learning required to complete the qualification	<table border="1"> <thead> <tr> <th rowspan="2">S No</th> <th rowspan="2">Course Element</th> <th colspan="2">Notional Training Hours</th> </tr> <tr> <th>1st Year</th> <th>2nd Year</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Professional Skill (Trade Practical)</td> <td>840</td> <td>840</td> </tr> <tr> <td>2</td> <td>Professional Knowledge (Trade Theory)</td> <td>240</td> <td>300</td> </tr> <tr> <td>3</td> <td>Employability Skills</td> <td>120</td> <td>60</td> </tr> <tr> <td></td> <td>Total</td> <td>1200</td> <td>1200</td> </tr> <tr> <td></td> <td>On the Job Training (OJT)/ Group Project</td> <td>150</td> <td>150</td> </tr> </tbody> </table>	S No	Course Element	Notional Training Hours		1 st Year	2 nd Year	1	Professional Skill (Trade Practical)	840	840	2	Professional Knowledge (Trade Theory)	240	300	3	Employability Skills	120	60		Total	1200	1200		On the Job Training (OJT)/ Group Project	150	150
S No	Course Element	Notional Training Hours																										
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1	Professional Skill (Trade Practical)	840	840																									
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	Total	1200	1200																									
	On the Job Training (OJT)/ Group Project	150	150																									
14	Indicative list of training tools required to deliver this qualification	As per Annexure I of curriculum.																										
15	Entry requirements and/or recommendations and minimum age	Passed 10th class examination with Science and Mathematics or with vocational subject in same sector or its equivalent. Minimum age 14 years as on first day of academic session.																										
16		An Individual can proceed for:																										

	Progression from the qualification (Please show Professional and academic progression)	Professional <ul style="list-style-type: none"> ● Mechatronics Technician ● Senior Technician ● Supervisor ● Manager ● Entrepreneur 	Technical / Academic ATS Diploma/ CITS Advance Diploma (Vocational)	
17	Arrangements for the Recognition of Prior learning (RPL)	Yes (For more details refer “Guidelines for Private candidate” in DGT website MIS portal).		
18	International comparability where known (research evidence to be provided)	---		
19	Date of planned review of the qualification.	3 Yrs from the Date of Approval		
20	Formal structure of the qualification			
	Mandatory components			
	Title of component and identification code/NOSs/ Learning Outcomes	Estimated size (learning hours)		Level
		SKILL	KNOWLEDGE	
TRADE SPECIFIC				
(i)	Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy following safety precautions. [Basic fitting operation – Filing, Marking, Hack sawing, Drilling, Taping, chipping and Grinding etc. Accuracy: ± 0.1mm] (Mapped NOS: CSC/N9452)	120	20	4
(ii)	Perform different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality. [Different Fit –Open & Square Fit;	45	10	4

	Required tolerance: ± 0.05 mm] (Mapped NOS: CSC/N9453)			
(iii)	Produce components involving different operations on Lathe, Milling and Grinding machines observing standard procedure and check for accuracy. (Different Operations –facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, threading (external ‘V’ only), plain milling, step milling, grooving, slot milling, profile milling, surface grinding and cylindrical grinding (internal and external)) (Mapped NOS: CSC/N9454)	160	25	4
(iv)	Perform different computer operation and trouble shoot. [Different computer operations: setting of computer & MS Office operation] (Mapped NOS: CSC/N9455)	45	10	4
(v)	Perform joining of metals by welding and brazing observing standard procedure. (Mapped NOS: CSC/N9456)	45	10	4
(vi)	Construct different electrical sub-systems and measure parameters. [Different electrical sub-systems: - AC/DC Motors, DC machine, DC motors, DC motor starter, Universal motor, Induction motor, AC drive, Servo drive, transformer.] (Mapped NOS: CSC/N9457)	80	15	4
(vii)	Construct different electronics sub system and test electronic devices and sub system. [Different sub system: - Diodes, rectifier circuit, voltage regulator, transistor power electronic devices, op-amp circuit, LED circuit, SCR etc.] (Mapped NOS: CSC/N9458)	80	15	4
(viii)	Estimate and perform panel wiring using cables, connectors, Protective devices and test functionality. (Mapped NOS: CSC/N9459)	60	12	4
(ix)	Construct and verify different Digital Logic Circuits. (Different DLC :- Logic Gates, half & full adder, binary & outer, P/down counter). (Mapped NOS: CSC/N9460)	45	10	4

NSQF QUALIFICATION FILE

Approved in 22th NSQC Meeting-NCVET-25th August 2022

Technician Mechatronics

(x)	Install different software in computer system and test. [Different software: Office, Multimedia, Fluidism, PLC, etc.] (Mapped NOS: CSC/N9461)	25	7	4
(xi)	Write an assembly level programme and interface peripherals to 8051 Microcontroller to check functioning. (Mapped NOS: CSC/N9462)	45	10	4
(xii)	Troubleshoot and repair different Electrical, Electronic systems/ devices. [Different Electrical, Electronic systems/ devices:- Fuse, MCB, Power circuit, Control panel, Circuit Breaker, Stabilizer, AC/DC drives.] (Mapped NOS: CSC/N9463)	45	10	4
(xiii)	Demonstrate function of different sensors. [Different sensors: Proximity Sensors, inductive sensor, capacitive sensor, magnetic sensor, Reflex Photoelectric Sensors, Temperature Sensors, etc.] (Mapped NOS: CSC/N9464)	45	10	4
(xiv)	Read and apply engineering drawing for different application in the field of work. (CSC/N9401)	-	40	4
(xv)	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study (CSC/N9402)	-	36	4
(xvi)	Set (both job and tool) CNC turn centre and milling machine to produce simple components as per drawing. (Mapped NOS: TSC/N5702, TSC/N9015)	90	27	4
(xvii)	Construct simple pneumatic control system to measure various parameters using transducer, sensor and switches. [Various parameter: pressure, flow, level of oil, load displacement] (Mapped NOS: TSC/N9015)	25	8	4
(xviii)	Check various components of pneumatics system and construct pneumatic circuit to check functionality. (Mapped NOS: TSC/N9015)	45	14	4

