QUALIFICATION FILE

Senior Technician - Mechatronics & Smart Factory Engineering

☐ Short Term Training (STT) ☑ Long Term Training (LTT) ☐ Apprenticeship
☐ Upskilling ☐ Dual/Flexi Qualification ☐ For ToT ☐ For ToA

☑ General ☐ Multi-skill (MS) ☐ Cross Sectoral (CS) ☐ Future Skills ☐ OEM

NCrF/NSQF Level: 4.5

Submitted By:

NETTUR TECHNICAL TRAINING FOUNDATION
23/24, II PHASE, PEENYA INDUSTRIAL AREA,
BENGALURU – 560058, KARNATAKA

Table of Contents

Contents

Section 1: Basic Details

1.	**Qualification Name**	**Senior Technician - Mechatronics & Smart Factory Engineering**	
2.	**Sector/s**	Capital Goods and Manufacturing	
3.	**Type of Qualification: ☑ New ☐ Revised** **☐ Has Electives/Options ☐ OEM**	**NQR Code & version of existing/previous qualification:** *(change to previous, once approved)*	**Qualification Name of existing/~~previous~~ version**: Senior Technician - Mechatronics & Smart Factory Engineering
4.	**a. OEM Name** ***b.*** **Qualification Name** (*Wherever applicable)*	NA	
5.	**National Qualification Register (NQR) Code &Version** (*Will be issued after NSQC approval)*	QG-4.5-CG-01034-2023-V1-NTTF	**6. NCrF/NSQF Level:** 4.5
7.	**Award (Certificate/Diploma/Advance Diploma/ Any Other** *(Wherever applicable specify multiple entry/exits also & provide details in annexure)*	Certificate	
8.	**Brief Description of the Qualification**	Candidate will be able to integrate Mechanical, Electronics, Embedded Systems, IoT and Automation. Will have Exposure on Artificial Intelligence and Machine Learning, Product Design and Development, PLC and Additive Manufacturing. Candidates with Mechatronics Engineering skills are highly required for the Recent Technological developments in Industries. The subjects covered in this program are –Robotic Engineering, Embedded systems and IoT, Advanced PLC, CNC Technology, Product Design and Development, Artificial Intelligence and Machine Learning, Industrial Management, Industrial Equipment Maintenance, Automated Production System and Additive Manufacturing. Hands-on projects emphasize designing Mechanical Systems using Embedded Real-Time Computing including projects in Embedded System, Robotics, Automation, Internet of Things and Controls.	

<table>
<tr><td>9.</td><td>Eligibility Criteria for Entry for Student/Trainee/Learner/Employee</td><td colspan="2">a. Entry Qualification & Relevant Experience:
<table>
<tr><th>S. No.</th><th>Academic/Skill Qualification (With Specialization - if applicable)</th><th>Required Experience (With Specialization - if applicable)</th></tr>
<tr><td>1</td><td>Advance Certificate - Technician - Industrial control and Instrumentation (Level 4.0) from NTTF.</td><td>NA</td></tr>
</table></td></tr>
<tr><td>10.</td><td>Credits Assigned to this Qualification, Subject to Assessment
(as per National Credit Framework (NCrF))</td><td>Total Credit: 46</td><td>11. Common Cost Norm Category (I/II/III) (Wherever applicable):
NA</td></tr>
<tr><td>12.</td><td>Any Licensing requirements for Undertaking Training on This Qualification (wherever applicable)</td><td colspan="2">NA</td></tr>
<tr><td>13.</td><td>Training Duration by Modes of Training Delivery
(Specify Total Duration as per selected training delivery modes and as per requirement of the qualification)</td><td colspan="2">☐ Offline ☐ Online ☑ Blended
<table>
<tr><th>Training Delivery Modes</th><th>Theory (Hours)</th><th>Practical (Hours)</th><th>OJT Mandatory (Hours)</th><th>OJT Recommended (Hours)</th><th>Total (Hours)</th></tr>
<tr><td>Classroom (offline)</td><td>330</td><td>630</td><td>360</td><td></td><td>1320</td></tr>
<tr><td>Online</td><td>60</td><td></td><td></td><td></td><td>60</td></tr>
</table>
(Refer Blended Learning Annexure for details)</td></tr>
<tr><td>14.</td><td>Aligned to NCO/ISCO Code/s
(if no code is available mention the same)</td><td colspan="2">NCO Code – 2015.2141.0200</td></tr>
<tr><td>15.</td><td>Progression path after attaining the qualification (Please show Professional and Academic progression)</td><td colspan="2">Professional Progression:
After Completion of 3 years of Full Time Programme and after 5 years of Industry Experience the Job Holder can work as a

R&D Engineer, Servicing Engineer, Maintenance Engineer, Automation Engineer and Robotic Engineer.

Academic Progression:
Post Diploma, B. VoC and B. Tech Degree Course in Relevant areas.</td></tr>
<tr><td>16.</td><td>Other Indian languages in which the Qualification & Model Curriculums are being submitted</td><td colspan="2">Hindi</td></tr>
<tr><td>17.</td><td>Is similar Qualification(s) available on NQR-if yes, justification?
for this qualification</td><td colspan="2">☐ Yes ☑ No URLs of similar Qualifications: NA</td></tr>
</table>

18.	**Is the Job Role Amenable to Persons with Disability**	**☐ Yes ☑ No If "Yes", specify applicable type of Disability:**	
19.	**How Participation of Women will be Encouraged**	**Yes** - Admission open to women candidates (30% seats reserved)	
20.	**Are Greening/ Environment Sustainability Aspects Covered (Specify the NOS/Module which covers it)**	**☑ Yes ☐ No Industrial Management CP15601T**	
21.	**Is Qualification Suitable to be Offered in Schools/Colleges**	**Schools ☐ Yes ☑ No Colleges ☐ Yes ☑ No**	
22.	**Name and Contact Details of Submitting / Awarding Body SPOC** *(In case of CS or MS, provide details of both Lead AB & Supporting ABs)*	**Name: Mr. R Rajagopalan** Position in the Organization: **Joint Managing Director** Tel number: 080 – 28390215 Mobile Number: 9844013448 **Email:** rg@nttf.co.in **Website: nttftrg.com**	
23.	**Final Approval Date by NSQC: 29 Sep 2023**	**24. Validity Duration: 3 Years**	**25. Next Review Date: 29 Sep 2026**

Section 2: Module Summary

Modules/ NOS/s of Qualifications: *(In exceptional cases these could be described as components)*

Mandatory Modules/ NOS/s: Specify the training duration and assessment criteria at NOS/ Module level. For further details refer curriculum document - In Annexure

Th*.-Theory* ***Pr.****-Practical* ***OJT****-On the Job* ***Man.****-Mandatory Training* ***Rec.****-Recommended* ***Proj.*** *-Project*

Sl. No.	NOS/Module Name	NOS/ Module Code & Version	Core/ Non-Core	NCrF/ NSQF Level	Credits as per NCrF	Training Duration (Hours)					Assessment Marks					
						Th.	Pr.	OJT-Man.	OJT-Rec.	Total	Th.	Pr.	Proj.	Viva	Total	Weightage (%) *(if applicable)*
Semester – 5																
1	Embedded Systems and IOT	CP15501T	Core	4.5	22	40	-	-	-	40	100	-	-	-	100	
2	Advanced PLC	CP15502T	Core	4.5		40	-	-	-	40	100	-	-	-	100	
3	Robotics	CP15503T	Core	4.5		40	-	-	-	40	100	-	-	-	100	
4	CNC Technology	CP15504T	Core	4.5		40	-	-	-	40	100	-	-	-	100	
5	Product Design and Development	CP15505T	Core	4.5		40	-	-	-	40	100	-	-	-	100	
6	Embedded Systems and IOT LAB	CP15506P	Core	4.5		-	60	-	-	60	-	80	-	20	100	
7	Advanced PLC LAB	CP15507P	Core	4.5		-	60	-	-	60	-	80	-	20	100	
8	Robotics LAB	CP15508P	Core	4.5		-	40	-	-	40	-	80	-	20	100	
9	CNC Technology LAB	CP15509P	Core	4.5		-	60	-	-	60	-	80	-	20	100	
10	MSD Project	CP15510P	Core	4.5		-	140	-	-	140	-	80	-	20	100	
11	Artificial Intelligence and Machine Learning Lab	CP15511P	Core	4.5		-	60	-	-	60	-	80	-	20	100	
12	Employability Skills	CP15512T	Core	4.5		40	-			40	75	-	-	25	100	
Duration (in Hours) / Total Marks					**22**	**240**	**420**			**660**	**575**	**480**		**145**	**1200**	
Semester – 6																
13	Industrial Management	CP15601T	Core	4.5		30	-	-	-	30	100	-	-	-	100	
14	Industrial Equipment Maintenance	CP15602T	Core	4.5		30	-	-	-	30	100	-	-	-	100	

15	Automated Production System	CP15603T	Core	4.5	24	30	-	-	-	30	100	-	-	-	100	
16	Additive Manufacturing	CP15604T	Core	4.5		40	-	-	-	40	100	-	-	-	100	
17	MSD Project	CP15605P	Core	4.5		-	210	-	-	210	-	80	-	20	100	
18	OJT	CP15606P	Core	4.5				360		360		75		25	100	
19	Employability Skills	CP15607T	Core	4.5		20				20	75	-	-	25	100	
Duration (in Hours) / Total Marks					**24**	**150**	**210**	**360**		**720**	**475**	**155**		**70**	**700**	
Total for 1-Year Programme					**46**	**390**	**630**	**360**		**1380**	**1050**	**635**		**215**	**1900**	

Elective Modules/ NOS/s: NA

S. No	NOS/Module Name	NOS/Module Code & Version *(if applicable)*	Core/ Non-Core	NCrF/NSQF Level	Credits as per NCrF	Training Duration (Hours)					Assessment Marks					
						Th.	Pr.	OJT-Man.	OJT-Rec.	Total	Th.	Pr.	Proj.	Viva	Total	Weightage (%) *(if applicable)*
1.																
2.																
Duration (in Hours) / Total Marks																

Optional Modules/ NOS/s: NA

S. No	NOS/Module Name	NOS/Module Code & Version *(if applicable)*	Core/ Non-Core	NCrF/NSQF Level	Credits as per NCrF	Training Duration (Hours)					Assessment Marks					
						Th.	Pr.	OJT-Man.	OJT-Rec.	Total	Th.	Pr.	Proj.	Viva	Total	Weightage (%) *(if applicable)*
1.																
2.																
Duration (in Hours) / Total Marks																

Assessment - Minimum Qualifying Percentage

*Please specify **any one** of the following:*

Minimum Pass Percentage: *(Every Trainee should score specified minimum aggregate passing percentage at qualification level to successfully clear assessment)*

To pass the Qualification, the trainee should score minimum of 40% in each Theory, 50% in Practical and 60%in Project work / Internship and Viva-voce.

Section 3: Training Related

1.	**Trainer's Qualification and experience in the relevant sector (in years)** *(as per NCVET guidelines)*	Diploma in relevant field with 3 years as trainer or industry experience B. Tech or BE with 2 years as trainer or industry experience
2.	**Master Trainer's Qualification and experience in the relevant sector (in years)** *(as per NCVET guidelines)*	Diploma in relevant field with 5 years as trainer or industry experience B. Tech or BE with 5 years as trainer or industry experience
3.	**Tools and Equipment Required for Training**	☑ Yes ☐No (*If "Yes", details to be provided in Annexure)*
4.	**In Case of Revised Qualification, Details of Any Upskilling Required for Trainer**	**NA**

Section 4: Assessment Related

1.	**Assessor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	Diploma with 4 years as trainer or industry experience B. Tech or BE with 3 years as trainer or industry experience
2.	**Proctor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	Diploma or B. Tech or BE with 2 years of experience
3.	**Lead Assessor's/Proctor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	Diploma with 4 years as trainer or industry experience B. Tech or BE with 3 years as trainer or industry experience
4.	**Assessment Mode** *(Specify the assessment mode)*	Blended theory (online and offline in the center) and practical
5.	**Tools and Equipment Required for Assessment**	Same as for training ☑ Yes ☐ No *(details to be provided in Annexure-if it is different for Assessment)*

Section 5: Evidence of the need for the Qualification

Provide Annexure/Supporting documents name.

