



QUALIFICATION FILE

Technician Industrial control and Instrumentation

- ☐ 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: 4.0

Submitted By:

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

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Section 1: Basic Details

1.	Qualification Name	Technician - Industrial control and Instrumentation	
2.	Sector/s	Capital Goods and Manufacturing	
3.	Type of Qualification: ☒ New ☐ Revised ☐ Has Electives/Options ☐ OEM	NQR Code & version of existing/previous qualification: <i>(change to previous, once approved)</i>	Qualification Name of existing/previous version: Technician - Industrial control and Instrumentation
4.	a. OEM Name b. Qualification Name <i>(Wherever applicable)</i>	NA	
5.	National Qualification Register (NQR) Code &Version <i>(Will be issued after NSQC approval)</i>	QG-04-CG-01033-2023-V1-NTTF	6. NCrf/NSQF Level: 4.0
7.	Award (Certificate/Diploma/Advance Diploma/ Any Other <i>(Wherever applicable specify multiple entry/exits also & provide details in annexure)</i>	Advance Certificate	
8.	Brief Description of the Qualification	Industrial control and Instrumentation Technician integrates Industrial Electronics, PCB Design, Microcontrollers and Programming, Pneumatics and Hydraulics. Candidates will be able to design and develop Electronics and Embedded systems. The subjects covered in this program are – Digital Electronics, Sensors and Actuators, Mechanical Design, Circuits and Systems, Industrial Electronics, PCB Design, Control Theory, Computer Programming, Programmable Logic Controller, Microcontroller Programming and Power Engineering. Hands-on projects emphasize designing Mechanical Systems using Embedded Real-Time Computing including projects in Automation and Controls.	

9.	Eligibility Criteria for Entry for Student/Trainee/Learner/Employee	a. Entry Qualification & Relevant Experience: <table border="1" data-bbox="916 193 2056 775"> <tr> <th data-bbox="916 193 992 363">S. No.</th> <th data-bbox="992 193 1839 363">Academic/Skill Qualification (With Specialization - if applicable)</th> <th data-bbox="1839 193 2056 363">Required Experience (With Specialization - if applicable)</th> </tr> <tr> <td data-bbox="916 363 992 432">1</td> <td data-bbox="992 363 1839 432">Certificate- Assistant Technician Electrical and Electronics (Level 3.5) from NTTF.</td> <td data-bbox="1839 363 2056 432">NA</td> </tr> <tr> <td data-bbox="916 432 992 775">2</td> <td data-bbox="992 432 1839 775"> Lateral Entry to Second Year 12th Pass with Mathematics OR After 10th Pass 2 years ITI Candidates of the following trades: Maintenance Mechanic (Chemical Plant), Technician Medical Electronics, Instrument Mechanic (Chemical Plant), Instrument Mechanic, Technician Mechatronics, Textile Mechatronics OR After 10th Pass completed 2 years diploma in relevant trade </td> <td data-bbox="1839 432 2056 775">NA</td> </tr> </table>						S. No.	Academic/Skill Qualification (With Specialization - if applicable)	Required Experience (With Specialization - if applicable)	1	Certificate- Assistant Technician Electrical and Electronics (Level 3.5) from NTTF.	NA	2	Lateral Entry to Second Year 12th Pass with Mathematics OR After 10th Pass 2 years ITI Candidates of the following trades: Maintenance Mechanic (Chemical Plant), Technician Medical Electronics, Instrument Mechanic (Chemical Plant), Instrument Mechanic, Technician Mechatronics, Textile Mechatronics OR After 10th Pass completed 2 years diploma in relevant trade	NA								
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10.	Credits Assigned to this Qualification, Subject to Assessment (as per National Credit Framework (NCrF))	Total Credit: 40			11. Common Cost Norm Category (I/II/III) (Wherever applicable): NA																			
12.	Any Licensing requirements for Undertaking Training on This Qualification (wherever applicable)	NA																						
13.	Training Duration by Modes of Training Delivery (Specify Total Duration as per selected training delivery modes and as per requirement of the qualification)	☐ Offline ☐ Online ☒ Blended <table border="1" data-bbox="808 1046 1910 1217"> <thead> <tr> <th data-bbox="808 1046 1088 1142">Training Delivery Modes</th> <th data-bbox="1088 1046 1245 1142">Theory (Hours)</th> <th data-bbox="1245 1046 1402 1142">Practical (Hours)</th> <th data-bbox="1402 1046 1559 1142">OJT Mandatory (Hours)</th> <th data-bbox="1559 1046 1783 1142">OJT Recommended (Hours)</th> <th data-bbox="1783 1046 1910 1142">Total (Hours)</th> </tr> </thead> <tbody> <tr> <td data-bbox="808 1142 1088 1174">Classroom (offline)</td> <td data-bbox="1088 1142 1245 1174">510</td> <td data-bbox="1245 1142 1402 1174">440</td> <td data-bbox="1402 1142 1559 1174">90</td> <td data-bbox="1559 1142 1783 1174"></td> <td data-bbox="1783 1142 1910 1174">1040</td> </tr> <tr> <td data-bbox="808 1174 1088 1217">Online</td> <td data-bbox="1088 1174 1245 1217">60</td> <td data-bbox="1245 1174 1402 1217">100</td> <td data-bbox="1402 1174 1559 1217"></td> <td data-bbox="1559 1174 1783 1217"></td> <td data-bbox="1783 1174 1910 1217">160</td> </tr> </tbody> </table> (Refer Blended Learning Annexure for details)					Training Delivery Modes	Theory (Hours)	Practical (Hours)	OJT Mandatory (Hours)	OJT Recommended (Hours)	Total (Hours)	Classroom (offline)	510	440	90		1040	Online	60	100			160
Training Delivery Modes	Theory (Hours)	Practical (Hours)	OJT Mandatory (Hours)	OJT Recommended (Hours)	Total (Hours)																			
Classroom (offline)	510	440	90		1040																			
Online	60	100			160																			
14.	Aligned to NCO/ISCO Code/s (if no code is available mention the same)	NCO Code – 2015.7311.0101																						