NSQF QUALIFICATION FILE**Approved in 22th NSQC Meeting-NCVET-25th August 2022***Technician Mechatronics*

(xix)	Construct an electro-pneumatic circuit and check functionality of a process. [E.g.-process: Automatic braking system.] (Mapped NOS: CSC/N9465)	25	8	4
(xx)	Install an electro-pneumatic system and trouble shoot faults. (Mapped NOS: CSC/N9466)	45	14	4
(xxi)	Construct simple hydraulic circuit and check functionality. (Mapped NOS: CSC/N9467)	25	8	4
(xxii)	Demonstrate installation of accessories in hydraulic system and trouble shoot defects. (Mapped NOS: CSC/N9468)	25	8	4
(xxiii)	Construct hydraulic circuit; verify various processes to assess functioning of valves and auxiliaries. [Various processes: - speed control, lub system, press control etc.] (Mapped NOS: CSC/N9469)	45	14	4
(xxiv)	Install hydraulic pump, motors and carryout maintenance of these components. (Mapped NOS: TSC/N5702, TSC/N5703, TSC/9015)	25	8	4
(xxv)	Construct different hydraulic system and operate to achieve desired functions. [Different hydraulic system:- Clamp control, injection control, reciprocating screw, oil filtration, hydraulic press control, accumulator control.] (Mapped NOS: CSC/N9470)	45	14	4
(xxvi)	Programme PLC and interface with other devices to check its Applications. (Mapped NOS: CSC/N9471).	75	20	4
(xxvii)	Explain robot anatomy and perform programming robot using teach box, software. (Mapped NOS: CSC/N9472)	45	14	4
(xxviii)	Simulate the electrical circuits on simulation software and detect fault as per diagnostic procedure for Electrical system design. (Mapped NOS: CSC/N9473)	45	14	4
(xxix)	Simulate the electronic circuits on simulation software and detect fault as per diagnostic procedure for Electronics	65	18	4

	system design. (Mapped NOS: CSC/N9474).			
(xxx)	Simulate the Hydraulic and Pneumatic circuit on simulation software and detect fault as per diagnostic procedure for Hydraulics and Pneumatics system design. (Mapped NOS: CSC/N9475)	75	20	4
(xxxi)	Perform project work on Mechatronics (Project-“Pick and Place Mechatronics system” involving Fitting, Drilling, Turning, Milling, Grinding, Electrical wiring, programming, Hydraulic circuit assembly, Pneumatic circuit assembly, Drives, system assembly and Interfacing, functional testing, trouble shooting and repair. Safety measures in each stage) (Mapped NOS: CSC/N9476)	140	35	4
(xxxii)	Read and apply engineering drawing for different application in the field of work. (Mapped NOS: CSC/N9401)	-	40	4
(xxxiii)	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Mapped NOS: CSC/N9402)	-	16	4
CORE SKILL				
EMPLOYABILITY SKILL				
i)	Introduction to Employability Skills	-	180	-
ii)	Constitutional values - Citizenship	-		-
iii)	Becoming a Professional in the 21st Century	-		-
iv)	Basic English Skills	-		-
v)	Career Development & Goal Setting	-		-
vi)	Communication Skills	-		-
vii)	Diversity & Inclusion	-		-
viii)	Financial and Legal Literacy	-		-
ix)	Essential Digital Skills	-		-

x)	Entrepreneurship	-		-
xi)	Customer Service	-		-
xii)	Getting Ready for Apprenticeship & Jobs	-		-
	Total		2400	-
	OJT/Group Project		300	

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SECTION 1
ASSESSMENT

21	<p>Body/Bodies which will carry out assessment: Controller of Examinations, DGT</p>
22	<p>How will RPL assessment be managed and who will carry it out? DGT will carry out the RPL assessment following the below mentioned eligibility criteria for Trainee: Applicants aspiring to appear as Private Candidates in the AITT under CTS for award of NTC, have been categorized based on their educational background and experience. Subsequently 'Private Candidates' may be admitted under one of the following categories. Category wise 'eligibility criteria' for appearing as 'Private Candidate' in AITT under CTS has been listed below: Category I: Ex-trainees (successful pass-outs) of ITI A. Ex-trainees of ITI who already possess NTC in one of the trades under CTS, are eligible for applying as Private candidate for an allied trade, provided he/ she fulfils all the conditions regarding educational qualification etc. prescribed for that allied trade. B. In addition, the applicant should possess minimum of 1 year experience (as on date of submission of application) post the date of AITT result declaration in the desired allied trade in establishments implementing Apprenticeship Training Scheme (ATS)/ establishments registered under the Apprenticeship portal or registered MSMEs or Entities registered with any government/local authorities / shops covered under Factories Act 1948 and Shops and Establishments Act applicable for the concerned State. Category II: 'Ex-trainees (successful pass-outs) and current trainees under CoE scheme A. The applicant should have the minimum prescribed entry qualification and should fulfil eligibility criteria for the desired trade under CTS, in which he/she intends to appear for AITT as Private Candidate. CoE candidates must register as 'Private Candidate' under CTS in the relevant/mapped CTS trade only. B. There should be a minimum gap of 1 year between successful completions of CoE training i.e. from the date of result declaration to the date of submission of application for 'Private Candidate' certification. C. During this gap of 1 year, the candidate must have undergone Industry training or gained experience in desired trade in establishments implementing Apprenticeship Training Scheme (ATS)/ establishments registered under the Apprenticeship portal or registered MSMEs or Entities registered with any government/local authorities / shops covered under</p>