1.	**Research Reports:** The following reports establish the Resource requirement for skill encompassed in Mechatronics Engineering for the Manufacturing, Capital Goods and Automotive Industries. a. MSDE Annual Report 2021- 22 predict very high growth on Auto sector, Food processing, Electronics and IT Hardware, Pharmaceuticals, Health care, Communication in India. b. MSDE/ NSDC Human Resources and Skill Requirements in the Auto and Auto Components Sector report (2013- 2017 2017 – 2022) The Report Forecast a Higher growth in Automotive Manufacturing, Automotive Components Manufacture Sector c. Annual reports 2021 – 22 of Ministry of Heavy Industries Government of India The above Studies has found Higher growth in Manufacturing, Capital Goods and Automotive Industries which will require Qualified Technicians in Mechatronics Engineering and Smart Factory.
2.	**Latest Market Research Reports or any other source (not older than 2 years) (Yes/No):** The following reports establish the Skilled Resource requirement for the Manufacturing, Capital Goods and Automotive Industries a. Indian Skills Report 2021-22 by **Wheebox** - partnered **CII** predicts skill requirement in Engineering and Manufacturing sectors, Pharma and Health care sector. b. NASSCOM, FICCI and EY report on **Future of Jobs in India – 2022 -** Perspective predicts higher growth in Component Manufacturing and Automotive sector.
3.	**Government /Industry initiatives/ requirement (Yes/No): YES –** a. Study on Job Role of the Future by Indian Institute of Skills. b. National Policy for skill Development and Entrepreneurship 2015 by MSDE has predicted skilled manpower requirement across key sectors by 2022. c. The Study has found Mechatronics Engineer, Embedded System Developers, 3D Printing Technician has new job roles emerging in Engineering and Manufacturing sectors.
4.	**Number of Industry validation provided: 74**
5.	**Estimated nos. of persons to be trained and employed: 1400/ year**
6.	**Evidence of Concurrence/Consultation with Line Ministry/State Departments:** If “No”, why: **(Letter to be sent to the concerned ministry and copy attached) – Under Process.**

Section 6: Annexure & Supporting Documents Check List

Specify Annexure Name / Supporting document file name.

1.	**Annexure - 1:** NCrF/NSQF level justification based on NCrF. level/NSQF descriptors (Mandatory)	Yes
2.	**Annexure - 2:** List of tools and equipment relevant for qualification (Mandatory, except in case of online course)	Yes
3.	**Annexure - 3:** Industry Validations Summary	Yes
4.	**Annexure - 4**: Training & Employment Details	Yes
5.	**Annexure - 5**: Blended Learning (Mandatory, in case selected Mode of delivery is “Blended Learning”)	Yes
6.	**Annexure - 6:** Detailed Assessment Criteria (Mandatory)	Yes
7.	**Annexure - 7:** Assessment Strategy (Mandatory)	Yes
8.	**Annexure - 13**: Multiple Entry-Exit Details (Mandatory, in case qualification has multiple Entry-Exit)	No
9.	**Annexure:** Acronym and Glossary (Optional)	No
10.	**Supporting Document:** Model Curriculum (Mandatory – Public view)	Digital content available to trainees through Edusquares ERP (Will be made public after the qualification is approved) (Annexure 8)
11.	**Supporting Document:** Career Progression (Mandatory – Public view)	Yes (Annexure 9)
12.	**Supporting Document:** Occupational Map (Mandatory)	Yes (Annexure 11)
13.	**Supporting Document:** Assessment SOP (Mandatory)	Yes (Annexure 10)
14.	**Supporting Document:** Key Learning Outcome	Yes (Annexure 12)
15.	**Any other document you wish to submit**	No

Annexure 1 - Evidence of Level

NCrF/NSQF Level Descriptors	Key requirements of the job role/ outcome of the qualification	How the job role/ outcomes relate to the NCrF/NSQF level descriptor	NCrF/NSQF Level
Professional Theoretical Knowledge/Process	Identify Applications, applying appropriate information, tools and material, Integrate and Troubleshoot Mechanical, Electrical, Electronics and Computer Systems for Automation. Will have Capability to Organize and Perform by self and or work with Others to Implement, Troubleshoot Mechatronics System in Industries. Knowledge of Programming using PLC and associated software, Pneumatic, Electro-pneumatic, Hydraulic, Electro- Hydraulic controls and circuits. Knowledge on Additive Manufacturing Will have Capability to organize and perform by self and/or work with others in the above areas.	Job Holder Understand Safety and Health aspects and Ensures Compliance with Health and Safety Regulations. Job Holder Can Design, Fabricate, Validate and Troubleshoot Mechatronics Systems. Job Holder can apply his/her Skill and Knowledge in the Operation of a Smart Factory.	**4.5**
Professional and Technical Skills/ Expertise/ Professional Knowledge	Specify and Use Electrical and Electronics Components and Equipment Explain Mechanical Drive systems, Control Electrical Drives and Systems. Develop, simulate and verify Mechanical, Electrical, Electronic, Pneumatic, Hydraulic circuit and systems. Ability to use Microcontrollers, Embedded systems programming, PLC, Hydraulics and Pneumatics Equipment, to develop and control Automation Processes. Program and simulate Industrial robot to perform specific operations. Demonstrate Professional Knowledge of Additive Manufacturing.	Trouble and maintain Electrical, Electronic Component/Equipment and their Appliances in the Industry. Will Have Knowledge in Applications of Computer and Programming Knowledge's Specific to his Domain. Will have Knowledge of Process Planning in an industry. Develop systems and programs to control by integrating to automate industry processes.	**4.5**

	Describe Artificial Intelligence and Machine learning. Can analyze Data situations and take appropriate decisions. Can do continuous improvement in processes (KAIZEN)	Can relate Artificial Intelligence and Machine Learning to his or her job role context.	
Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill	Able to communicate Effectively with Peers and Supervisors in the work area. Good Knowledge on Organization, ethical & moral values, and Practice Time Management Able to Analyze solutions Critically and Logically for fine decision making. Able to work Effectively in a Team and lead a Team. Knowledge of the latest Technologies and Industrial Trends. Will have good Ingenuity and Creativity. Will have good Leadership Skills and have an entrepreneurial for small start-up.	Good Communication with Peers, superiors both verbal and written, Good on Presentation Skills, QC,5S and KAIZEN. Can Analyze situations Critically and Logically. Adopt latest Technologies emerging in the Domain. Can lead a group to work Effectively. Can solve, adopt to new Situations Creatively.	**4.5**
Broad Learning Outcomes/Core Skill	Proficiency in using simulation software for validating system performance. Can use CAD software for making Mechanical and Electrical drawings. Can perform arithmetic and mathematic operations to evaluate system performance. Prepare Technical Reports and Presentations using MS Office Prepare emails for correspondence. Use Internet to get additional Technical Information	Ability to create Technical Drawings. Ability to calculate required details for Mechatronic system performance evaluation and Inspection. Ability to make technical reports and Presentation using MS Office. Correspond through emails. Ability to retrieve necessary technical details from the Internet. Will follow all safety norms and standard operating	**4.5**

	Safety and standard operating Procedures and Practices in the work area. Communicate with Peers and Superiors. Critical Thinking, Creativity and Logical thinking. Data collection, analysis, decision making ability. Solve problems using QC tools and contribute for Kaizen in the work areas. Knowledge on effective 5S, TPM and TQM activities.	Procedures in the work area. Verbal and written communication, computer literacy. Maintain Good Relationship with Peers and Superiors and Will be able to Win Good will and Trust of Peers. Analyze Critical problems in work area and real life. Decision Making ability. Process improvement and problem-solving skills.	
Responsibility	Aware of Personal/Industrial goals Adapt to changes in the work area. Thorough understanding of safety Procedures and SOPs in the relevant work area Supervise, evaluate, and improve the activities of team in the work area.	Able to Carry out Design and Integration of Mechatronics Systems Under Minimum Supervision Guide Junior Technicians in Fulfilling Tasks Assigned to them.	**4.5**

Annexure 2: Tools and Equipment (Lab Set-Up)

List of Tools and Equipment for a batch of 30 trainees

Computer Lab			
Sl. No.	**Equipment**	**Specification**	**Quantity**
1	Server	Intel Xeon Processor, 2.8GHz 8M Cache, 2TD SSD, RPS.	1
2	Switch and Cabling		1
3	Networked Computers with Furniture	Core i5 10th Gen 23.8-inch FHD with Alexa (8GB/256 GB SSD+1TB HDD/Windows 10/MS Office	10
4	UPS	5kVA	1
5	LED Smart TV	73”	1

CNC Lab			
Sl. No.	**Equipment**	**Specification**	**Quantity**
1	CNC Milling with Servo Stabilizer	800 x 350 x 380mm	1
2	CNC Lathe with Servo Stabilizer	60 x 150mm	1
3	Compressor	Reciprocating Air Compressor - 2 stage/2 Cylinder with 5HP, 3.7kW, Air delivery 440 l/min., Tank capacity – 220 l.	1
4	3D Printing Machine with UPS		1
5	Machine Cupboard	Lockable – 400mm x 750mm x 750mm with 3 racks	1
6	**CNC Milling Accessories 1 each**		
6.1	Vice with swivel base jaw width 130mm & 110 opening		
6.2	Clamping kit 14*M12 (70 Pieces)		
6.3	Integral type dial holder to suit machine spindle		
6.4	ER 25/A 70 Collet holder		
6.5	FMB 16/60 milling arbour to suit machine spindle.		
6.6	FMB 22/60 milling arbour to suit machine spindle.		

6.7	FMB 27/60 milling arbour to suit machine spindle.	
6.8	MT2 holder screw type	
6.9	MT2-1 reduction sleeve	
6.10	Pull stud (MAS 403 45)	
6.11	Tool tightening fixture to suit machine spindle	
6.12	Electronic touch probe	
6.13	'Z' off set measuring probe	
7	**CNC Lathe 1 each**	
7.1	Turning tool holder MTJNL 16*16 H16 (Rough) with inserts	
7.2	Turning tool holder MTJNL 16*16 H16 (Finish) with inserts	
7.3	Facing tool holder PCNLL 16*16 with inserts	
7.4	Grooving tool holder 16*16 with 9/12 inserts	
7.5	Threading tool holder 16*16 with inserts	
7.6	Parting tool holder 16*16 with 9/12 inserts	
7.7	Copying holder PDJNL 16*16 with inserts	
7.8	Boring bar dia 6 SCLCL screw type with inserts	
7.9	Boring bar dia 8 SCLCL screw type with inserts	

Automation Lab			
Sl. No.	**Equipment**	**Specification**	**Quantity**
1	Robot with Accessories		1
2	Modular Manufacturing System Station for Industry 4.0 smart factory		1
3	IoT Trainer Kit	Node MCU, Arduino, Raspberry Pi	10

4	Networked Computer with Furniture	Core i5 10th Gen 23.8-inch FHD with Alexa (8GB/256)	2
5	UPS	5kVA	1

Project Lab			
Sl. No.	**Equipment**	**Specification**	**Quantity**
1	Work Bench	(L x B x H) 1200mm x 580mm x 840mm	2
2	Soldering Station	Power- 60W, Temperature range - 180 to 400˚ C	1
3	Analog/ Digital Oscilloscope	No of Channels - 2, Bandwidth: DC - 50 MHz	2
4	Variable Regulated Power supply	0-30V/1A	2
5	Function Generator	Frequency Range: 0.3 Hz to 3 MHz, Functions: Sine, Square, Triangle, DC Sweep	1
6	Networked Computer with Furniture	Core i5 10th Gen 23.8-inch FHD with Alexa (8GB/256) - Proteus loaded	1
7	UPS	5kVA	

Software			
Sl. No.	**Software**	**Specification**	**Quantity**
1	Robot Simulation Software – 10 user License		1
2	Master CAM – 10 user License		1
3	CNC Simulation Software – 10 users		1

Note:

- The Tools and Equipments and other lab facilities are shared between Qualifications and batches.
- During the admission the trainees are supplied with toolkit containing DMM, soldering iron, Breadboard, and other tools for conducting experiments in different labs.
- Trainees are provided with Laptop.