15.	Progression path after attaining the qualification (Please show Professional and Academic progression)	Professional Progression: After completion, can work as an Industrial Control and Instrumentation Technician in Electronics and automation industry. After Completion of 3 years of Full Time Programme after 5 years of Industry Experience the Job Holder can work as R&D Engineer, Service Engineer, Maintenance Engineer, Automation Engineer and Robotic Engineer. Academic Progression: Diploma - Mechatronics Engineering and Smart Factory, Post Diploma, B. VoC and B.Tech Degree Course in Relevant areas.	
16.	Other Indian languages in which the Qualification & Model Curriculum are being submitted	Hindi	
17.	Is similar Qualification(s) available on NQR-if yes, justification? for this qualification	☐ Yes ☒ No URLs of similar Qualifications: NA	
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 Employability Skills (CP15310T)	
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 – 3																
1	Digital Electronics	CP15301T	Core	4.0	19	80	-	-	-	80	100	-	-	-	100	
2	Control System	CP15302T	Core	4.0		40	-	-	-	40	100	-	-	-	100	
3	Computer Programming - C, C++	CP15303T	Core	4.0		40	-	-	-	40	100	-	-	-	100	
4	Industrial Electronics	CP15304T	Core	4.0		60	-	-	-	60	100	-	-	-	100	
5	Mechanics of Machines	CP15305T	Core	4.0		50	-	-	-	50	100	-	-	-	100	
6	Digital Electronics LAB	CP15306P	Core	4.0		-	80	-	-	80	-	80	-	20	100	
7	Computer Programming – C, C++ LAB	CP15307P	Core	4.0		-	60	-	-	60	-	80	-	20	100	
8	Industrial Electronics LAB	CP15308P	Core	4.0		-	70	-	-	70	-	80	-	20	100	
9	PCB Design and Fabrication LAB	CP15309P	Core	4.0		-	60	-	-	60	-	80	-	20	100	
10	Employability Skills	CP15310T	Core	4.0		30				30	75	-	-	25	100	
Duration (in Hours) / Total Marks					19	300	270			570	575	320		105	1000	
Semester – 4																
11	Microcontroller and Applications	CP15401T	Core	4.0	21	40	-	-	-	40	100	-	-	-	100	
12	Computer Programming – Python and Data Base	CP15402T	Core	4.0		30	-	-	-	30	100	-	-	-	100	
13	Pneumatics and Hydraulics	CP15403T	Core	4.0		30	-	-	-	30	100	-	-	-	100	
14	Programmable Logic Controller – I	CP15404T	Core	4.0		30	-	-	-	40	100	-	-	-	100	
15	Measurement and Instrumentation	CP15405T	Core	4.0		40	-	-	-	40	100	-	-	-	100	
16	Applied Mechanics	CP15406T	Core	4.0		30	-	-	-	30	100	-	-	-	100	
17	Artificial Intelligence and Machine Learning	CP15412T	Core	4.0		40	-	-	-	40	100	-	-	-	100	
18	Microcontroller and Applications Lab	CP15407P	Core	4.0		-	60	-	-	60	-	80	-	20	100	

19	Computer Programming – Python and Data Base Lab	CP15408P	Core	4.0	-	40	-	-	40	-	80	-	20	100	
20	Pneumatics and Hydraulics Lab	CP15409P	Core	4.0	-	40	-	-	40	-	80	-	20	100	
21	Measurement and Instrumentation Lab	CP15410P	Core	4.0	-	60	-	-	60	-	80	-	20	100	
22	Programmable Logic Controller – I Lab	CP15411P	Core	4.0	-	70	-	-	70	-	80	-	20	100	
23	Employability Skills	CP15413T	Core	4.0	30	-	-	-	30	75	-	-	25	100	
24	OJT	CP15414P	Core	4.0	-	-	90	-	90	-	75	-	25	100	
Duration (in Hours) / Total Marks					21	270	270	90	-	630	775	475	-	150	1400
Total for 1-Year Programme					40	570	540	90	-	1200	1350	795	-	255	2400

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 PercentagePlease 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 centre) 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	Describe the Number systems, codes, Logic gates. Explain the logical circuit reduction techniques, combinational and Sequential circuits, Timers & Counters, Registers and Flip-Flops, Data converters. Explain control systems, list out different control systems, control elements and components and explain the characteristics, and response of control systems. Explain C, C++ syntax and programming. Describe the construction of different power devices, analysis of different power circuits. Describe different mechanics, drives and maintenance procedures.	Identify, analyse and trouble shoot different Logical Circuits. Complement advance use of logics for programming Automation and control components & Circuits. Maintenance of control system components and monitoring system processes. Troubleshooting and maintenance of power devices and circuits in domestic and industrial applications. Maintenance of mechanics and drives of equipments in industry.	4.0
Professional and Technical Skills/ Expertise/ Professional Knowledge	Explain the architecture, codes and perform programming of different Micro-controllers. Explain Computer programming and Data management using Python and Data base concepts. Describe the construction and characteristics of different sensors, transducers and actuators. Describe PCB Design and Fabrication using application software. Hands-on on Pneumatic and Hydraulic components, circuits design and control. Perform PLC/ HMI & SCADA Programming and control.	Perform Data analysis and management in automation industry. Maintenance and troubleshooting of various process and controls in any process industry.	4.0

Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill	Explain Diversity, inclusion, gender sensitivity. Describe Goal setting and career development. Describe Analytical thinking and adaptive thinking. Explain about Financial & Legal literacy. Specify Occupational Safety, Health, and Environment education.	Propagate inclusiveness and team working. Propagate Personal development & team building. Developing creativity and reasoning, making decisions in dynamically challenging situations. Good understanding of various statutory and legal benefits and requirements of an employee. Knowledge of Occupational safety hazards and methods to mitigate them.	4.0
Broad Learning Outcomes/Core Skill	Practical hands-on experience on Power electronics, Hands on experience on Pneumatics, Hydraulics and PLC.	Maintenance and troubleshooting of Power Systems. Maintenance of Instrumentation Process control systems.	4.0
Responsibility	Awareness of safety Procedures and SOPs in the relevant work area. Identify, monitor & report occurrences in the work area.	Work effectively in any component assembly. Assist Maintenance activity in industry. Can work independently.	4.0

Annexure 2: Tools and Equipment (Lab Set-Up)
List of Tools and Equipment for a batch of 30 trainees

Digital Electronics and Micro controller Lab			
Sl. No.	Equipment	Specification	Quantity
1	IC Tester (for Linear IC's)		1
2	IC Tester (for Digital IC's)		1
3	Digital Trainer Kit	Fixed +5V/ 1A, 16pin ZIF Socket, Logical switch with I/O Indicators, 4mm patch cords with short circuit & Overload Protection.	10
4	Microcontroller Trainer Kit	8051 AT89S52 Development Board with Interfacing Modules.	10
5	Networked Computer with Furniture	Core i5 10th Gen 23.8-inch FHD with Alexa (8GB/256)	2
6	UPS	5kVA	1
7	PIC Development Kit	16F877A, Development Board, PIC KIT 3 Programmer with associated cables and accessories	10
8	Electronics Work Bench	(L x B x H)1200mm x 1180mm x 800mm, saddle mount - 1200mm x 520mm x 350mm	3

Instrumentation Lab			
Sl. No.	Equipment	Specification	Quantity
1	Digital Storage Oscilloscope with Current Probe	0-100 MHz, 2-Channel	5
2	Variable Regulated Power supply	0-30V/1A	5
3	Pulse Generator	20MHz	5
4	AC Drive /VFD		2
5	DC Drive		2

6	Displacement Measuring system	LVDT 0-20mm With Instrumentation Amplifier & Digital Display	2
7	Force measuring system	Load Cell 20 kg With Instrumentation Amplifier & Digital Display.	2
8	Pressure measuring System	Pressure Cell with Pressure Tank 10 Bar with Instrumentation Amplifier & Digital Display	2
9	Speed Measuring System	0-9999 RPM Non-Contact Type with Speed control circuit and Stroboscope	2
10	Digital Temperature Controller	Digital Temperature Controller Compatible to Connect J, K Thermo / Couple & RTD	2
11	Digital Tacho Meter	0-9999 RPM	1

Automation Lab

Sl. No.	Equipment	Specification	Quantity
1	Pneumatic Trainer Kit		1
2	Hydraulic Trainer Kit		1
3	PLC Trainer Kit with HMI SCADA with license	CPU, 24VDC Supply, Onboard IO- 14, DI 24V, 10 DO relay 0.5A, 2 AI 0-10 VDC, Power Supply AC 85VAC – 264VAC @47 to 63 Hz, program memory 64 KB.	4 Kit
4	Networked Computer with Furniture	Core i5 10th Gen 23.8-inch FHD with Alexa (8GB/256)	2
5	UPS	5kVA	1
6	Sensor Trainer Kit with Assorted Sensors		1

Software

Sl. No.	Software	Specification	Quantity
1	Pneumatic Simulation	10 User License	1
2	Hydraulic Simulation	10 User License	1
3	PLC Simulation	10 User License	1

4	Proteus Software	5 User License - to be distributed - 3 Nos to Digital Lab, 2 Nos- Project Lab	1
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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

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@zf india.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,	Pune	Santosh Shindhe	9890990234	santosh.shinde@spengine

		Behind Poona Forge Pvt. Ltd, Near Sonawane Wasti, Village- Talawade Gaon				erspune.com
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 Borooh	+91.33.2243494 1/22315344/329 50386	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	hkrbdblhubli@gmail.com
23	Wipro Automation	Bangalore	Bangalore	Girish	8904021754	info@wintech.com
24	Minda Industries Ltd	B-6, M.I.D.C. Chakan, Village- 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@ktm.toyota-industries.com
29	Tata Advanced Materials Limited	10, Jigani Industrial Area, Jigani	Bangalore	Mahesh	8747844393	procurement@tamindia.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@biesse.mnfg.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, Dakshineswar 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.com
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	Bangalore	Papia	9600952502	PAPIA@ARMAXINDIA.COM

		Estate, Bengaluru, Karnataka 560091				
49	Sansontech Technologies	A-108 Block li 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-Thurairakkam 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	0806683463/66 83464/6683911	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	IIInd 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@hemaa dri.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.co m
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.co m