	<p>Factories Act 1948 and Shops and Establishments Act applicable for the concerned State.</p> <p>Category III: SCVT Candidates (admitted till August 2018 session) A. No special provisions have been made for SCVT Trainees to enrol as 'Private Candidate'. Going forward, SCVT trainees have been granted equivalence vide G.S.R 186(E) dated 2nd March 2017 for undergoing apprenticeship training under the Apprentices Act 1961 to obtain 'NAC'. B. Only for SCVT trainees admitted till August 2018 batch, provision has been made for obtaining NTC by appearing in AITT under 'Private Candidate'. Such trainees will continue to be governed by old guidelines for 'Private Candidate'.</p> <p>Category IV: Other Candidates (candidate not falling in any of the above 3 categories, including SCVT trainees enrolled from admission session 2019 onwards) A. The applicant should have the minimum prescribed entry qualification and should fulfil eligibility criteria for the relevant trade under CTS, in which he/she desires to appear for AITT as Private Candidate. B. Applicant should be minimum 21 years of age on the date of submission of application. There is no upper age limit. C. The applicant should possess minimum of 3 years' experience (on the date of submission of application) in the relevant trade in establishments implementing Apprenticeship Training Scheme (ATS)/ establishments registered under the Apprenticeship portal or registered MSMEs or Entities registered with any government/local authorities / shops covered under Factories Act 1948 and Shops and Establishments Act applicable for the concerned State. For detail and updated information please refer to DGT web portal.</p>
<p>23</p>	<p>Describe the overall assessment strategy and specific arrangements which have been put in place to ensure that assessment is always valid, reliable and fair and show that these are in line with the requirements of the NSQF.</p> <p>(1) Assessment process: The assessment for the qualification is carried out by conducting formative assessments, and end of year examinations (Summative). The formative assessments in respect of each Learning Outcome for practical and related theory are conducted by the concerned instructors for evaluating the knowledge and skill acquired by trainees and the behavioural transformation of the trainees. This formative assessment is primarily carried out by</p>

collecting evidence of competence gained by the trainees by evaluating them at work based on assessment criteria, asking questions and initiating formative discussions to assess understanding and by evaluating records and reports. Summative assessment is carried out by All India Trade Test on Trade Theory, Trade practical and Employability Skills. The question papers for the theory Examinations contain objective type questions.

The marking pattern and distribution of marks for the qualification are as under:

Marking Pattern				
Sl. No.	Type of assessment	Subject for the trade test	Marks for the 1st Year	Marks for the 2nd Year
1	Summative Assessment	Practical	250	250
2		Trade Theory	100	100
3		Employability Skills	50	50
6	Formative assessment based on Learning Outcomes		200	200
TOTAL:			600	600

(2) Minimum pass marks:

The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects 33%.

Testing and certifications for the course:

Controller of examinations, DGT carries out the assessment and issues National Trade Certificate (NTC) following the norms and guidelines issued by the Directorate from time to time.

Overall assessment strategy:

Assessment of the qualification evaluates trainees to show that they can integrate knowledge, skills and values for carrying out relevant tasks as per the defined learning outcomes and assessment criteria. The trainees may choose the preferred language for assessment. The underlying principle of assessment is fairness and transparency. While assessing the trainee, assessor is directed to assess as per the defined assessment criteria against the learning outcomes. The evidence of the competence acquired by the trainees can be obtained by conducting theory and practical examinations, observing the trainees at work, asking questions and initiating discussions to assess, understand and evaluate records and reports. The ultimate objective of the assessment is to assess the candidates as per the defined assessment criteria for the learning outcomes.

Specific Arrangements for assessment:

- Assessment is outcome-based.
- There are formative and summative assessments in Theory and Practical.
- Assessment is carried out in Trade theory, Trade Practical, and Employability Skills.
- While Trade Theory and Trade Practical are used for assessing Trade-related jobs, Workshop Calculation and Science is used to test trainee's numerical and logical skills, Drawing is used to test the ability of the trainee to draw and read sketches and Employability skills is used to test the communication, professional language, leadership, entrepreneurship and team-work abilities of the trainee.
- In addition to demonstration of theory and practical knowledge, trainees get a chance to present total personality.

Quality assurance activities:

Question papers are set by external paper setters / software generated.
Evaluation of Theory Examinations in Trade and Employability Skill is done by third-party agency.
Trade Practical is examined by External Examiner.