Classroom Aids

The aids required to conduct sessions in the classroom are:

1. White board.
2. Projector with screen / Smart TV
3. Laptop / computer

Annexure -3: Industry Validations Summary

Provide summary information of all the industry validations in table. This is not required for OEM qualifications.

SL. NO.	Organization Name	Contact Address	LOCATION	Representative Name	Contact Phone No	E-mail ID
1	Pari Robotics	Gat No. 463a, 463b & 464, Village Dhangarwadi	Satara	Sharad Agrawal	+91 2169 246 714	sharadpa@parirobotics.com
2	Mogora Cosmic (P) Ltd	El 31/16 Electronic Zone, Pimpri Industrial Area, MIDC Bhosari	Pune	Aravind	9820907828	aravindn@mogora.com
3	Yanfeng Lndia Automotive Interior Systems Pvt. Ltd.	Plot No. G-1, Chakan MIDC Phase -III, Village: Nighoje	Pune	Subodh Deshmukh	+91 9822721116	subodh.deshmukh@yfai.com
4	Tata Hitachi Construction Machinery Co. Pvt. Ltd. (Thcm)	Jubilee Building, 45 Museum Road	Bangalore	Monikut Sharma	080669 53301	monikut.sharma@tatahitachi.co.in
5	Johnson Controls (India) Private Limited	Johnson Controls (India) Private Limited #507, Delphina Building, 2nd Floor, Cmh Road, Indiranagar 1st Stage	Bangalore	Joel D' Silva	+91-80-6773 6784	Joel.1.Dsilva@jci.com
6	Signode India Limited	Rudraram Village, Patancheru Mandal,	Hyderabad	Mrs. Haritha D	+91 8455674821	haritha@signodeindia.com
7	Cotmac Electronics Pvt. Ltd.	No 70/5, Suvarna Tower, 21st Cross, Vijayanagar,Chbs Layout, Near Bda Complex,	Bangalore	Vishal Surve	80-23147172	vishal.surve@cotmac.io
8	Zf Steering Gear (India) Ltd.	No 70/5, Suvarna Tower, 21st Cross, Vijayanagar,Chbs Layout, Near Bda Complex,	Pune	Rahul Tayade	02137 305 100	rahul.tayade@zfindia.com
9	Hytek Marketing	503, Mariegold, Neco Gardens Vimannagar	Pune	Clara F. Caldeira	+912040036057	sales1@hytekmarketing.biz
10	Achintyo Engineering Llp	#2331/B, 1st Floor, Rohan Plaza, 17th Cross, 1st Sector, Hsr Layout	Bangalore	Mr Manjunath Kalburgi	+91 (0)80 2258 2821	manjunath.k@achintyo.com
11	Bector Automation Rml India Pvt. Ltd.	Plot No. 24, Gat No 613/1, Kuruli	Pune	Amol Chougule	+91 7506506098	cgu5@bectorrml.com
12	S.P Engineers	Gate No: 73(1), Plot No: 17, Behind Poona Forge Pvt. Ltd, Near Sonawane	Pune	Santosh Shindhe	9890990234	santosh.shinde@spengineerspune.com

		Wasti, Village-Talawade Gaon				
13	Aisin Automotive Karnataka Pvt Ltd	Kiadb Industrial Area, Narasapura.	Kolar	Vijay S	9900087705	vijay.s@aisin-akl.co.in
14	Smp Engineers & Electricals Pvt. Ltd.	A-44, MIDC Malegaon Sinnar	Nasik	Swati Gangurde	7030917846	hr@divineindia.co.in
15	Kspg Automotive India Private Limited	Gat No. 380, Village Takwe Budruk, Tal Maval	Pune	Shrikant Bongale	+91 9552667100	shrikant.bongale@in.kspg.com
16	Beckhoff Automation Pvt. Ltd	No.15, Shraddhanand Bhavan, I Floor,New Market Road,V V Puram	Bangalore	Krishnamurthy Kulkarni	+91 80 40824800	K.Kulkarni@Beckhoff.com
17	Dearadhpro Automation	1879, 3 Main 7 Cross Judicial Layout, Yelhanka, New Town	Bangalore	Murali	+91-8310646216	murali@designproautomation.in
18	Purshotam Company Private Limited	8 Lyons Range, 1st Floor	Kolkata	Monujesh Borooah	+91.33.22434941/22315344/32950386	consultant@purshotam.com
19	Tm Automotive Seating Systems Private Limited	Survey No. 296,297,303,304,305, Plot No. 173, Kiadb, Belur Industrial Area	Dharwad	Praveen Hegde	+91-7022868626	Praveen.Hegde@tmseating.com
20	Whirlpool Of India Ltd	Plot # A4, Ranjangaon Midc	Pune	Mahendra D Jadhav	9028031731	mahendra_d_jadhav@whirlpool.com
21	Magna Automotive India Pvt. Ltd	Plot # A 12 Talegaon Midc, Navlakh Umbare, Tal.– Maval	Pune	Suyog Chhatre	9145286093	suyog.chhatre@magna.com
22	KBD Sugars And Distilleries Ltd	No 787, 10th KM, Pune Bangalore Road, Noolvi Cross,	Dharwad	Shanmukhappa Alle	9743883777	hrkbdhubli@gmail.com
23	Wipro Automation	Bangalore	Bangalore	Girish	8904021754	info@wintech.com
24	Minda Industries Ltd	B-6, M.I.D.C. Chakan,Tvillage-Mahalunge, Tal.-Khed	Pune	Amar thakur	-21356683240	athakur@mindagroup.com
25	Velankani Electronics Pvt Ltd	Velankani Tech Park, 43 Electronic City, Phase -I	Bangalore	Jyothsna Rao	+91 80-66145852	jyothsnarao@velankanigroup.com
26	Micropack Pvt Ltd	Plot # 16, Jigani Industrial Area, Anekal Taluk,	Bangalore	Lakshmi	7760976713	hr@micropack.in
27	Toyota Industries Engine India	Plot No. 9, Jigani Industrial Area Phase Ii,	Bangalore	Brijendra Shah	9538997508	brijendra_shah@tiei.toyota-industries.com

28	Kirloskar Toyota Textile Machinery Pvt Ltd	Plot 10/13, Phase II Jigani Industrial Area,	Bangalore	Kiran Kumar Deshpande	7026998585 / 9449991396	kiran.deshpande@kttm.toyota-industries.com
29	Tata Advanced Materials Limited	10, Jigani Industrial Area, Jigani	Bangalore	Mahesh	8747844393	procurement@tamlindia.com
30	Ace Designers	Plot No 7&8 Ii Phase|Peenya Industrial Area	Bangalore	Sunil Ashok Sathe	8892464180	sunilashok_sathe@acedesigners.co.in
31	Araymond Fasteners India Pvt Ltd	Gat No. 259, 276/8B, Nighoje-Chakan, Taluka-Khed,	Pune	Vilas Kasulkar	9730004714	Vilas.Kasulkar@araymond.com
32	Biesse Manufacturing Company Private Limited	Survey No.28/1 & 28/2, Nagarur Village, Huskur Road, Dasanapura	Bangalore	Raghvendra M V	9880800999	raghavendra.mv@biessemnfg.com
33	Esautomotion Controls	Plot No: 488b, Kiadb M.S.Complex, Unit No:2b-07, Ground Floor, 2nd Block, 14th Cross, 4th Phase, Peenya Industrials Area	Bangalore	S.M.Chandra	9686654400	esautomotioncontrols@gmail.com
34	Insight Technologies	2nd C Main, 2nd Stage, Peenya Industrial Estat	Bangalore	Ajay V	7975232396	ajay.v@insight-technologies.in
35	Skh Sheet Metals Components Pvt. Ltd	Gat No. 542-545, Village- Dhoksangavi, Behind Bombay Dyeing Factory, ,	Pune	Mani Awasthi	9607034533	maniawasthi@skhsmc.com
36	Ming Xu Stamping Solutions Pvt Ltd.	706, 3rd A Cross Rd, HRBR Layout 1st Block, HRBR Layout, Kalyan Nagar, Bengaluru, Karnataka 560043	Bangalore	Balakrishna Nair	9890015302	bala.nair@mxsspl.com
37	Difacto Robotics & Automation Pvt Ltd	Peenya Industrial Area, Bangalore	Bangalore	Mrs.Bina Nathan	7406022719	bina.nathan@difacto.com
38	Phillips Machine Tools India Pvt. Ltd.	Sub Plot No. 3, Ramtekdi Industrial Estate, Hadapsar,	Pune	Deepika Mahapatra	9193716411	dmahapatra@phillipscorp.com
39	Gestamp	E1 (Part), Midc Industrial Area Phase3, Village Nigoje Mhalunge, Kharabwadi, Taluka Khed,	Pune	Shweta K	9673330972	skarekar@in.gestamp.com
40	Vandhana International Pvt. Ltd.	36, Dakshineshwar Building, 9th Floor, 10, Hailey Road,	New Delhi	Bhavna Chhatwani	+91 9311552111	careers@vandhana.com

41	Lohia Corp, Noida	B-2/15, Safdarjung Enclave, B5 Block, B4 Block, Safdarjung Enclave, New Delhi, Delhi 110029	Noida	Mahima	6390014838	mahima.singh@lohiagroup.om
42	Metlok	Qmv7+F4v, Jigani, Karnataka 560099	Bangalore	Uday	9704241821	hr2@metlok.com
43	Cadmax	#2095, 2nd Floor, 9th Cross, 5th Main Rd, Rpc Layout, Vijayanagar, Bengaluru, Karnataka 560040	Bangalore	Ankur	6363880528	hr@cadmax.com
44	Trelleborg	Plot 285, Rajdhani Industrial Park, Kengalkempohalli, Karnataka	Bangalore	Anitha	7349282915	anitha.karan@trelleborg.com
45	Arcus Automation	Velappanchavadi, Poonamallee, Chennai, Tamil Nadu 600077	Chennai	Ramesh	9884032017	ramesh@arcusautomation.com
46	Venson Electric	Venson Electric Pvt Ltd, #331, 9th Cross Rd, 4th Phase, Ganapathy Nagar, Phase 3, Peenya, Bengaluru, Karnataka 560058	Bangalore	Arya	9448288863	arya@vensonelectric.com
47	Difacto	Unit -3, S.No 103, 113, 114, 7th Main, 3rd Cross Rd, 3rd Phase, Peenya, Bengaluru, Karnataka 560058	Bangalore	Bina	9900487722	hr@difacto.com
48	Armax Automation	Chetan Circle, No.51-54, 2nd Cross, Vinayaka Layout, Andrahalli Main Rd, Peenya 2nd Stage, Shushruti Nagar, Byraveshwara Industrial Estate, Bengaluru, Karnataka 560091	Bangalore	Papia	9600952502	PAPIA@ARMAXINDIA.COM
49	Sansontech Technologies	A-108 Block Ii Kssidc Complex, Phase 1 Electronic City, Bengaluru, Karnataka 560100	Bangalore	Hari Prasad	9620204044	sonyt@sansontechs.com
50	Cardiac Design	#184, 2, Whitefield Main Rd, Palm Meadows, Mahadevapura, Bengaluru, Karnataka 560066	Bangalore	Praveen	9008655091	
51	Interplex	89a, Hosur Rd, Electronics City Phase 1, Electronic City, Bengaluru, Karnataka 560100	Bangalore	Preethi	906644327	manohara.n@in.interplex.com