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:**2nd 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 - 3					
Digital Electronics	Number systems & code conversions-	6			
	Logic gates and truth table	8			
	Boolean Algebra and Boolean Implementation – simplifying Boolean expressions	17			
	Combinational logic circuits – different types and applications	17			
	Timers and timing circuits – Types and applications	5			
	Latches & flip-flops – Types, working and applications	8			
	Sequential Logics – Types, working and applications	25			
	Data converters – AD and DA converters and operation	8			
	Integrated logic family- applications	6			
	Total Marks	100			
Control System	Introduction & basic elements of control system - Introduction & basic elements of control system – Control system types, transfer functions, Analogies, Block diagram, applications	40			
	Components of control system – Blocks of Closed loop control systems, controllers and applications	20			
	Analysis - Response of Control System – time response characteristics, steady state error, stability.	20			
	Process control system – applications of process control in industry	10			
	Mechatronics system - examples	10			
	Total Marks	100			
Computer Programming C, C++	Introduction to C programming language- Tokens, Data types, variables & storages, header files	20			
	Operators and Expressions – Arithmetic, relational & logical operators,	10			
	Control statements – formatted, unformatted, decision making, loops	10			
	Arrays – multidimensional & strings	10			
	Functions – library, user defined,	10			

	Pointers & Miscellaneous Topics – declaration, definition, call by value, memory allocation.	10			
	Structure & Union – declaration and accessing of structure and union	10			
	C++ Introduction and OOps Concepts – benefits of OOps and Applications.	20			
	Total Marks	100			
Industrial Electronics	Thyristor – types, construction and characteristics and applications	30			
	Thyristor circuits – Protection, phase-controlled rectifier, choppers, DC-DC converters	30			
	Inverters – circuits and applications	10			
	Cycloconverters – circuits and applications	10			
	Power supplies, AC & DC Control drives	20			
	Total Marks	100			
Mechanics of Machines	Mechanics of machines – physical concepts associated – work, energy, load, effort, simple machines,	10			
	Kinematic links, pairs and chains basic understanding	10			
	Intermittent mechanisms – working and applications	5			
	Drive mechanisms – Belt, gear, chain, comparison and applications	20			
	Lubrication – types, specification and application	5			
	Bearing – Types, maintenance and application	10			
	CAM followers – Types and applications	10			
	Guideways – types, comparison, advantages, maintenance and application.	20			
	Balancing of rotating masses, vibration of equipments and machinery	10			
	Total Marks	100			
Employability Skill	Diversity and Inclusion, Gender sensitivity PwD etc.	15			5
	Career development & Goal setting	20			10
	Entrepreneurship	15			5
	Analytical thinking & Adaptive Thinking	25			5
	Total Marks	100			
Digital Electronics LAB	Familiarization of GATE ICs, Implementation of GATES using other GATE components.		10		3
	Implementation of Sum of Products and vice versa using GATES and K- Map techniques		10		2

	Code conversions.		10		
	Adder and subtractor circuits design and analysis. Using IC packages.		10		5
	Familiarization of Encoders, decoders, MUX, DEMUX, Latches and applications		10		2
	Design of A-stable, Monostable Multi- vibrator and application		15		5
	Design, implementation of counters, familiarisation of counter IC packages		15		3
	Total Marks	100			
Computer Programming C, C++ LAB	C, C++ Lab – Perform programs using C, C++ commands for various exercises		80		20
	Total Marks	100			
Industrial Electronics LAB	VI Characteristics of various power components – Power diode, SCR, TRIAC,		15		3
	Switching characteristics of IGBT		5		2
	Execution of Triggering circuits of SCR		15		2
	UJT relaxation Oscillator and application		5		3
	Chopper Circuit for DC motor drive		10		3
	Half & Full Bridge Converters, Buck, Boost, Buck-Boost Converters,		20		3
	Study of Bridge Inverter, PWM IC, UPS Circuit, AC & D Drives.		10		4
	Total Marks	100			
PCB Design and Fabrication LAB	Types and Properties of copper clad Sheet. Design layout for different technology of PCBs.		10		5
	PCB design and Fabrication process.		10		5
	PCB design of different circuits using EAGLE software. - Exercises		50		5
	PCB development process understanding.		10		5
	Total Marks	100			
Semester - 4					
Microcontroller and Applications	Introduction to Microprocessors & Microcontrollers- RISC & CISC Processor – Processor architecture.	10			
	Study of Memory – Memory storage elements, memory model, mapping classification, Addressing, decoding	15			
	8051 Microcontrollers – Architecture, PIN configuration, basic programming.	15			
	Peripheral Interface Controller – PIC16F877A - Architecture, PIN configuration, basic programming	25			