24. Assessment evidences

Title of Component: Formative Assessment Breakup

(on half yearly average of the learning assessment covered)

Means of assessment

Assessment will be evidence based comprising the following for each Learning Outcome:

Serial No.	Terminal Competency	Maximum Weightage (%)
1	Safety consciousness	15
2	Workplace hygiene	5
3	Attendance/ Punctuality	10
4	Ability to follow Manuals/ Written instructions	5
5	Application of Knowledge	10
6	Skills to handle tools / equipment/ Instruments/ Devices	10
7	Economical use of materials	5
8	Working Strategy	10
9	Quality in workmanship/ Performance	15
10	VIVA	15
	Total Maximum Weightage (%)	100

Pass/Fail

The minimum pass percentage is 60% marks for formative assessment.

ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
FIRST YEAR	
1. Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy following safety	Plan and Identify tools, instruments and equipment for marking and make this available timely.
	Select raw material and visual inspection for defects.
	Mark as per specification applying desired mathematical calculation and observing standard procedure.
	Identify Hand Tools for different fitting operations and make these available timely.

<p>precautions. [Basic fitting operation – Filing, Marking, Hack sawing, Drilling, Taping, chipping and Grinding etc. Accuracy: $\pm 0.1\text{mm}$] (CSC/N9452)</p>	Prepare the job for Hacksawing, chiselling, filing.
	Perform basic fitting operations viz., Hacksawing, filing and Chipping of close tolerance as per specification to make the job.
	Observe safety procedure during above operations as per standard norms and guidelines.
	Measure and Check all dimensions of the work pieces as per standard procedure in accordance with specifications and tolerances.
	Identify unused materials and components for storing in an appropriate environment and prepare for disposal.
<p>2. Perform different fit of components for assembling as per required tolerance observing principle of interchangeability and check for functionality. [Different Fit –Open & Square Fit; Required tolerance: $\pm 0.05\text{ mm}$] (CSC/N9453)</p>	Recognize general concept of Limits, Fits and tolerances necessary for fitting applications and functional application of these parameters.
	Plan and Identify tools, instruments and equipment for workpiece and make this available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.
	Demonstrate possible solutions and agree tasks within the team.
	Make components according to the specification for different fits using a range of practical skills including scraping and ensuring interchangeability of different parts.
	Measure the components using Vernier, Micrometer and Height gauge.
	Assemble components applying a range of skills to ensure proper fit.
	Check functionality of components.
<p>3. Produce components involving different operations on Lathe, Milling and Grinding machines observing standard procedure and check for accuracy. (Different Operations – facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, threading (external ‘V’ only), plain milling, step milling, grooving, slot milling, profile milling,</p>	Ascertain basic working principles and safety aspects of machines.
	Understand functional application of different levers, stoppers, adjustment etc.
	Identify different lubrication points and lubricants, their usage for application in machines as per machine manual.
	Identify different work and tool holding devices and collect information for functional application of each device.
	Mount the work and tool holding devices with required alignment and check for its functional usage to perform machining operations.
	Solve problem by applying basic methods, tools, materials and information during setting.
	Observe safety procedure during mounting as per standard norms.
	Produce components observing standard procedure.

<p>surface grinding and cylindrical grinding (internal and external) (CSC/N9454)</p>	<p>Check accuracy/ correctness of job using appropriate equipment/gauge.</p>
	<p>Identify unused materials and components for storing in an appropriate environment and prepare for disposal.</p>
<p>4. Perform different computer operation and trouble shoot. [Different computer operations: setting of computer & MS Office operation] (CSC/N9455)</p>	<p>Collect relevant information to operate and trouble shoot computer.</p>
	<p>Set the computer and carryout basic computer related operation using MS Office.</p>
	<p>Conduct basic trouble shooting of PC.</p>
<p>5. Perform joining of metals by welding and brazing observing standard procedure. (CSC/N9456)</p>	<p>Plan and select the type & size of electrode, welding current, nozzle size, working pressure type of flame, filler rod and flux as per requirement as per process requirement.</p>
	<p>Prepare edge as per requirement.</p>
	<p>Prepare, set SMAW machine/Gas welding plant and tack the pieces as per drawing.</p>
	<p>Set up the tacked pieces in specific position.</p>
	<p>Deposit the weld maintaining appropriate arc length, electrode angle, welding speed, weaving technique / Braze the joint adapting proper brazing technique and safety aspects.</p>
	<p>Clean the welded joint thoroughly.</p>
	<p>Carry out visual inspection for appropriate weld joint & check by gauges.</p>
<p>2. Construct different electrical sub-systems and measure parameters. [Different electrical sub-systems: - AC/DC Motors, DC machine, DC motors, DC motor starter, Universal motor, Induction motor, AC drive, Servo drive, transformer.] (CSC/N9457)</p>	<p>Plan and identify tools, instruments and equipment for the work and make it available timely.</p>
	<p>Set up workplace/ assembly location with due consideration to operational stipulation.</p>
	<p>Plan work in compliance with standard safety norms and collecting desired information.</p>
	<p>Demonstrate possible solutions and agree tasks within the team.</p>
<p>3. Construct different electronics sub system and test electronic devices and sub system. [Different sub system: - Diodes, rectifier circuit,</p>	<p>Plan and identify tools, instruments and equipment for the work and make it available timely.</p>
	<p>Set up workplace/ assembly location with due consideration to operational stipulation.</p>
	<p>Plan work in compliance with standard safety norms and collecting desired information.</p>