52	Nash Inustries	Survey No 38/1, 39/2 B, Nagaruru Village, Dasanapura Hobli, Nagaruru North Taluk, Bengaluru, 562123	Bangalore	Jayashree	8660531921	
53	Rossell Techsys	Plot 58c(Aerospace Sector) At Hitech Defence And Aerospace Park, Devanhalli, Bengaluru, Karnataka 562110	Bangalore	Jennifer	7829378144	rossell@rossellindia.com
54	Sigma Forging & Forming Pvt. Ltd	Vwx5+7c7, Vadagal Rd, Vadagal, Tamil Nadu 631604	Vadagal, Tamil Nadu	Kamaraj	8939396971	Mayurbatra_ca@mayurbatra.com
55	Protocol Automation	59/1, Langford Road, Richmond Town, Bengaluru, Karnataka 560025	Bangalore	Mihir	9341235828	
56	Steel Strips Wheels Limited	Plot No. A-10, Sipcot Industrial Growth Centre, Singaperumal Koil - Sriperumbudur Rd, Oragadam Industrial Corridor, Oragaram, Tamil Nadu 602105	Oragaram, Tamil Nadu	Muhammad	7550009491	
57	Greenvision	45, 4th Cross Rd, 2nd Block, Malleswaram, Bengaluru, Karnataka 560003	Bangalore	Muralaesh	9655945444	
58	Rising Star Mobile India Pvt Ltd	Rising Star Mobile India Pvt Ltd, Pallavaram-Thuraipakkam Rd, Sunguvarchatram, Tamil Nadu	Chennai	Chandrakumar	4426170442	prasadpaldmk@gmail.com
59	Omax	Plot No. 6, 4th Phase, Bommasandra Jigani Link Rd, Kiadb Industrial Area, Bengaluru, Karnataka 562106	Bangalore	Sunaina	9582519058	sunaina.vashist@omaxauto.com
60	Control Print	No-4, 3rd Floor, Koleth Court, 995a, 11th Main Road, 2nd Ave, Anna Nagar, Chennai, Tamil Nadu 600040	Chennai	Rashtrapal Bhosale	9892330112	rashtrapal@controlprint.com
61	Taegu Tech	Plot No. 120, Bommsandra Jigani Link Road, Bommasandra Industrial Area, Phase 4, Bengaluru, Karnataka 560099	Bangalore	Primila	8049013303	primila@taegutechindia.com
62	Zf Steering	Icc Towers, A-Wing, 6th Floor, Senapati Bapat Rd, Model Colony, Shivajinagar, Pune, Maharashtra 411016	Pune	Asoka	9373693053	ashoka.d@zfindia.com

63	Dr.Fritsch Machines & Powders Pvt Ltd.,	4th Phase, Ind. Area, 453/A, 12th Cross Rd, Shivapura, Peenya, Bengaluru, Karnataka 560058	Bangalore	Makhbul Ahmmed	7022037333	makhbul.ahmed@dr-fritsch.com
64	Niehoff Of India Private Limited	PLOT Nos. 186 TO 194, Pashamylaram, Telangana 502307	Bangalore	M H Nageswara Rao	8184922671	m.nageswararao@niehoff.in
65	Tyche Diecast Pvt. Ltd.	Plot # 9 & 10B, Phase IV Extension, IDA Jeedimetla, Chinthal, Jeedimetla, Hyderabad, Telangana 522259	Hyderabad	H Sandhu	9241323402	sandhu.egic@gmail.com
66	Dubas Engineering Pvt Ltd	# 43 (P), Electronics City, Phase II, Hosur Main Road, Bengaluru, Karnataka 560100	Bangalore	V Keshava Murthy	0806683463/6683464/6683911	dubas@vsnl.com
67	M/S. Micropack	Plot # 16, Jigani Industrial Area, Anekal Taluk, Bengaluru, Karnataka 560105	Bangalore	Mr Lakshmi	7760976713	hr@micropack.in
68	e-Mug Engineering Services Ltd	IInd floor, 21, Ceon Road, Jayabheri Pine Valley, Gachibowli, Telangana 500032	Bangalore	Y V Rajeswara reddy	9989145042	yvr.reddy@emugtech.com
69	Hemaadri Elex Systems Private Limited	Plot No.809, 17th D Cross, 37th A Main, JP Nagar 6th Phase, Bengaluru, Karnataka 560078	Bangalore	Padmanabhan Venkata Krishna Subramanian	-9449084977	pvksubramanian@hemaadri.com
70	Ostritch Mobility	#235-J/1, 3rd Phase, Bommasandra Industrial Area Hosur Road, Bangalore 560 099, Bengaluru, Karnataka 560099	Bangalore	Jayan	9845841155	jayan@ostritchmobility.com
71	Zentron labs pvt ltd	#16, PSS Plaza Gr. Floor, New Thippasandra Main Rd, HAL 3rd Stage, Bengaluru, Karnataka	Bangalore	Ravi Subramanian	9845172632	ravis@zentronlab.com
72	TAFE pvt ltd	7H35+HF5, Doddaballapura, Karnataka 561203	Bangalore	Keshav	9538895168	keshava@tafe.com
73	Electrohms pvt ltd	67/6-1 Ullas Theatre Road, Yeshwanthpur Industrial Suburb, Yeswanthpur, Bengaluru, Karnataka 560022	Bangalore	G N Kotresh	+91 (80) 43492200	hr@electrohms.com
74	S R Automation	#91, Ground floor, Gowri Tanaya, Mookambika layout Mylasandra, Kengeri, Bengaluru, Karnataka 560059	Bangalore	Ullas U	9739716463	ullas.u@srautomations.com

Annexure - 4: Training & Employment Details

Training and Employment Projections: *Data to be provided year-wise for next 3 years.*

Year	Total Candidates		Women		People with Disability	
	Estimated Training #	Estimated Employment Opportunities	Estimated Training #	Estimated Employment Opportunities	Estimated Training #	Estimated Employment Opportunities
2023	1200	More than 10000	480	More than 3000	-	
2024	1400	More than 10000	560	More than 3000	-	
2025	1600	More than 10000	640	More than 3000	-	

Training, Assessment, Certification, and Placement Data for previous versions of qualifications: (Previous years)

Qualification Version	Year	Total Candidates				Women				People with Disability			
		Trained	Assessed	Certified	Placed / Higher Studies	Trained	Assessed	Certified	Placed / Higher Studies	Trained	Assessed	Certified	Placed
	2017- 2020	1065	968	961	961	58	55	52	52	NIL			
	2018 - 2021	868	835	831	831	81	74	69	69				
	2019 - 2022	856	799	764	764	72	67	64	64				

Applicable for revised qualifications only, data to be provided year-wise for past 3 years.

List Schemes in which the previous version of Qualification was implemented:

3rd year of three years Full Time Programme

Content availability for previous versions of qualifications:

☐ Participant Handbook ☐ Facilitator Guide ☑ Digital Content ☐ Qualification Handbook ☑ Any Other: In NTTF LMS and Edusquares ERP

Languages in which Content is available: English

Annexure -5: Blended Learning

Blended Learning Estimated Ratio & Recommended Tools:

Refer NCVET "Guidelines for Blended Learning for Vocational Education, Training & Skilling" available on:

https://ncvet.gov.in/sites/default/files/Guidelines%20for%20Blended%20Learning%20for%20Vocational%20Education,%20Training%20&%20Skilling.pdf

S. No.	Select the Components of the Qualification	List Recommended Tools – for all Selected Components	Offline: Online Ratio
1	Theory/ Lectures - Imparting theoretical and conceptual knowledge	Physical classroom, LMS, Augmented reality, Web based	90:10
2	Imparting Soft Skills, Life Skills, and Employability Skills /Mentorship to Learners	Physical classroom, Workshops, Mock sessions, Case study, Role play, Group Discussions, LMS	90:10
3	Showing Practical Demonstrations to the learners	Workshop / Lab, Augmented reality, Video recording	80:20
4	Imparting Practical Hands-on Skills/ Lab Work/ workshop/ shop floor training	Workshop machines, Lab equipment, Simulators, Mini projects, Project	80:20
5	Tutorials/ Assignments/ Drill/ Practice	Class assignments, LMS assignments, Simulators	60:40
6	Proctored Monitoring/ Assessment/ Evaluation/ Examinations	Physical classroom, Labs, Workshop, Online tests, Project	75:25
7	On the Job Training (OJT)/ Project Work Internship/ Apprenticeship Training	Industry	100:00

Annexure -6: Detailed Assessment Criteria

Detailed assessment criteria for each NOS/Module are as follows:

NOS/Module Name	Assessment Criteria for Performance Criteria/Learning Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Semester - 5					
Embedded Systems and IOT	Embedded System - – Architecture & Applications	15	-	-	-
	Peripheral Interface Controller – PIC16F877A– Architecture and applications	20	-	-	-
	Node MCU - ESP8266 – Features and pin configurations.	10	-	-	-
	Node MCU And Arduino Programming - Variables, data types, & constants, programming structure, Digital and Analog I/O, serial data monitoring	20	-	-	-
	IOT (Internet of Things) – Definition, components of IoT, Architecture, stages, Process and applications	15	-	-	-
	Networking and Cloud Computing – Networking layer, protocol, Introduction to cloud, MQTT, PUB, SUB comparison, HTTP client server concept.	10	-	-	-
	IOT Framework – IoT framework and applications	10	-	-	-
	Total Marks	**100**			
Advanced PLC	PLC Analog signals, Analog I/O	15	-	-	-
	PLC programming Languages	30	-	-	-
	PLC communication & trouble shooting	20	-	-	-
	HMI (Human Machine interface)	10	-	-	-
	DCS (Distributed control systems)	5	-	-	-
	SCADA Supervisory Control and Data Acquisition	20	-	-	-
	Total Marks	**100**			
Robotics	Introduction to Robotics – Generation, laws of robotics, structure of Industrial Robot, types and application	10	-	-	-
	Robot Anatomy – Links, joints, notation scheme, degrees of freedom, Manipulator, workspace, work envelope work cell, ARM & Wrist configuration, Robot end effector, grip design and development consideration.	20	-	-	-
	Robot Motion Analysis – D H parameter, Direct Manipulator Kinematics, trajectory planning	15	-	-	-
	Robot Communication Methods and Vision System – Robot I/O, Robot vision, aspect of vision systems.	15	-	-	-

	Robot Programming – different programming methods, software and languages,	15	-	-	-
	Robot Application	10	-	-	-
	Robot Maintenance	15	-	-	-
	Total Marks	**100**			
CNC Technology	Introduction to Computerized Numerical Control- CNC applications.	10	-	-	-
	CNC Control System- Types of control.	10	-	-	-
	Elements of CNC Machine – Drives, controls, Tool post, tool and work holding devices	20	-	-	-
	Nomenclature of Lathe Tool – Tool holders, selection of tool, speed and feed cutting tool material	10	-	-	-
	CNC Operating Modes – Different operating modes.	10	-	-	-
	CNC Programming – steps & procedure for programming	20	-	-	-
	CNC Maintenance and Troubleshooting – coolant, response to machine alarms, backlash, checklist for maintenance.	20	-	-	-
	Total Marks	**100**			
Product Design and Development	Design Process – Design process, mechatronics approach, elements of Mechatronics design, bottom -up, and Top-down approach.	25	-	-	-
	Design Thinking – design thinking process.	25	-	-	-
	Advanced Product Quality Planning – Product design, process design, product & process validation,	30	-	-	-
	Product Management- Classification, strategy, production – consumption cycle, product life cycle	20	-	-	-
	Total Marks	**100**			
Employability Skill	Leadership & Motivation	20	-	-	5
	Quality Management – Importance of quality in industry	15	-	-	10
	Critical thinking and Problem solving	20	-	-	5
	Getting ready for Entrepreneurship	20	-	-	5