	PIC 16F877A Peripheral Features – Timers, A/D Converters, CCP, PSP, USART, SSP with SPI & I2C	20			
	Special Microcontroller Features- Watch dog timer, Power ON reset, Interrupt Handling.	15			
	Total Marks	100			
Computer Programming - Python and Data Base	Basics of Management -	5			
	Python Data type, Decision Making and Loops- Data types, Variables, Basic I/O operations, Decision making loops.	15			
	Tuples, Dictionaries, and Data Processing.	15			
	Functions and Files – Types, Arguments, Recursive functions, Python Anonymous, Lambda functions, Local, global, Python module packages	15			
	Python Object Oriented Programming – Introduction to OOPs	10			
	Database concept – Introduction to Data base applications	10			
	SQL – simple commands, constraints & views.	30			
	Total Marks	100			
Pneumatics and Hydraulics	Fluid Power & Pneumatic power – Advantages & Disadvantages, Applications	5			
	Properties of Fluids – Density, relative density, pressure, Hydrostatics – Pascals Law, Hydrodynamics – Bernoulli's Theorem, Boyles Law, Gay Loussac's Law	10			
	Compressed Air Production and Preparation – parameters associated with production & delivery.	20			
	Pneumatic Working Elements- Types, Construction, working pneumatic cylinders, Pneumatic actuators, Valves, symbols and applications	20			
	Hydraulic Working Elements - Types, Construction, working pneumatic cylinders, Pneumatic actuators, Valves, symbols and applications	10			
	Hydro-Pneumatic Systems – Converters and intensifiers	10			
	Electrical Control in Pneumatics and Hydraulics – Electro- pneumatic valves, Actuators, relays, switches and circuits.	15			
	Maintenance and Trouble Shooting- removal replacement, cleaning lubrication and troubleshooting.	10			
	Total Marks	100			
Programmable Logic Controller – I	PLC Basics – Introduction to PLC - Manufacturers	10			
	Basic PLC programming – Creating Ladder diagram for process control.	30			
	Basic PLC functions- Registers, counters & Timers and application	25			
	Intermediate functions – Arithmetic, comparison and conversion function.	15			

	Data handling functions – PLC SKIP & MASTER Relay functions, JMP Functions, Data movement functions.	10			
	PLC functions working with bits – Digit bit function & their applications, sequencer function.	10			
	Total Marks	100			
Measurement and Instrumentation	Introduction to Measuring System – Measuring systems elements, sensors, transducers – static & Dynamic characteristics, Parameters.	10			
	Electronic Instrumentation – Voltage to Frequency converters, Frequency to voltage converters.	5			
	Temperature Measurement – Nonelectric sensors, Electrical types, Thermocouple principle, construction, signal conditioning circuits.	20			
	Pressure Measurement- Pressure standards, conventional, electric & electronic transducers. Calibration of pressure sensors.	20			
	Displacement Measurement- potentiometer construction, principle, errors, LVDT operation principle, application, inductive proximity switch, encoders (Digital, magnetic & optical). Angular displacement.	20			
	Force, Weight and Flow Measurement- Strain gauges operation, load cell construction, and principle of operation, flow measurement using orifice plate.	15			
	Speed Measurement – Mechanical, electrical & contact less tachometer.	5			
	Ultrasonic Measurement – Piezo electric, ultrasonic transmitter and receiver working principle.	5			
	Total Marks	100			
Applied Mechanics	Force & Moment of Inertia – Determination of Moment of inertia for different sections, Beams , types and their applications, Draw SFD and BMD	30			
	Strength of Material – Stress, determination of stress – Young's Modulus, Euler's column theory, Thick & thin cylinders – fluid pressures, bending stress, Torsion shaft, torsion spring	40			
	Material Handling- – Types of conveyors, types of Industrial vehicles, job holding, positioning equipments, racks, hoist & cranes	30			
	Total Marks	100			
Artificial Intelligence & Machine Learning	AI Basics –Introduction, Machine Learning v/s Traditional Programming and Applications	5			
	Data Preprocessing and Visualization-Excel & Python- Data cleaning, Data Transformation and Data Visualisation methods	10			
	Supervised Learning – Regression- Linear and Polynomial Regression	10			
	Supervised Learning – Classification- Logistic Regression, KNN, Evaluation Metrics for Classification Models	10			
	Unsupervised Learning – Introduction, K-means Clustering, Hierarchical Clustering	10			
	Model Selection and Validation - Cross-Validation Techniques	10			

	Introduction to Deep Learning - Neural Networks and their Architecture, Functions and Optimization	10			
	Convolutional Neural Networks (CNN) – Architectures, Image Classification	10			
	Recurrent Neural Networks (RNN)- Introduction	5			
	Model Deployment and AI Ethics - Strategies for model deployment and scaling, Cloud based AI services	5			
	Case Studies on AI/ML techniques to a real-world problem	15			
	Total Marks	100			
Employability Skill	Financial and Legal Literacy	20			10
	Occupation safety, Health, and Environment education.	20			5
	Digital Literacy Skills	15			5
	Essential skills for success.	20			5
	Total Marks	100			
Microcontroller and Applications LAB	8051 Programming – Programming using Keil software – interfacing I/O devices (switches, motors) and applications		20		5
	PIC microcontroller programming – familiarization of PIC microcontroller compiler, programming & uploading using PICKit 3, interfacing I/O devices.		15		5
	Display interfacing – 7 segment display, scrolling LCD display, LED DOT matrix display.		15		
	Motor Interfacing – PIC – DC, Servo and Stepper motors.		10		5
	Internals – PIC timers & ADC Module		10		
	Sensor Interfacing – Line tracking module, PIR sensor, PIC relay module, PIC Ultrasonic sensor module		10		5
	Total Marks	100			
Computer Programming - Python and Data Base LAB	Conduction of lab using Python Programming of various exercises		60		10
	Writing and executing programs using select statement queries		20		10
	Total Marks	100			
Pneumatics and Hydraulics LAB	Execution of different controls, logical circuits using pneumatic cylinders, valves, delay timers		40		10
	Execution of different controls, logical circuits using Hydraulic cylinders, valves, delay timers		40		10
	Total Marks	100			
	Converters – V to F & Vice versa		5		5