<p><i>voltage regulator, transistor power electronic devices, op-amp circuit, LED circuit, SCR etc.] (CSC/N9458)</i></p>	Demonstrate possible solutions and agree tasks within the team.
	Construct different electronics subsystem test electronics devices and subsystems.
<p>4. Estimate and perform panel wiring using cables, connectors, Protective devices and test functionality. (CSC/N9459)</p>	Plan and estimate material requirement for panel wiring.
	Identify tools equipment for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.
	Perform panel wirings.
<p>5. Construct and verify different Digital Logic Circuits. [Different DLC:- Logic Gates, half & full adder, binary & outer, P/ down counter.] (CSC/N9460)</p>	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Construct and verify digital logic circuits.
<p>6. Install different software in computer system and test. [Different software: Office, Multimedia, Fluidism, PLC, etc.] (CSC/N9461)</p>	Identify different components/ parts of PC.
	Collect relevant information for installing software.
	Check operation of computers.
	Install software in the computer and check its functioning.
<p>7. Write an assembly level programme and interface peripherals to 8051 Microcontroller to check functioning. (CSC/N9462)</p>	Write Basic Assembly language Programming.
	Interface peripherals to 8051 Microcontroller.
	Check the functioning as per programme.
<p>8. Troubleshoot and repair different Electrical, Electronic systems/ devices. [Different Electrical, Electronic systems/ devices:- Fuse, MCB, Power circuit, Control panel, Circuit Breaker, Stabilizer,</p>	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Plan work in compliance with standard safety norms and collecting desired information.
	Demonstrate possible solutions and agree tasks within the team.
	Trouble shoot and repair electrical & electronics system/ devices observing safety procedure.
	Check the functionality of the system.

AC/DC drives.] (CSC/N9463)	
9. Demonstrate function of different sensors. [Different Proximity Sensors, inductive sensor, capacitive sensor, magnetic sensor, Reflex Photoelectric Sensors, Temperature Sensors, etc.] (CSC/N9464)	Demonstrate the Behaviour of Proximity Sensors and ultra sonic sensors and logic operation of sensors. Limits and level control using sensors. Interfacing of sensors with electrical actuators.
14. Read and apply engineering drawing for different application in the field of work. (CSC/N9401)	Read & interpret the information on drawings and apply in executing practical work. Read & analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (CSC/N9402)	Solve different mathematical problems Explain concept of basic science related to the field of study
SECOND YEAR	
16. Set (both job and tool) CNC turn centre and milling machine to produce simple components as per drawing (TSC/N5702, TSC/N9015)	Operation of CNC machine in different Modes [JOG, MPG, MDI, EDIT, AUTO]. Operation of CNC machine using G codes and M codes, Measure offset –Work and Tool Offset for Turning and Milling. Tool Path simulation for Turning and Milling. Working on tool handling and work handling:-Methods of mounting Tool and work –use of cutting tool as per material and tool cutter compensation. Program Preparation and Practice on Plain, step and taper turning, Face Milling and Step Milling. Check for dimensional accuracy of job using appropriate gauges and measuring instruments.
17. Construct simple pneumatic control	Plan and identify tools, instruments and equipment for the work and make it available timely.

system to measure various parameters using transducer, sensor and switches. [Various parameter: pressure, flow, level of oil, load displacement] (TSC/N9015)	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.
	Construct pneumatic control system as per design/ application requirement.
	Measure various parameters as per the set up.
	Record data as per standard format/ designed chart.
18. Check various components of pneumatics system and construct pneumatic circuit to check functionality. (TSC/N9015)	Identify various components of pneumatic system and check their functionality.
	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.
	Construct pneumatic circuits and check their functionality.
19. Construct an electro-pneumatic circuit and check functionality of a process. [E.g.-process: Automatic braking system.](CSC/N9465)	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.
	Construct electro-pneumatic circuit as per design/ application requirement.
	Check the functioning of processes as per desired requirement.
20. Install an electro-pneumatic system and trouble shoot faults. (CSC/N9466)	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.
	Construct and Install electro-pneumatic system as per design/ application requirement.
	Check the functioning of system as per desired requirement.
	Troubleshoot the faults during functioning.
21. Construct simple hydraulic circuit and check functionality. (CSC/N9467)	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.

	Construct simple hydraulic circuit as per design/ application requirement.
	Check the functionality of the circuit.
22. Demonstrate installation of accessories in hydraulic system and troubleshoot defects. (CSC/N9468)	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.
	Demonstrate the possible solution and agree tasks within the team.
	Install accessories in hydraulic system as per design/ application requirement.
	Check the functioning of system as per desired requirement.
	Troubleshoot the faults during functioning.
23. Construct hydraulic circuits; verify various processes to assess functioning of valves and auxiliaries. [Various processes:- speed control, flow control, lub system, press control etc.] (CSC/N9469)	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.
	Construct hydraulic circuit as per design/ application requirement.
	Verify processes to ascertain functioning of valves and auxiliaries.
24. Install hydraulic pump, motors and carryout maintenance of these components. (TSC/N5702, TSC/N5703, TSC/9015)	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.
	Install hydraulic pump & motors as per design/ application requirement.
	Check the functioning of system as per desired requirement.
	Carryout maintenance of these components during non-functioning.
25. Construct different hydraulic system and operate to achieve desired functions. [Different hydraulic system: - Clamp control,	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.