	Total Marks	**100**			
Embedded Systems and IOT LAB	PIC microcontroller programming using embedded C - executing different programmes.	-	15	-	5
	PIC Microcontroller Interface programming.	-	25	-	5
	Control of output devices using NODE MCU	-	25	-	5
	IoT based programming – Controlling Output device using android App.	-	15	-	5
	Total Marks	**100**			
Advanced PLC LAB	Interfacing Pneumatic system with PLC – develop PLC program to control electro pneumatic systems	-	25	-	5
	Analog value processing on PLC – Scaling,	-	10	-	5
	HMI – Configuring New HMI panel, Design HMI screen, TAG creation.	-	25	-	5
	SCADA configuration, Alarms and messages using SCADA, develop simple project using SCADA simulator editors	-	20	-	5
	Total Marks	**100**			
Robotics LAB	Handling teach-pendant & Controller	-	5	-	-
	Sequence of Jogging, working limit and changing speed	-	10	-	5
	Recording desired positions of Robotic arm, modifying the same.	-	10	-	5
	Writing simple programs, executing them	-	15	-	-
	Creating program for motion for various motion path	-	10	-	5
	Control Instructions – Register instructions for position register, wait, override	-	15	-	5
	Coordinate system – create an orient origin point	-	5	-	-
	Macros, mastering, backup and restore	-	10	-	-
	Total Marks	**100**			
CNC Technology LAB	Introduction to MASTERCAM- 2D Drafting, contouring and pocket, Drilling & Patterns, Facing & Turning, 3D counter& surface Machining. Generation and communication of NC codes to CNC machines.	-	25	-	5
	CADEM – NC MILLING & NC LATHE,	-	15	-	5

	CNC Machines- Machine specifications, Machine control Panel, setting offset, Editing program, Dry run.	-	10	-	5
	Basic maintenance of CNC machines – Preventive maintenance, Breakdown maintenance	-	10	-	5
	Practice on CNC machine	-	20	-	-
	Total Marks	**100**			
MSD Project	Justification, designing, planning	-	-	10	-
	Drawing (CAD)	-	-	10	-
	Engineering specification	-	-	10	-
	Material Specification	-	-	10	-
	Bill of Material	-	-	10	-
	Project submission	-	-	10	-
	Presentation	-	-	10	20
	Simulation	-	-	10	-
	Total Marks	**100**			
Artificial Intelligence & Machine Learning Lab	Python Programming for Data Science with basic operations, data structures and control statements	10			5
	Data Processing and Visualisation in Excel and python	10			
	Supervised Learning – Regression, KNN, Evaluation Metrics for Classification Models	10			5
	Unsupervised Learning –K-means Clustering, Hierarchical Clustering	10			
	Cross-Validation Techniques	10			
	Build CNN Architecture	5			
	Strategies for model deployment and scaling, Cloud based AI services	10			5

	Project on AI/ML techniques to a real-world problems	15			5
	Total Marks	**100**			
Semester - 6					
Industrial Management	Basics of Management – Management & Functions, Levels of Management	10	-	-	-
	Pollution Prevention and Waste Management – Issues, Impact study, EMS – ISO 14001	10	-	-	-
	Industrial Safety Management – Unsafe & Safe, Direct & Indirect Losses, Preventive measures of accident, Hierarchy of safety control.	10	-	-	-
	Inspection and Quality Control – Quality Control, Inspection, 7 QC Tools, SQC & SPC, Quality standards – ISO 9000 clauses & steps for implementation.	15	-	-	-
	Modern Production Management – 5S, Kaizen, KANBAN, POKA - YOKE	10	-	-	-
	Lean Management – Toyota Production system, lean management, 8 wastes of lean manufacturing, and common lean tools, JIT and lean deployment.	10	-	-	-
	Total Productive Maintenance and Total Quality Management – benefits, 8 pillars of TPM,	15	-	-	-
	Human Resource Management – Recruitment, Training and training needs.	10	-	-	-
	Industrial Relation Legislation management – Industrial relations & Industrial disputes, Employee's welfare facilities.	10	-	-	-
	Total Marks	**100**			
Industrial Equipment Maintenance	Maintenance Management and Planning– Types of maintenance, condition monitoring, overall equipment effectiveness.	15	-	-	-
	Maintenance Forms and Actions– History card, Master schedule card, work order, report card	12	-	-	-
	Installation, Troubleshooting and Servicing– Installation commissioning & erection, tools for servicing & troubleshooting, Troubleshooting techniques	25	-	-	-

	Reliability and Machine Availability– Reliability predictions, Failure rates, MTTF, MTBF, Availability, maintainability & MTTR	15	-	-	-
	Spare Parts Planning– Codification of parts, Classification of spare parts, VED analysis, FAST moving, Non-moving and slow-moving parts	15	-	-	-
	Smart Maintenance– Remote monitoring & Maintenance, Intelligence maintenance, Additive manufacturing maintenance, AMS, Prognosis approach for condition-based maintenance, Limitations of smart maintenance, supply chain collaboration.	18	-	-	-
	Total Marks	**100**			
Automated Production System	Introduction to Automation– Principles & strategies, elements of automated system, types of automation.	15	-	-	-
	Design Consideration for Automation – Automated flow line, transfer mechanisms, part feeding devices, TAKT time, cycle time, lead time, throughput time, Assembly line system.	40	-	-	-
	Automation in Material Handling– function & purpose, ASRS and benefits, automated inspection.	25	-	-	-
	Digital Manufacturing– CIM, CAPP, FMS, Advantages of FMS	12	-	-	-
	Smart Factory– Benefits of smart manufacturing, Architecture, I-4.0 Intelligent manufacturing.	8	-	-	-
	Total Marks	**100**			
Additive Manufacturing	Introduction to AM Technologies – Additive manufacturing characteristics, difference with conventional manufacturing, advantage & disadvantage.	10	-	-	-
	AM Technologies and Materials – different technologies Additive manufacturing, classification of materials and properties of material	30	-	-	-
	Introduction to machine – Machine demonstration	8	-	-	-
	Design for AM – concept of designing, meshing & STL format	12	-	-	-
	Post Processing-post processing methods, consideration of part quality.	15	-	-	-
	Part Printing – procedure for printing	15	-	-	-

	Applications of AM – Benefits, industry applications	10	-	-	-
	Total Marks	**100**			
Employability Skill	Labour Welfare and Legislation.	20	-	-	5
	Customer Interaction/ Service.	15	-	-	10
	Conflict resolution and Negotiation	20	-	-	5
	Job readiness and Career building	20	-	-	5
	Total Marks	**100**			
MSD Project – Work Instruction	Verification	-	-	10	-
	Assembly	-	-	20	-
	Trailing	-	-	10	-
	Implementation	-	-	20	-
	Presentation	-	-	10	20
	Project report	-	-	10	-
	Total Marks	**100**			
OJT	Presentation	-	75	-	25
	Total Marks	**100**			

Annexure -7: Assessment Strategy

1 ASSESSMENT STRATEGY

The Criteria for assessment is based on Modules, and. will be assigned marks proportional to its importance.

The assessment for the semester-based qualification is carried out by conducting Formative and Summative Assessments.

Regarding Theory – Sessional is based on Intermediate Tests, File / Assignments & Viva –voce: Semester end examination wherein for each Individual batch, A&E dept. at Corporate office, Bangalore creates unique question papers for theory part as well as practical – Theory comprises MCQ and descriptive questions drawn randomly from Question Bank.

Regarding the practical part, the experiments/ exercises are performed by the trainees during the LAB Hours and the trainees are allowed to record the learning of it which will be carried as their Record Marks & one Lab Test and semester end examination. Semester end examination is outcome-based experiments/ exercises of the course will be given to trainees to perform and based on the performance the mark will be awarded. The passing criteria is based on practical's performance, viva or oral exam, Test and final semester end examination.

Theory and practical Examinations are carried out by Examiners under the overall supervision of the Assessment & Evaluation Dept.

Evaluation of Theory & Practical examination is carried out by the Trained Assessors (NTTF faculty members) under the supervision of Shop floor Manager / senior faculty in a fair manner as per the assessment criteria set by A&E dept. of NTTF.

The Tabulation and processing of results shall be carried out under EDUSQUARE campus Software.

Assessment comprises the following components:

- Job carried out in Labs / workshops
- Record book
- ONLINE Examination
- Answer sheet of assessment
- Viva-voce
- Semester end examination
- ON-THE-JOB training
- Tech Talk / Shop Talk
- Extracurricular and Co-curricular Activities
- Projects
- Attendance and punctuality

2. ASSESSORS

Evaluation of Theory & Practical examination is carried out by the Trained Assessors (NTTF faculty members) in a fair manner as per the assessment criteria set by A&E dept. of NTTF.
Assessors / Faculties are trained from time to time to upgrade their skills on various aspects such as conduct of assessments, teaching methodology etc.

3 ELIGIBILITY TO APPEAR FOR THE EXAM:

- The candidates should have an attendance of a minimum 90% in a semester.
- The candidates should have secured minimum Sessional Marks in Theory & Practical

4 PASS CRITERIA:

To pass the Qualification, every trainee should score a minimum of 40% in each Theory and 50% in each Practical and 60% in OJT / Projects.

5 RESULTS AND CERTIFICATION:

The assessment results are backed by evidence collected by assessors. Successful trainees are awarded the Diploma certificate by NTTF Corporate Office.

6 ON THE JOB:

1. The candidate must score 60% to successfully complete the OJT.
2. Tools of Assessment that will be used for assessing whether the candidate is having desired skills and etiquette of dealing with customer needs & requirements and perform Soft Skills effectively:
    - Videos/photos of Trainees during OJT
    - Suggestions / Kaizens from trainees
    - Rewards and appreciation to trainees as applicable
3. Assessment will ensure the following:
    - Effective engagement with the customers
    - Understand the working of various tools and equipment.

7 SYSTEM OF GRADING:

An alphabetical letter grade will be assigned for each subject based on the total marks scored in the sessional and end semester examination.
Equivalent Grade Points are used: A = 9.5, B = 8.5, C = 7.5, D = 6.5, E = 5.5, F = 0 (FAIL), I = Incomplete (MP/AB/SP) Supplementary cleared = E

The student will be issued Semester Grade Report calculating SGPA / CGPA as follows:

$$\text{Semester Grade Point Average (SGPA)} = \frac{\Sigma \text{ (No. of Credits x Grade Point)}}{\Sigma \text{ (No. of Credits for the Program)}}$$

$$\text{Cumulative Grade Point Average (CGPA)} = \frac{\sum \text{ (SGPA} \times \text{total Credits of each semester)}}{\text{Total credits Acquired.}}$$

Awarding of class:

a) Awarding of class for semester:

SGPA	Classification
8.5 and above	First class with distinction
7.5 to 8.4	First class
6.0 to 7.4	Second class
5.5 to 5.9	Pass class

b) Awarding of class for Programme:

First class with Distinction	Should have scored CGPA 8.5 and above and should have cleared all Semesters in the first attempt.
First class	Should have scored CGPA 7.5 to 8.4
Second class	Should have scored CGPA 6.0 to 7.4
Pass class	5.5 to 5.9

8 ASSESSMENT TOOLS

All assessment and evaluation activities are carried out under EDUSQUARE campus software which includes Formative assessment & Summative assessment.

- EDUSQUARE : NTTF ERP/CRM used for academic purpose EDUSQUARE erp.nttftrg.com used as SaaS (software as a service) mode
- Digital Valuation System: Digital Valuation system is an innovative software solution which automates manual evaluation and help institutions to minimize the time, effort and human errors in the entire valuation process.
- Remote proctoring which includes AI based Auto Proctoring, Student authentication & Multi secure Exam browser as and when the need arises.