Measurement and Instrumentation LAB	Characteristics of various sensors & Transducers (Thermocouple, RTD, Temperature diodes, Temperature sensors LM 35 & AD 590, , , Reed switches.		20		5
	Characteristics of various sensors & Transducers - pressure gauges- digital gauges		10		
	Characteristics of various sensors & Transducers - displacement measurement LVDT,		10		5
	Characteristics of various sensors & Transducers - Load cell		10		
	Characteristics of various sensors & Transducers - proximity sensor, Reed switch, Capacitive and Inductive Proximity sensors		15		
	Characteristics of various sensors & Transducers - Contact and non-contact speed measurements and applications		10		5
	Total Marks	100			
Programmable Logic Controller - I LAB	PLC program for DOL starter for Motor and other industrial applications		30		10
	Digital programming for expressing different mathematical expressions,		20		5
	Familiarization of different timers & Counters.		30		5
	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 Shopfloor 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:

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

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

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.nttfrg.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 White Board

CCTV Camera

Pen Drive

Video Conferencing

Biometric

Edusquare: NTTF ERP/CRM used for academic purpose Edusquare erp.nttfrg.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.nttfrg.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 - 3		Module Name: Digital Electronics	Module code: CP15301T
Sl. No	Module Details	Theory Hours 80	
1	Introduction to digital electronics	3h	
2	Number systems & code conversions	10h	
3	Logic gates	6h	
4	Boolean algebra & Boolean function implementation	9h	
5	Combinational logic circuits	14h	
6	Timers & timing circuits	5h	
7	Latches & flip-flops	6h	
8	Sequential logic circuits	16h	
9	Data converters	6h	
10	Integrated logic families	5h	

Semester - 3		Module Name: Control Systems	Module code: CP15302T
Sl. No	Module Details	Theory Hours 40	
1	Introduction & basic elements of control system	14h	
2	Components of control system	9h	
3	Analysis - Response of Control System	9h	
4	Process control system	6h	
5	Mechatronics system	2h	

Semester - 3		Module Name: Computer Programming C, C++	Module code: CP15303T
Sl. No	Module Details		Theory Hours 40
1	Introduction to Computer programming		1h
2	Introduction to C programming language		6h
3	Operators and Expressions		3h
4	Control statements		6h
5	Arrays		3h

6	Functions	4h
7	Pointers & Miscellaneous Topics	5h
8	Structure & Union	2h
9	C++ Introduction and OOps Concepts	10h

Semester - 3		
Module Name: Industrial Electronics		Module code: CP15304T
Sl. No	Module Details	Theory Hours 60
1	Introduction To Industrial Electronics	5h
2	Introduction to thyristor family	8h
3	Application of thyristor	3h
4	Protection Circuits	2h
5	Phase controlled rectifier	6h
6	Choppers	6h
7	DC-DC Convertors	4h
8	Inverter	6h
9	Cyclo-converter	4h
10	Power Supplies	5h
11	Control of DC drives	7h
12	Control of AC drives	4h

Semester - 3		
Module Name: Mechanics of Machines		Module code: CP15305T
Sl. No	Module Details	Theory Hours 50
1	Introduction to simple machines	6h
2	Basics of kinematics	6h
3	Mechanism of machines	4h
4	Belt Drives	4h
5	Chain Drives	4h
6	Gears, Gear drives and Gear trains	4h
7	Lubrication	4h

8	Bearings	4h
9	CAM and follower	2h
10	Guide ways	5h
11	Introduction to Balancing of rotating masses	3h
12	Introduction to vibrations of equipment's and machinery	4h

Semester - 3		
Module Name: Employability Skills		Module code: CP15310T
Sl. No	Module Details	Theory Hours 30
1	Diversity and Inclusion, Gender sensitivity PwD etc.	10h
2	Career development & Goal setting	4h
3	Entrepreneurship	6h
4	Analytical thinking & Adaptive Thinking	10h

Semester - 3		
Module Name: Digital Electronics Lab		Module code: CP15306P
Sl. No	Module Details	Practical Hours 80
1	Familiarization of Logic gate IC's -a) 7404 b) 7408 c) 7432 d) 7400 e) 7402 f) 7486	4h
2	Implementation of NOT, AND, OR, NOR, EX-OR & EX-NOR using NAND gate.	4h
3	Implementation of NOT, OR, AND, NAND, EX-OR & EX-NOR using NOR gate.	4h
4.a	Simplify and Design SOP Expressions using Basic Logic Gates.	4h
4.b	Simplify and Design POS Expressions using Basic Logic Gates.	
5.a	Simplify and Design SOP Expressions using K-map.	4h
5.b	Simplify and Design POS Expressions using K-map.	
6.a	Implement Binary to Gray Code Converter using K-map method.	4h
6.b	Implement Gray Code to Binary Converter using K-map method.	
7	Design and Implement Half Adder and Full Adder circuits.	4h
8	Design and Implement Half Subtractor and Full Subtractor circuits.	4h
9	Implement 4-bit Parallel Adder & Subtractor using IC 7483	4h
10	Implement 4-bit Comparator using IC 7485	4h
11.a	Familiarization of Priority Encoder IC 74147	4h
11.b	Familiarization of Decoder IC 74138	

12.a	Familiarization of MUX IC 74151	4h
12.b	Familiarization of DEMUX IC 74138	
13.a	Design a Monostable Circuit using IC 555	4h
13.b	Design a Astable Circuit using IC 555	
14.a	Familiarize Octal D-Latch IC 74373	4h
14.b	Familiarize Octal D-FF IC 74374	
15.a	Familiarize D-FF IC 7474	4h
15.b	Familiarize JK-FF IC 7476	
16	Implement 3-bit Ripple Up & 3-bit Ripple Down Counter using D-FF	4h
17	Design & Implement Mod-6 & Decade Counter using IC 7474	4h
18	Familiarize Decade Counter IC 7490 & 4-bit Ripple Counter IC 7493	4h
19	Design & Implement 3-bit SISO & PIPO SRG using IC 7474	4h
20	Design & Implement 3-bit Ring & Johnson Counters using IC 7474	4h