<i>injection control, reciprocating screw, oil filtration, hydraulic press control, accumulator control.] (CSC/N9470)</i>	Demonstrate the possible solution and agree tasks within the team.
	Construct hydraulic system as per design/ application requirement.
	Operate to verify functioning of hydraulic system.
26. Programme PLC and interface with other devices to check its Applications. (CSC/N9471)	Programme a PLC as per application requirement.
	Interface PLC with other devices observing standard procedure and safety.
	Check the functionality of device as per programme.
27. Explain robot anatomy and perform programming robot using teach box, software. (CSC/N9472)	Explain anatomy of robot.
	Collect relevant information to programme robot via teach box, software.
	Programme robot via teach box, software.
	Test functionality.
28. Simulate the electrical circuits on simulation software and detect fault as per diagnostic procedure for Electrical system design. (CSC/N9473)	Develop electrical circuit as per desired application.
	Assemble and test Electrical Circuit on simulation software.
	Detect fault observing diagnostic procedure and rectify using simulation software.
	Rectify by resetting errors using simulation software.
29. Simulate the electronic circuits on simulation software and detect fault as per diagnostic procedure for Electronics system design. (CSC/N9474)	Develop electronic circuit as per desired application.
	Assemble and test Electronic Circuit on simulation software.
	Detect fault observing diagnostic procedure and rectify using simulation software.
	Rectify by resetting errors using simulation software.
30. Simulate the Hydraulic and Pneumatic circuit on simulation software and detect fault as per diagnostic procedure for Hydraulics and Pneumatics system design. (CSC/N9475)	Develop Hydraulic and Pneumatic circuit as per desired application.
	Assemble and test Hydraulic and Pneumatic circuit on simulation software.
	Detect fault observing diagnostic procedure and rectify using simulation software.
	Rectify by resetting errors using simulation software.
31. Perform project work on Mechatronics (<i>Project- "Pick and Place</i>	Manufacture and assemble Mechanical sub system.
	Prepare Pneumatic circuit and interface.
	Prepare Electrical/Electronic circuit and interface.

<p><i>Mechatronics system” involving Fitting, Drilling, Turning, Milling, Grinding, Electrical wiring, programming, Hydraulic circuit assembly, Pneumatic circuit assembly, Drives, system assembly and Interfacing, functional testing, trouble shooting and repair. Safety measures in each stage)</i> (CSC/N9476)</p>	<p>Develop and download PLC program.</p>
	<p>Integrate, Test and Repair for functionality.</p>
<p>32. Read and apply engineering drawing for different application in the field of work (CSC/N9401)</p>	<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>
<p>33. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (CSC/N9402)</p>	<p>Solve different mathematical problems</p>
	<p>Explain concept of basic science related to the field of study</p>

EMPLOYABILITY SKILLS (CORE SKILL)	
LEARNING OUTCOME	ASSESSMENT CRITERIA
1. Introduction to Employability Skills	Outline the importance of Employability Skills for the current job market and future of work
	List different learning and employability related GOI and private portals and their usage
	Research and prepare a note on different industries and the available opportunities
2. Constitutional values - Citizenship	Explain the essential civic rights and duties required to be followed to become a responsible citizen
	Discuss the role of personal values and ethics in personal and social development
	Identify and practice different environmentally sustainable practices
3. Becoming a Professional in the 21st Century	Discuss relevant 21st century skills required for employment
	Highlight the importance of practicing 21st century skills like Self-Awareness, Behavior Skills, Positive attitude, self-motivation, problem solving, and time management skills in personal or professional life
	Create a pathway for adopting a learning mindset for personal and professional development
4. Basic English Skills	Use appropriate grammar and sentences while interacting with others
	Read English text with appropriate articulation
	Role play a situation on how to talk appropriately to a customer in English, over the phone or in person
	Write a short note/paragraph / letter/e-mail using correct English
5. Career Development & Goal Setting	Research and identify trends and different skills required to match the current market requirement for a job
	Create a career development plan with well-defined short- and long-term goals
6. Communication Skills	Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette
	Write a short note/paragraph on a familiar topic
	Explain the importance of communication etiquette including active listening for effective communication
	Role play a situation on how to work collaboratively with others in a team

7. Diversity and Inclusion	Exhibit how to behave, communicate and conduct oneself appropriately with all genders and PwD
	Discuss the POSH Act and its significance
8. Financial and Legal Literacy	Discuss various financial institutions, products, and services
	Demonstrate how to carry out offline and online financial transactions, safely and securely and check passbook/statement
	Explain the common components of salary such as Basic, PF, Allowances (HRA, TA, DA, etc.), tax deductions
	Calculate income and expenditure for budgeting
	Discuss the legal rights, laws, and aids
9. Essential Digital Skills	Describe the role of digital technology in day-to-day life and the workplace
	Demonstrate how to operate digital devices and use the associated applications and features, safely and securely
	Demonstrate how to connect devices securely to internet using different means
	Follow the dos and don'ts of cyber security to protect against cyber crimes
	Discuss the significance of displaying responsible online behaviour while using various social media platforms
	Create an e-mail id and follow e- mail etiquette to exchange e -mails
	Show how to create documents, spreadsheets and presentations using appropriate applications
10. Entrepreneurship	Describe the types of entrepreneurship and enterprises
	Discuss the process of identifying opportunities for potential business and relevant regulatory and statutory requirements
	Describe the 4Ps of Marketing-Product, Price, Place and Promotion and apply them as per requirement
	Create a sample business plan, for the selected business opportunity
	Discuss various sources of funding and identify associated financial and legal risks with its mitigation plan
11. Customer Service	Describe different types of customers
	Role play a situation on how to identify customer needs and respond to them in a professional manner
	Explain various tools used to collect customer feedback
	Draft a professional Curriculum Vitae (CV)