List of ICT Tools :

Desktop and laptops
Interactive While Board
CCTV Camera
Pen Drive
Video Conferencing
Biometric
Edusquare: NTTF ERP/CRM used for academic purpose Edusquare erp.nttftrg.com used as SaaS (Software as a Service) mode
Networking: Includes Wireless access Points, Switches, Routers, Controllers across all NTTF
AWS Cloud: AWS Cloud computing platform to host NTTF website www.nttftrg.com and used as backup storage.
Firewall: Network security device protecting our network by filtering traffic and blocking outsiders.
Microsoft (O365/M-365) – Email/office (Word, Excel, PPT, One Drive for all staff/students are provided using Microsoft O365 MDM (BYOD) policies implemented through M365 used as SaaS

Annexure - 8: Model Curriculum

Semester - 5	Module Name: Embedded Systems and IoT	Module code: CP15501T
Sl. No	**Module Details**	**Theory Hours 40**
1	Embedded System	7h
2	Peripheral Interface Controller – PIC16F877A	9h
3	Node MCU - ESP8266	3h
4	Node MCU And Arduino Programming	7h
5	IOT (Internet of Things)	6h
6	Networking and Cloud Computing	5h
7	IOT Framework	3h

Semester - 5	Module Name: Advanced PLC	Module code: CP15502T
Sl. No	**Module Details**	**Theory Hours 40**
1	PLC Analog Signals	3h
2	PLC Analog Input and Output	7h
3	PLC Programming Languages - Basics	4h
4	PLC Communication	4h
5	PLC Trouble Shooting	3h
6	Human Machine Interface (HMI)	6h
7	Distributed Control System (DCS)	5h
8	Supervisory Control and Data Acquisition (SCADA)	8h

Semester - 5	Module Name: Robotics	Module code: CP15503T
Sl. No	**Module Details**	**Theory Hours 40**
1	Introduction to Robotics	5h
2	Robot Anatomy	9h
3	Robot Motion Analysis	6h
4	Robot Communication Methods and Vision System	4h
5	Robot Programming	5h

6	Robot Application	6h
7	Robot Maintenance	5h

Semester - 5	**Module Name: CNC Technology**	**Module code: CP15504T**
Sl. No	**Module Details**	**Theory Hours 40**
1	Introduction to Computerized Numerical Control	5h
2	CNC Control System	9h
3	Elements of CNC Machine	6h
4	Nomenclature of Lathe Tool	4h
5	CNC Operating Modes	5h
6	CNC Programming	6h
7	CNC Maintenance and Troubleshooting	5h

Semester - 5	**Module Name: Product Design and Development**	**Module code: CP15505T**
Sl. No	**Module Details**	**Theory Hours 40**
1	Design Process	7h
2	Design Thinking	11h
3	Advanced Product Quality Planning	17h
4	Product Management	5h

Semester - 5	**Module Name: Employability Skills**	**Module code: CP15512T**
Sl. No	**Module Details**	**Theory Hours 40**
1	Leadership & Motivation	10h
2	Quality Management – Importance of quality in industry	10h
3	Critical thinking and Problem solving	10h
4	Getting ready for Entrepreneurship	10h

Semester - 5	**Module Name: Embedded Systems and IoT Lab**	**Module code: CP15506P**
Sl. No	**Module Details**	**Practical Hours 60**

1	**PIC MICROCONTROLLER PROGRAMMING USING EMBEDDED C**	
1.1	Familiarization of MP LAB IDE software	2h
1.2	Complement an 8-bit number	2h
1.3	Shift of an 8 - bit number	2h
1.4	Masking of lower four bits of an 8 - bit number.	2h
1.5	Checking D3rd bit of an 8-bit data	2h
2	**PIC MICROCONTROLLER INTERFACE PROGRAMMING**	
2.1	LED with Switch control.	3h
2.1.1	LED Blinking with Timer Control	3h
2.1.2	Alternate Blinking of LED	
2.1.3	Sequential Blinking of LED	
2.2	DC motor direction control with switch.	3h
2.3	Seven segment display.	3h
2.4	LCD interfacing.	3h
3	**NODE MCU**	
3.1	Control LED with a switch	3h
3.2	Control LED Intensity using POT	3h
3.3	Direction Control of DC Motor	3h
3.4	Angle control using DC Servo Motor.	3h
3.5	Displacement measurement using Ultrasonic sensor.	3h
4	**IOT BASED PROGRAMMING**	
4.1	Familiarization of MQTT Protocol.	1h
4.2	Create a topic based on PUB/SUB approach.	2h
4.3	Create an android app and integrate the same with smartphone.	3h
4.4	D.C motor control using NODE MCU and blynk.	3h
4.5	LED ON/OFF over web page using NODE MCU and blynk.	3h
4.6	Create a broker ID using thing speak.	2h
4.7	Publish and subscribe a topic using thing speak.	3h
4.8	Data acquisition from the displacement sensor using thing speak.	3h

Semester - 5	Module Name: Advance PLC Lab	Module code: CP15507P
Sl. No	**Module Details**	**Practical Hours 60**
1	**INTERFACING PNEUMATIC SYSTEM WITH PLC**	
1.1	Actuation of pneumatic cylinders with PLC	2h
1.2	Build and test PLC control systems for pneumatic circuits using Timers	2h
1.2.1	Exercise - 01) Automate magazine feed Mechanism using Electro-pneumatic control System.	
1.2.2	Exercise - 02) Bank vault door controller using Electro-pneumatic control system.	
1.3	Build and test PLC control systems for pneumatic circuits using counter	2h
1.3.1	Automate magazine feed with a limited run on a particular commodity	
1.4	Actuation of Multi cylinders for the given sequence. A+, B+, A-, B-	4h
1.5	Build and test PLC control systems for pneumatic application with feed back	
2	**ANALOG I/O SIGNAL PROCESSING**	
2.1	Analog value processing on PLC	2h
2.2	Input channel Voltage / current mode configuration	2h
2.3	Analog Input scaling	4h
2.3.1	Exercise – 01) Processing of Potentiometer analog values and interface with PLC Analog input module.	
2.3.2	Exercise – 02) Processing of Analog values using Thermocouple to PLC Analog input module.	
2.4	Output Voltage / current mode configuration	1h
2.5	Analog output scaling / Un-scaling	4h
2.5.1	Speed control of a Motor using Unscaled Analog output.	
3	**HMI**	
3.1	Configuring a new HMI Panel	2h
3.2	Design of HMI screen	4h
3.3	Tag Creations	2h
3.4	Start and Stop command using Blinking and sizing elements in HMI	4h
3.5	Working with Date/Time field elements in HMI	2h

3.6	Data entry	4h
3.6.1	**Exercise – 01)** HMI Numeric Data Entry	
3.6.2	**Exercise – 02)** Reading and Writing Analog Values to an HMI Screen	
3.7	Movement, Visibility and Filling	3h
3.7.1	Bottle filling and movement on Conveyor exercise.	
3.8	Alarms Messaging configuration using HMI	2h
4	**SCADA**	
4.1	SCADA configuration	2h
4.2	SCADA Screen /Creating & Editing graphic display with animation	2h
4.3	Alarms Messaging configuration using SCADA	3h
4.4	Reporting and Trending in SCADA System	3h
4.5	Use various functions of SCADA simulation editors and HMI to develop simple project	4h

Semester - 5	**Module Name: Robotics Lab**	**Module code: CP15508P**
Sl. No	**Module Details**	**Practical Hours 40**
1	**ROBOT COMPONENT RECOGNITION**	
1.1	Robot Component – Handling of Teach pendant and Controller	2h
1.2	Selection Factors	
1.3	General Safety Precautions	
1.4	Safety precautions - Operator Safety, Programmer Safety &Maintenance Safety	
2	**MANIPULATING THE ROBOT**	
2.1	Sequence of Jogging	2h
2.2	Joint Co-ordinates & XYZ Co-ordinates	
2.3	Three switch modes: Manual Mode& Auto Mode	1h
2.4	Robot working limits, Changing a speed	
2.5	Homing	
3	**RECORDING THE POSTION**	
3.1	Program Creation	1h

3.2	Recording desired robot positions	1h
3.3	Moving robot to the recorded positions	1h
3.4	Editing comments for recorded positions: Inserting &Deleting	2h
3.5	Modifying the program	
4	**WRITING AND RUNNING THE ROBOT PROGRAMS**	
4.1	Program line description	1h
4.2	Writing a simple program	
4.3	Saving and Running the Program	
4.4	Aborting program	1h
4.5	Inserting and deleting the programs	
5	**CREATING A PROGRAM**	
5.1	Joint Motion	1h
5.2	Linear Motion	1h
5.3	Circular Motion	1h
5.4	FINE positioning path	1h
5.5	CNT positioning path	1h
6	**CONTROL INSTRUCTIONS**	
6.1	Register instruction.	2h
6.2	Position Register Instruction.	
6.3	I/O instructions – RI/RO, DI/DO, AI/AO.	
6.4	Branch instruction.	1h
6.5	Wait instruction.	
6.6	User Alarm Instruction.	
6.7	Message Instruction.	1h
6.8	Timer Instruction.	
6.9	Override Instruction.	
6.1	Selecting Timeout Option.	1h
6.11	Cycle time.	

7	**CREATE A PICK AND PLACE PROGRAM USING CONTROLINSTRUCTION**	
7.1	Control Instruction.	3h
8	**ROBOT SIMULATION**	
8.1	Introduction to Simulation Software.	1h
8.2	Familiarization of Library functions - menu bar, tool bar and status bar.	1h
8.3	Creating a Work Cell.	1h
8.4	Creating a Rectangular pattern – Linear Interpolation.	1h
8.5	Creating a Circular Pattern – Circular Interpolation.	1h
8.6	Familiarization of adding elements to Work Cell – e.g., Fixtures, Grippers.	1h
8.7	Design and Simulate Pick and Place Operation in a Work cell.	1h
8.8	Create and adding a Rail Unit in a Work cell.	1h
8.9	Design and simulate to move the elements on the Conveyor.	1h
8.1	Design and simulate a work cell for Material Handling.	1h
9	**COORDINATE SYSTEM**	
9.1	Setting a User Coordinate System (User frame setting: 3-point method).	1h
9.2	Create an Orient Origin Point.	
9.3	Setting a Tool Coordinate System (Setting up Tool Frame) in 3-point method and 6-point method.	1h
10	**MACROS, MASTERING, BACKUP AND RESTORE**	
10.1	Macros.	1h
10.2	Mastering.	1h
10.3	Backup and restore.	1h

Semester - 5	**Module Name: CNC technology Lab**	**Module code: CP15509P**
Sl. No	**Module Details**	**Practical Hours 60**
1	**MASTERCAM SOFTWARE**	
1.1	Introduction to MASTERCAM Software	1h
1.2	2D Drafting	
	Exercise - 01 (MCAM - 2D - Drafting)	1h

	Exercise - 02 (MCAM - 2D - Drafting)	1h
	Exercise - 03 (MCAM - 2D - Drafting)	1h
	Exercise - 04 (MCAM - 2D - Drafting)	1h
1.3	2D Contour & Pocket	
	Exercise - 05 (MCAM - Mill)	2h
	Exercise - 06 (MCAM - Mill)	2h
1.4	Drilling & Patterns	
	Exercise - 07 (MCAM - Mill)	2h
	Exercise - 08 (MCAM - Mill)	2h
1.5	Facing & turning	
	Exercise - 09 (MCAM - Lathe)	2h
	Exercise - 10 (MCAM – Lathe)	2h
1.6	3D Counter & Surface Machining	
	Exercise - 11 (MCAM - Mill)	2h
1.7	Generation of NC Codes & Communication of NC Codes to CNC M/C	1h
2	**CADEM SOFTWARE**	
2.1	Introduction to CADEM Software	3h
2.2	NC Milling	
2.2.1	Exercise – 01	2h
2.2.2	Exercise – 02	2h
2.2.3	Exercise – 03	2h
2.3	NC Lathe	
2.3.1	Exercise – 04	2h
2.3.2	Exercise – 05	2h
2.3.3	Exercise – 06	2h
3	**CNC MACHINES**	
3.1	Introduction to CNC Machines.	1h
3.2	Machine specification.	
3.3	Machine Control Panel.	