Semester - 3		Module Name: Computer Programming C, C++ Lab	Module code: CP15307P
Sl. No	Module Details	Practical Hours 60	
1	Introduction to Visual studio 2019. Menu and sub menu. a. Install and configure. b. Learn to create a project, empty project, add a c file. c. Write "Hello world" program, compile, execute and see output d. Learn about menu items under File, Edit, View (class view, error list, code definition, and output), Project, and Build.	1h	
2	a. Write a C program to declare suitable variables and initialize values for printing: Name, token number, section, present SGPA, mobile number. The variables should include integer, float, char & double. Print all the values on the monitor using printf. b. Modify the above program to read the values through keyboard using scanf ().	1h	
3	Write a program to print bytes required for short, integer, float, char and double by using size of () function.	1h	
4	Write a program to declare int x, y, float k, m and char chk[10]. Initialize some values. a. Write code to x= x+y; m+= k; k=k+y; printf("%s",chk); b. Insert toggle break point on x=x+y; c. Add watch for all variables.	2h	

	d. Compile and run code one step at a time. Watch how each line of code executes and the values in the variables change. e. Open inspect window to see how character string is stored. f. Declare the variables as global variables and execute. g. Modify the above program to calculate $x = x + m$ and $m = x + m$. Check the difference in the results. h. Modify above program to calculate $x = x \% 4$. Check the results in the watch window. i. Add the code <code>int z; z=++x; z=x++;</code> Check the results in the watch window.	
5	a. Declare 3 alphabets and 3 single digit (0 to 9) as char. Printf all of them using %c and also as %d. b. Swap any of the two alphabets. c. Declare any two numbers integer or float as variables. Swap the numbers.	2h
6	a. Write a program to read (scanf) marks of a subject and display if marks more than or less than 50, using 'if' statement. b. Modify the program to display grade: A if marks>80, B if marks<80 and >70, C if marks<70 and >60, D if marks<60 and >50, E if marks<50. Use 5 if statements. c. Modify program to display grades using nested if else statements.	2h
7	a. Write a program to calculate square and also square root of any number. Number to be read using scanf. Print the answer using printf. b. Modify the code to round off the answers to lower / higher integer using floor () and ceil (). c. Add code to read angle in radians and print sin, cos and tan of the angle. d. Modify the program to input co-efficient of x^2, x and the constant of the quadratic equation. e. Calculate $b^2 - 4ac$. If zero or more than zero then calculate and output the two roots. If less than 0 then display message.	2h
8	a. Write a program using while loop to print first 10 numbers of Fibonacci series. b. (Fibonacci series is adding previous value to next number 1, 1, 2, 3, 5, 8, 13, 21, c. Modify the program to use for a loop. d. Insert toggle break point at main () function line and run in debug mode one step at a time. See how the program flows in while and also in for loops. e. Modify the program to accept input through keyboard about how many numbers to be generated and print the series. f. Include <code>stdlib.h</code> and then add the following code before the loop and check what they do. <pre>system("color 09"); system("date"); system("dir");</pre>	2h
9	a. Write a c program using do-while loop, such that the loop should read an integer numbers between 1 and 99. It should exit from do-while loop when number entered is 0.	

	b. Write code inside the loop to count how many numbers lie between 90 to 99, 80 to 89, 70 to 79, 60 to 69, 50 to 59 and 1 to 49 (default). By using switch case. Think what expression to use for while condition. c. Display the results with appropriate message: total how many numbers entered and how many in each of the given range. Total numbers entered : Numbers 90 to 99 : Numbers 80 to 89: d. Modify the code to use while loop instead of do-while.	2h
10	a. Write a program with infinite while loop. Use ESC (ASCII code of ESC) to exit loop. b. Use switch case for branching. c. Display the number in Binary / Octal / Hexadecimal based on menu option input. Write code using while loop. d. (Note: You are actually displaying the numbers in that format and not doing actual conversion. We can use printf ("%x, %o); for octal and hexadecimal. e. Write above code using for loop. f. Add the following code and learn what is being done. <pre>#include <windows.h> COORD c = {60, 10}; printf("\033[0;31m"); SetConsoleCursorPosition(GetStdHandle(STD_OUTPUT_HANDLE), c); printf("I am here in RED");</pre>	2h
11	a. Write a program to input 6 integers and store them in an array. b. Arrange these numbers in ascending order and then print them. c. Modify the above program to input 6 names. d. Arrange them in alphabetical order. e. Add the following code: <pre>#include <stdlib.h> srand(12); // try with different numbers for (int i = 0; i < 10; i++) { x = rand() % 60; //Generates random numbers from 1 to 59. //Change to some other number and try printf(" %d, ", x);</pre>	2h