12. Getting ready for apprenticeship & Jobs	Use various offline and online job search sources such as employment exchanges, recruitment agencies, and job portals respectively
	Demonstrate how to apply to identified job openings using offline /online methods as per requirement
	Discuss the significance of maintaining hygiene and dressing appropriately
	Discuss how to prepare for an interview
	Role play a mock interview
	List the steps for searching and registering for apprenticeship opportunities

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SECTION 2

25. EVIDENCE OF LEVEL

OPTION A

Title/Name of qualification/component: TECHNICIAN MECHATRONICS			Level: 4
NSQF Domain	Outcomes of the Qualification/Component	How the outcomes relates to the NSQF level descriptors	NSQF Level
Process	<p>Requires Well Developed Skill</p> <ul style="list-style-type: none"> Plan and organize the work to make job as per specification applying different types of basic fitting operation and check for dimensional accuracy following safety precautions. <i>[Basic fitting operation – Filing, Marking, Hack sawing, Drilling, Taping, chipping and Grinding etc. Accuracy: $\pm 0.1mm$]</i> Perform different fit of components for assembling as per required tolerance observing principle of interchangeability and check for functionality. <i>[Different Fit –Open & Square Fit; Required tolerance: $\pm 0.05 mm$]</i> <p>Clear choice of procedures in familiar context</p> <ul style="list-style-type: none"> Perform different computer operation and troubleshoot. <i>[Different computer</i> 	<p>The learner requires to demonstrate well developed skill for example ‘Plan and organize the work to make job as per specification applying different types of basic fitting operation and check for dimensional accuracy following safety precautions. <i>[Basic fitting operation – Filing, Marking, Hack sawing, Drilling, Taping, chipping and Grinding etc. Accuracy: $\pm 0.1mm$]</i>’ and ‘Perform different fit of components for assembling as per required tolerance observing principle of interchangeability and check for functionality. <i>[Different Fit –Open & Square Fit; Required tolerance: $\pm 0.05 mm$]</i>. One needs to perform complex set of activities for these outcomes with developed skill to give the required outcome.</p> <p>The learner requires applying clear choice of procedures in familiar context for example ‘Perform joining of metals by welding and brazing observing standard procedure’. The learner has to apply one's knowledge and decide what needs to be done to either meet the client's requirement or identify and</p>	4

Title/Name of qualification/component: TECHNICIAN MECHATRONICS			Level: 4
NSQF Domain	Outcomes of the Qualification/Component	How the outcomes relates to the NSQF level descriptors	NSQF Level
	<p><i>operations: setting of computer & MS Office operation]</i></p> <ul style="list-style-type: none"> Perform joining of metals by welding and brazing observing standard procedure. 	<p>fault and decide how to rectify it to ensure good operation of the automated systems for the industry.</p> <p>Hence NSQF Level is 4 for this descriptor.</p>	
Professional knowledge	<p>Knowledge of facts in the field of work or study</p> <ul style="list-style-type: none"> Measuring Instruments – purpose –Function- types – Calculation of Least count of :- Vernier Caliper, Micro meter, height gauge, Vernier bevel protector and Sine bar). Pedestal Grinding Machine- Constructional features- working principle-Purpose-function – uses and applications. <p>Knowledge of Principles and general concepts in the field of work or study</p> <ul style="list-style-type: none"> Concept of current, voltage, resistance, electric charge, current density and Power and energy. Basic Electronic components (active and passive) and its symbols. 	<p>The learner requires to demonstrate knowledge of facts, principles, processes and general concepts, in the field of work or study which involves ‘Concept of current, voltage, resistance, electric charge, current density and Power and energy’, ‘Basic Electronic components (active and passive) and its symbols’ and ‘Grinding-Surface grinding machine- Constructional features-working principle-Purpose - functions, types, machine elements and uses of accessories, machine calculation and method of Surface Grinding operations’.</p> <p>Hence NSQF Level is 4 for this descriptor.</p>	4

Title/Name of qualification/component: TECHNICIAN MECHATRONICS			Level: 4
NSQF Domain	Outcomes of the Qualification/Component	How the outcomes relates to the NSQF level descriptors	NSQF Level
	<p>Knowledge of processes in the field of work or study</p> <ul style="list-style-type: none"> Grinding-Surface grinding machine- Constructional features-working principle- Purpose -functions, types, machine elements and uses of accessories, machine calculation and method of Surface Grinding operations. 		
Professional skill	<ul style="list-style-type: none"> Construct different electrical sub-systems and measure parameters. [Different electrical sub-systems: - AC/DC Motors, DC machine, DC motors, DC motor starter, Universal motor, Induction motor, AC drive, Servo drive, transformer.] Estimate and perform panel wiring using cables, connectors, Protective devices and test functionality. Construct and verify different Digital Logic Circuits. [Different DLC:- Logic Gates, half & full adder, binary & outer, P/ down counter.] Write an assembly level programme and interface peripherals to 8051 Microcontroller to check functioning. 	The learning outcomes as indicated require cognitive and practical skills to accomplish tasks that involve construction of different electrical and electronic sub systems and measure, estimate the requirements of wiring of cables and connectors, construct DLC and write an assembly level programme and interface peripherals to ensure functionality of automated systems as per requirement and conditions available or detecting fault and deciding course of action for repair, all of which involve solving problems by selecting and applying basic methods, tools, materials and information.	4