3.4	Setting of Offset.	2h
3.5	Editing of Program.	
3.6	Single Block, Dry Run.	
4	**BASIC MAINTENANCE IN CNC MACHINES**	
4.1	Introduction to Maintenance.	2h
4.2	Preventive Maintenance.	2h
4.3	Breakdown Maintenance.	2h
5	**PRACTICE ON THE CNC MACHINES**	
5.1	CNC Milling Machine.	
5.1.1	Exercise – 01	4h
5.1.2	Exercise – 02	4h
5.2	CNC Lathe Machine.	
5.2.1	Exercise – 01	4h
5.2.2	Exercise – 02	4h

Semester - 5	**Module Name: MSD Project**	**Module code: CP15510P**
Sl. No	**Module Details**	**Practical Hours 140**
1	MSD Project	140h

Semester - 5	**Module Name: Artificial Intelligence and Machine Learning Lab**	**Module code: CP15511P**
Sl. No	**Module Details**	**Practical Hours 60**
1	Python for Data Science	4h
2	Data Preprocessing and Visualization-Excel & Python	8h
3	Supervised Learning - Regression	6h
4	Supervised Learning - Classification	6h
5	Unsupervised Learning	6h
6	Model Selection and Validation	6h
7	Introduction to Deep Learning	6h
8	Convolutional Neural Networks (CNN)	6h
9	Model Deployment and AI Ethics	3h

10	Case Studies on AI/ML techniques to a real-world problem	9h

Semester - 6	**Module Name: Industrial Management**	**Module code: CP15601T**
Sl. No	**Module Details**	**Theory Hours 30**
1	Basics of Management	2h
2	Pollution Prevention and Waste Management	2h
3	Industrial Safety Management	2h
4	Inspection and Quality Control	5h
5	Modern Production Management	2h
6	Lean Management	4h
7	Total Productive Maintenance and Total Quality Management	9h
8	Human Resource Management	2h
9	Industrial Relation Legislation management	2h

Semester - 6	**Module Name: Industrial Equipment Maintenance**	**Module code: CP15602T**
Sl. No	**Module Details**	**Theory Hours 30**
1	Maintenance Management and Planning	6h
2	Maintenance Forms and Actions	2h
3	Installation, Troubleshooting and Servicing	8h
4	Reliability and Machine Availability	3h
5	Spare Parts Planning	4h
6	Smart Maintenance	7h

Semester - 6	**Module Name: Automated Production System**	**Module code: CP15603T**
Sl. No	**Module Details**	**Theory Hours 30**
1	Introduction to Automation	4h
2	Design Consideration for Automation	10h
3	Automation in Material Handling	7h
4	Digital Manufacturing	5h
5	Smart Factory	4h

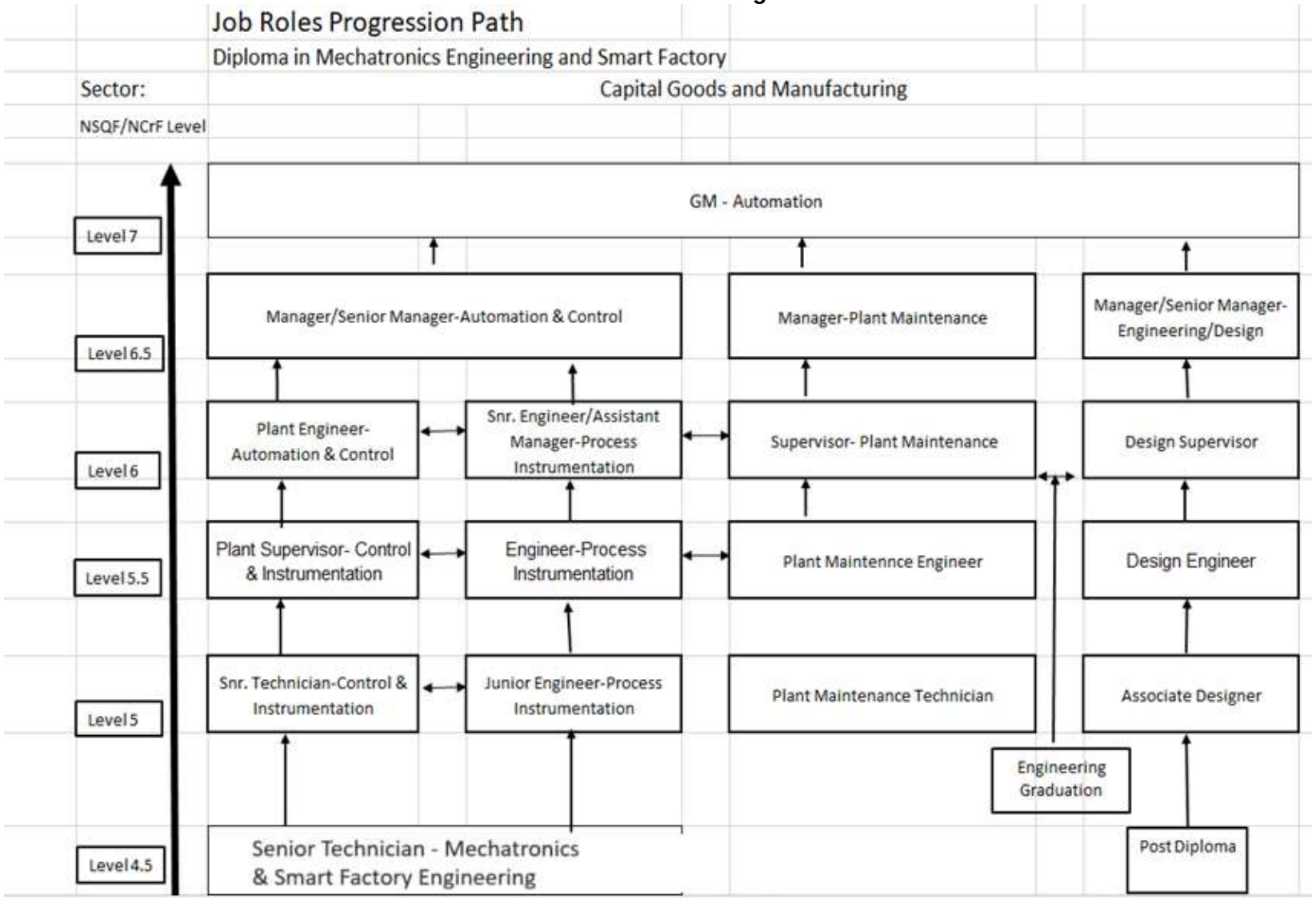
Semester - 6	Module Name: Additive Manufacturing	Module code: CP15604T
Sl. No	**Module Details**	**Theory Hours 40**
1	Introduction to AM Technologies	3h
2	AM Technologies and Materials	15h
3	Introduction to the Machine	4h
4	Design for AM	7h
5	Post Processing	3h
6	Part Printing	6h
7	Applications of AM	2h

Semester - 6	Module Name: MSD Project	Module code: CP15605P
Sl. No	**Module Details**	**Practical Hours 210**
1	MSD Project	210h

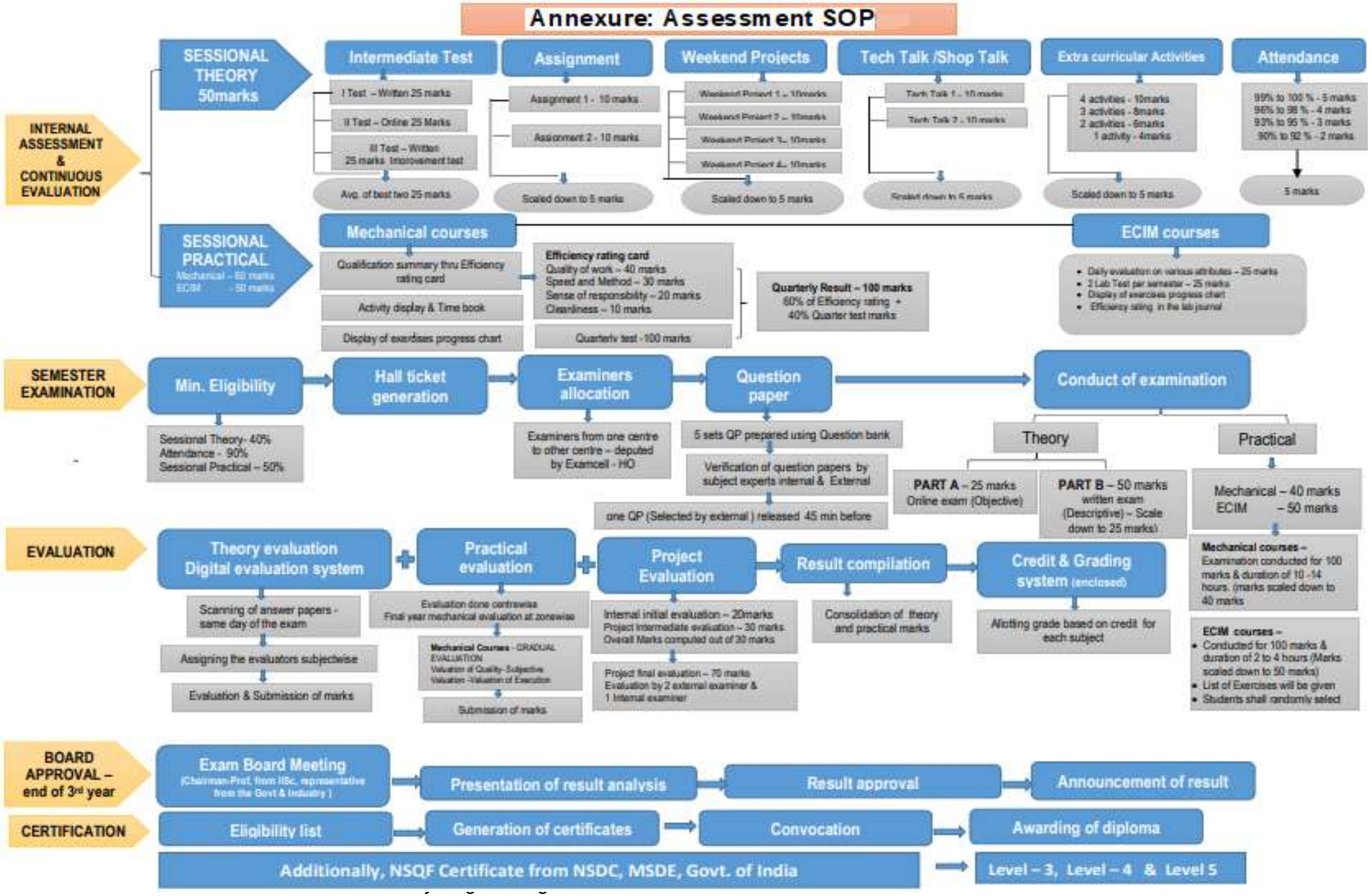
Semester - 6	Module Name: OJT	Module code: CP15606P
Sl. No	**Module Details**	**Practical Hours 360**
1	OJT- On the Job Training in the Industry	360h

Semester - 6	Module Name: Employability Skills	Module code: CP15607T
Sl. No	**Module Details**	**Theory Hours 30**
1	Labour Welfare and Legislation.	5h
2	Customer Interaction/ Service.	5h
3	Conflict resolution and Negotiation	5h
4	Job readiness and Career building	5h

Annexure 9 Career Progression



Annexure – 10 Assessment Sop



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Annexure -11: Occupational Map

Sector Name: Capital Goods Manufacturing

As per NCrF		As per NCO-2015	Sub-Sector 1/Automotive, Aerospace, Home appliances, Textile, Construction machinery	
NCrF Level (1-8)	**Level Descriptors**	**NCO-15 -- Family (First 4 digits code/s for the given level cross cutting the OM Sub-Sectors/Occupations)**	**Occupation 1**/Process control and instrumentation, maintenance, embedded system developer.	**Occupation 2/ Industrial Automation planning and implementation. Product design and development.**
Level 8	**1.** Professional Theoretical Knowledge: **Mastery of knowledge / Innovation driven/ Comprehensive knowledge 2. Professional and Technical Skills/ Expertise: Most advanced Technical and Managerial skills** **3. Employment Readiness & Entrepreneurship Skills & Mind-set: Significant authority, transformational leadership, Social intelligence** **4. Broad Learning Outcomes: Lead large transformational projects** **5. Responsibility: Business Vision Chairperson/ Board Member / CMD**			
Level 7	**1.** Professional Theoretical Knowledge: **Advanced knowledge with critical understanding of emerging developments2. Professional and Technical Skills/ Expertise: Highly specialized skills, transdisciplinary skills, leadership skills** **3. Employment Readiness & Entrepreneurship Skills & Mind-set: Cross cultural competency, transformational leadership** **4. Broad Learning Outcomes: Apply acquired advanced technical skills, technical appraisal and reviews** **5. Responsibility: Business Management (like GM/ CEO / CXO ,etc.)**	1223, 1321, 3155.	GM - Instrumentation & Control, Power Electronics & Systems, Process Automation, Industrial Automation Engineering, Industrial Maintenance Engineering, Consumer Electronics. Embedded Developer Project Head.	GM - Engineering/Design Entrepreneur
Level 6.5	**1.** Professional Theoretical Knowledge: A**dvanced multidisciplinary and specialized knowledge2. Professional and Technical Skills/ Expertise: Advanced Technical and Managerial Skills** **3. Employment Readiness & Entrepreneurship Skills**	1321, 3114, 3155 2144, 1223, 2151,	Manager/ Sr. Manager - Instrumentation & Control, Power Electronics & Systems, Process Automation, Industrial Automation Engineering,	Manager/Senior Manager- Engineering Process planning/ Product development, Industrial Automation.