Title/Name of qualification/component: TECHNICIAN MECHATRONICS			Level: 4
NSQF Domain	Outcomes of the Qualification/Component	How the outcomes relates to the NSQF level descriptors	NSQF Level
Core skill	<p>Desired Mathematical Skills</p> <ul style="list-style-type: none"> • Demonstrate mathematical concept and principles to perform practical operations. • Understand and explain science in the field of study including simple machine. <p>Understanding of social/political</p> <ul style="list-style-type: none"> • Apply the concept in productivity & quality management in day to day work to improve productivity & quality. • Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources. <p>Organizing information and communication</p> <ul style="list-style-type: none"> • Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth. 	<p>Hence NSQF Level is 4 for this descriptor.</p> <p>The learning outcomes for example 'Demonstrate mathematical concept and principles to perform practical operations' and 'Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources' display the learning outcomes where the learner needs to display desired mathematical skill; understanding of social, political; and some skill of collecting and organising information, communication.</p> <p>Hence NSQF Level is 4 for this descriptor.</p>	4

Title/Name of qualification/component: TECHNICIAN MECHATRONICS			Level: 4
NSQF Domain	Outcomes of the Qualification/Component	How the outcomes relates to the NSQF level descriptors	NSQF Level
	<ul style="list-style-type: none"> Utilize computer applications and internet to take benefit of IT developments in the industry. 		
Responsibility	<ul style="list-style-type: none"> Construct simple pneumatic control system to measure various parameters using transducer, sensor and switches. <i>[Various parameter: pressure, flow, level of oil, load displacement]</i> Check various components of pneumatics system and construct pneumatic circuit to check functionality. Construct an electro-pneumatic circuit and check functionality of a process. <i>[E.g.- process: Automatic braking system.]</i> Simulate the electronic circuits on simulation software and detect fault as per diagnostic procedure for Electronics system design. 	<p>The role of Technician Mechatronics is independently responsible to perform the work as per specifications and their own analysis of what needs to be done based on their understanding of processes, principles and standards. Learning outcomes like “Check various components of pneumatics system and construct pneumatic circuit to check functionality”, and “Simulate the electronic circuits on simulation software and detect fault as per diagnostic procedure for Electronics system design” etc. reveal the same .</p> <p>Hence NSQF Level is 4 for this descriptor.</p>	

SECTION 3

EVIDENCE OF NEED

26	<p>What evidence is there that the qualification is needed? What is the estimated uptake of this qualification and what is the basis of this estimate?</p>
<p>Basis</p>	<p>In case of other Awarding Bodies (Institutes under Central Ministries and states departments)</p>
<p>Need of the qualification</p>	<p>Capital Goods & Manufacturing Sector has a significant presence of organized as well as unorganized skilled manpower requirement. This sector is poised to grow exponentially in the years to come and is highly labour intensive and there are many emerging trends in this sector. Hence the qualification has been designed keeping in view to cater to the ever-increasing demand of skilled manpower in consultation with stakeholders.</p>
<p>Industry Relevance</p>	<p>The job role defined for the qualification is as per the National Classification of Occupations 2015 which is developed by Employment Directorate under the ministry of Labour and Employment in collaboration with different industry partners and as per ILO guidelines. Moreover, the training is imparted in ITIs/NSTIs/MSTIs/ BTC/ BTPs/ Industries / Establishments etc. where such requirement is available. This justifies the qualification is very much relevant for industry.</p>
<p>Usage of the qualification</p>	<p>The Proposed qualification will create skilled Technician for various establishments in different Sectors.</p>
<p>Estimated uptake</p>	<p>The present seating capacity is approximately 72.</p>
27	<p>Recommendation from the concerned Line Ministry of the Government/Regulatory Body. To be supported by documentary evidences.</p> <p>The qualification, originally designed for Craftsman Training Scheme is in existence for many years and approved by DGT (Regulatory Body) under Ministry of Skill Development and Entrepreneurship, Govt. of India.</p>
28	<p>What steps were taken to ensure that the qualification(s) does (do) not duplicate already existing or planned qualifications in the NSQF? Give justification for presenting a duplicate qualification</p>

	The qualification is originally designed and approved by DGT for the Craftsman Training Scheme and is in existence for many years. No such duplicate qualification of same duration and competencies exists.
29	<p>What arrangements are in place to monitor and review the qualification(s)? What data will be used and at what point will the qualification(s) be revised or updated? Specify the review process here</p> <ul style="list-style-type: none"> • The research wing of CSTARI & DGT reviews and updates the qualification, in consultation with industries and other stakeholders, on a regular basis by conducting trade committee meetings. • DGT will monitor any duplicity by comparing existing qualifications with upcoming ones in the National Qualifications Register (NQR) and relevant sectors.

SECTION 4

EVIDENCE OF PROGRESSION

30	<p>What steps have been taken in the design of this or other qualifications to ensure that there is a clear path to other qualifications in this sector? Show the career map here to reflect the clear progression</p> <p>On completion of the training the trainee will have an opportunity to move in vertical / horizontal pathways to promote to higher designations. The learner can further undergo other specialised courses to excel in the relevant field.</p> <pre> graph LR A[Mechatronics Technician] --> B[Senior Technician] B --> C[Supervisor] C --> D[Manager] B --> E[Entrepreneur] </pre>
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