	& Mind-set: Leadership, effective resource management **4. Broad Learning Outcomes: Judgement in complex problems** **5. Responsibility: Vertical/ Business unit management –Manager or Senior Manager**		Industrial Maintenance Engineering, Consumer Electronics. Embedded Developer Product designer.	
Level 6	**1.** Professional Theoretical Knowledge: **Multidisciplinary and specialized knowledge 2. Professional and Technical Skills/ Expertise: Range of skills along with specialized domain skills** **3. Employment Readiness & Entrepreneurship Skills & Mind-set: Entrepreneurial mindset, self-management** **4. Broad Learning Outcomes: Judgement / decision making – specialized** **5. Responsibility: Team leader – Assistant technical supervisor, technical supervisor or Assistant/ deputy manager**	2152, 2151, 3114 2144, 1223, 2512, 3155.	Plant Engineer - Instrumentation & Control, Power Electronics & Systems, Process Automation, Industrial Automation Engineering, Industrial Maintenance Engineering, Consumer Electronics. Embedded Developer Senior Team Lead	Design Supervisor - Process planning/ Product development, Industrial Automation.
Level 5.5	**1.** Professional Theoretical Knowledge: **Specialized knowledge 2. Professional and Technical Skills/ Expertise: Specialized skills** **3. Employment Readiness & Entrepreneurship Skills & Mind-set: Team readiness, self-entrepreneurship readiness** **4. Broad Learning Outcomes: Specialized/ complex jobs/tasks** **5. Responsibility: Self and team responsibility – Sr. Technician or Master Technician**	2152, 2151, 3114 2512, 3155, 7412.	Plant Suprevisor - Instrumentation & Control, Power Electronics & Systems, Process Automation, Industrial Automation Engineering, Industrial Maintenance Engineering, Consumer Electronics. Embedded Developer Team Leader	Design Engineer - Process planning/ Product development , Industrial Automation.
Level 5		2152, 2512, 3114, 3122, 3139, 3155, 7412.	Senior Technician - Instrumentation & Control, Power Electronics & Systems, Process Automation, Industrial Automation Engineering, Industrial Maintenance Engineering, Consumer Electronics. Senior Embedded Developer	Associate Designer - Process planning/ product development, Industrial Automation.

Level 4.5	**1.** Professional Theoretical Knowledge: **Range of knowledge 2. Professional and Technical Skills/ Expertise: Range of technical skills** **3. Employment Readiness & Entrepreneurship Skills & Mind-set: Team readiness & Enterpreurial readiness** **4. Broad Learning Outcomes: Carry out Range of tasks and may provide range of solutions** **5. Responsibility: Accountable/ responsible - Technician**	2152, 2512, 3114, 3122, 3139, 3155, 7412.	Technician - Instrumentation & Control, Power Electronics & Systems, Process Automation, Industrial Automation Engineering, Industrial Maintenance Engineering, Consumer Electronics. Embedded Developer	Study Post Diploma

Annexure-12: Key Learning Outcome

SL. NO.	MODULE NAME	KNOWLEDGE AND UNDERSTANDING	TECHNICAL & PROFESSIONAL SKILLS	APPLICATION OF KNOWLEDGE AND SKILLS
3rd Year				
1	**Embedded Systems and IoT - (CP15501T)** **Embedded Systems and IoT Lab - (CP15506P)** Understanding IoT Architecture, Cloud computing and their applications.	Knowledge on Hardware and Software architecture of Embedded system. IoT Technologies, components, Architecture, Stages of IoT, Industrial IoT. Knowledge on Raspberry Pi, Understanding Architecture, PIN description. Understanding, Python, Interpreted Languages, Data types, Flow control, Conditional statements.	ESP8266 and Node MCU Features, configuration and modes of operation. Arduino Programming, controlling Output interface elements. Networking and Cloud Computing. IoT Framework, Open source IoT Framework, Testing IoT framework. Applications of Raspberry Pi.	Programming Arduino and interface and control external output devices Creation of Android App, integrate with smart phones, control of external devices using smart phones, Data acquisition using thing speak. Programming using Raspberry Pi. - Interface sensors, controlling Output devices.
2	**Advanced PLC - (CP15502T)** **Advanced PLC Lab - (CP15507P)** Ability to develop simple projects using PLC/HMI/SCADA to interface and control digital and analog devices.	Understanding on PLC Analog and Digital Input/ Output. PLC Programming, Communication, Troubleshooting, HMI Interface, SCADA and DCS.	Knowledge to configure HMI and SCADA to PLC and executing Programs.	Programming HMI and SCADA, interface to PLC and execute programs. PLC to control Pneumatic elements, Sensors and Transducers, Configuring and design of new projects on HMI and SCADA

3	**Robotics - (CP15503T)** **Robotics Lab - (CP15508P)** Ability to program ROBOT using the teach pendant, associated software.	Understanding types of Robots, knowledge on Robot Anatomy, Degree of Freedom, Understanding Robot motion analysis, Robot communication Methods. Knowledge on Robot programming, Application and Maintenance.	Recognition of Robot components Safety precautions for Operator, Programmer, Maintenance etc. Jogging a robot, working limits of a Robot, Changing Speed, Homing a robot. Control Instructions.	Programming a Robot, Modifying Program. Creating a Pick & Place Robot. Creating Macros, Mastering, Backup and restore.
4	**CNC Technology - (CP15504T)** **CNC Technology Practical - (CP15509P)** Write CNC program, execute different operations on CNC machine, Edit Programs. Knowledge on CNC Maintenance	Knowledge and understanding on CNC control Systems- Feedback and Motion Control. Understanding on CNC Elements - Drives, Control Unit, Automatic- tool changers, Pallet Changers, Swarf removal mechanism, Tool and Work Holding devices. CNC operating Modes, CNC Programming, Maintenance and Troubleshooting.	Working with master CAM. Working with other simulation software. Conversant with Machine control Panel, setting offset, editing programs, Preventive maintenance of CNC Machines.	Execution of Programs on CNC milling and Lathe Machines.
5	**Product Design & Development - (CP15505T)** Understanding the stages of Mechatronics System design and development.	Understanding on General Design Process, Mechatronic design process, Various approaches in Design of a system. Product and process quality planning.	Design Thinking, - Steps in the design thinking process. Product Management - Production strategy, Time to Market, Consumption cycle, Importance of Design for environment, Product lifecycle.	Apply design and Development concepts for development of new products and update of existing products.

6	**Industrial Management - (CP15601T)** Understanding Management structure, Safety, Productivity improvement practices, and Factory Acts and regulations.	Understand the basics of management structure and management strategies of an industry Understand Pollution and waste management. Understanding Lean Management, Human Resource Management	Able to use the tools used in the industry to improve and control the quality of products. Able to apply the Importance of TPM & TQM Concepts, Inspection and QC Industrial relation legislations	Apply the importance of the Industrial safety Apply the Importance of modern production management system.
7	**Industrial Equipment Maintenance - (CP15602T)** Understanding of Plant Maintenance procedures and Practices.	Knowledge on types of maintenance, monitoring for effective maintenance management. Understanding various parameters of Maintenance - Reliability, Machine availability.	Installation, Troubleshooting, and service process. Parts planning - Analysis, ordering/ replenishment methods. Smart Maintenance Practice.	Maintenance forms - History card, Master Schedule, work order, work report, calibration report etc.
8	**Automated Production Systems - (CP15603T)** Understanding concepts of Automation, Material Handling, Control and Inspection in Automated Manufacturing process, Concept of Digital Manufacturing and Smart Factory.	Understanding Automation principles, strategy and Types. Understanding Automation process - Detroit model of Automation, Automated flow line, Work transport methods, Understanding Industry 4.0	Knowledge on TAKT time, cycle time, lead time, throughput time, Various Automated Material handling methods, benefits and applications. Industry 4.0	Digital Manufacturing - Computer Integrated Manufacturing, Computer aided process planning, Flexible manufacturing,

9	**Additive Manufacturing - (CP15604T)** Ability to design, produce 3D objects using Pre-processing software, Processing tools, and material selection procedures.	Knowledge of conventional Manufacturing. Additive manufacturing process and application. Understanding Post processing methods, Part printing process. Describe the process of Material Extrusion – FDM and Material Jetting – Polyjet.	Additive manufacturing Technology, and the materials used and their properties. Hands-on on the Machine. Interpret and design part using Pre-processing Software	Design the concept for Additive Manufacturing. Converting 3D model to -. stl format. Part printing process and post process of printed materials. Prototyping, and other applications.

10	**MSD Project – (CP15510P)** **MSD Project - (CP15605P)** Ability to create a working model using the skill developed during the course of their training.			Perform project work on application of Mechatronics. Project should comprise of Hardware, Software as well as Display/ User Interface systems. The Hardware shall be based on Electrical/ Electronic Circuits for Motor/Power control or Pneumatic Circuits controlled by PLC or Microcontroller/Embedded controllers. A combination of the above also is accepted. Integrating Communication protocols into the above also is desirable. Manufacture and assemble Mechanical sub system. Prepare Pneumatic & Hydraulics circuit and interface. Prepare Electrical/Electronic circuit and interface Develop and download PLC / Embedded program. Integrate, Test and Troubleshoot for functionality.
11	**Artificial Intelligence and Machine Learning Lab (CP15511P)**	Knowledge on Python programming for Data science	Perform data cleaning, transformation and Visualisation	Develop the applications or Cloud based AI services using AI and ML methodologies

		Distinguish various methods in supervised Learning Explain the cross validation techniques Differentiate CNN and RNN	Implement model deployment and scaling using deep learning Create Evaluation Metrics for Classification Models	Apply the Supervised learning methods in the appropriate applications
12	**Employability Skills (CP15512T) (CP15607T)** Understand Labour Welfare and Legislation. Understand the concept of Quality Management Getting ready for Employment/ Entrepreneurship Learn to interact with customers/ provide service.	Knowledge on benefits guaranteed under various Acts, legislations, Factories act, Apprenticeship Act, ESI, EPF Acts, Payment of wages act, women's compensation Act, POSH, and other industrial laws. Understanding of Quality concepts, QMS, PDCA QC Tools, 5S, Kaizen. ISO Process. Distinguishing between Job and Career, Awareness of different job roles in the related sector. Understanding the pathway and progression. Creating resume and apply for Jobs.	Explain various Acts enacted for labour welfare by various Governments. Attend mock interviews, create Resume documents. Body language, relationship building, probing techniques.	Use of various QC tools and Kaizen for problem solving and Quality improvement themes. Customer handling from greeting, grievance handling.

Annexure: Acronym and Glossary

Acronym

Acronym	Description
AA	Assessment Agency
AB	Awarding Body
ISCO	International Standard Classification of Occupations
NCO	National Classification of Occupations
NCrF	National Credit Framework
NOS	National Occupational Standard(s)
NQR	National Qualification Register
NSQF	National Skills Qualifications Framework
OJT	On the Job Training

Glossary

Term	Description
National Occupational Standards (NOS)	NOS define the measurable performance outcomes required from an individual engaged in a particular task. They list down what an individual performing that task should know and also do.
Qualification	A formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards
Qualification File	A Qualification File is a template designed to capture necessary information of a Qualification from the perspective of NSQF compliance. The Qualification File will be normally submitted by the awarding body for the qualification.
Sector	A grouping of professional activities on the basis of their main economic function, product, service or technology.
Long Term Training	Long-term skilling means any vocational training program undertaken for a year and above. https://ncvet.gov.in/sites/default/files/NCVET.pdf