	}	
12	a. Write a program to input two 3x3 matrix using two dimensional array. b. Find the sum of those matrix. c. Calculate determinant of both the matrix. d. Modify the program to find area of triangle with vertices (0, 1), (2, 5) and (3, -3).	2h
13	a. Declare an array of 10 integers and initialize with some data. Decide if array has to be global or local. b. Declare and define a function to calculate and RETURN the average value of these numbers. c. Declare and define one more function to calculate the variance of the numbers. The average calculated earlier should be sent as an argument. The function should return the variance. d. Call both the functions from main (). e. Modify the program to call variance function from average function. f. Create another c file. Move the function to calculate the variance to this file. How will you ensure array data is available in this file?	2h
14	a. Write a program to input a sentence (gets). b. Open another c file. Display length of the sentence in that file. c. Copy first 10 characters to another string. d. Reverse the string and print.	2h
15	a. Write a C Program to input a number and print the factorial of that number. b. Use while loop. Use multiplication in reverse order to find factorial. Example : 8x7x6x5x4x3x2 12x11x10x9x8x7x6x5x4x3x2 c. Modify the program to use recursive function.	2h
16	a. Write a function to input a number. b. Write a function doubler(), to double the number and store back in same variable. Pass the variable by value. Print the number before calling function in main, inside the function and then after calling the function in main. c. Modify the program to pass variable by reference. d. Add the following code and learn about it : <pre>char buffer[50]; int a = 10, b = 20, c; c = a + b; sprintf(buffer, "Sum of %d and %d is %d", a, b, c); /*The string "sum of 10 and 20 is 30" is stored into buffer instead of printing on stdout */ printf("%s", buffer);</pre>	2h

17	a. Declare the variables to store marks of 10 students. Use names of students as name of the variables: Example: int suresh =76, roshan=82, ramya=78 etc. b. Declare an array of integer pointers and store the address of the above variables in it. c. Add 5 grace marks to all students using address stored in pointer array. d. Print the marks using address stored in pointer array.	2h
18	a. Write a program and define a macro to calculate area of a rectangle and another macro to calculate area of a triangle. b. Add the following code with the macros. printf("The current date is: %s\n", __DATE__); printf("The current time is: %s\n", __TIME__); printf("The total lines in the code is: %d\n", __LINE__); printf("The file name is: %s\n", __FILE__);	1h
19	Write a C program to implement the concept of enum.	1h
20	a. Write a program to input at least 80 characters of text. Like char data[80]. b. Open a file for writing. Input 5 lines of text in a loop and write them into file. c. Modify program to open a file with .csv. Input text /numbers separated by commas. Each line should have same number of words (say 8 words). Example: 1762, 838, Suresh, pass 7152, 826, Sihan, fail Open this file in Excel and check. c. Modify the code to read a file and write into another file (make copy of the file). d. You may delete a file using the function remove("file_name") ; e. Add this code above the #include <stdio.h> #define _CRT_SECURE_NO_WARNINGS This will suppress the warnings.	4h
21	a. Write a C Program to create a structure called student, with members name, token number & age and display the details for one student. b. Declare an array of pointers to store address for the above structure. c. Modify the code to use typedef for the structure declared. d. Modify code to allocate memory for new structure and input student data, in that new structure. Store its address in the array of pointers. e. Add code to execute in a loop to input data for 5 students. Use separate function for this. f. Add code to open a file with .csv extension and write data of all the 5 students. Separate each data with a comma. Open the file in Excel and verify.	3h
22	a. Modify the above exercise (21). Create a header file and move all the #include statements, data declaration code such as structure and variables in to header file. b. Move the function declaration of function for data input also to the header file.	1h
23	a. Copy the code and execute in Visual studio. b. Observe what the program does. c. Run step by step and comment what is done by each statement. d. Use right arrow and left arrow to use menu. Press enter key to select.	1h
24	a. Copy the code and execute in Visual studio. b. Observe what the program does. c. Run step by step and comment what is done by each statement.	1h

25	a. Write a C++ program by having the class name "Personal Details" with data members Name, Token_no, Maths, English, Electronics, Science, AvgMaths_Science, AvgMath_Eng_Science, AvgAll. b. Write two member functions. i. GetData(); // To input the above data li. PutData(); // To display the above data. c. Declare an array of above class to store details of 3 students. d. Modify the code to include default constructor and destructor. e. In constructor initialize all marks and averages to 0. f. Declare and write 3 functions to calculate the three averages. All three functions should have same name but different parameters (overloading/polymorphism).	4h
26	a. Write a program to create a class land. b. Create 3 member functions with name "Area" inside a class and find the area for 1) Square 2) rectangle 3) Circle (Function Overloading) c. Decide what variables are to be declared.	2h
27	a. Create a class called "Complex". The data members of the class are real & imaginary. b. The member functions of the class are void getdata (), Complex ADD (Complex, Complex), Complex SUB (Complex, Complex). c. With these details stated, 1) Add 2 complex numbers 2) Subtract 2 complex numbers (Note: Objects are passed as arguments to member functions and the member functions ADD & SUB are returning objects. Understand the memory allocation for objects). d. Check the class view in Visual Studio 2019 and explore it.	3h
28	a. Write a program with a class Time having Hour and minute as members. b. Write constructor to initialize the member's variables. c. Declare two objects of the class. d. Write a function to overload ++ (increment operator to increment both hour and minutes. Take care that hours can be 0 to 23 and minutes 0 to 59. e. Write a function to overload + (addition operator) to give result of addition of hours and minutes of two objects.	4h
29	a. Write a program with a class department having Dept_name, subject, subject_hours as its members. b. Define another class student inherited from class department and having name, Stud_ID and mobile_no as its members. c. Declare an object of class student, enter all the data and display all the data of three students. Name, stud_ID, Department, subject, subject_hours and mobile_no.	4h

Semester - 3	Module Name: Industrial Electronics Lab	Module code: CP15308P
Sl. No	Module Details	Practical Hours 70

1	Familiarization of digital oscilloscope	1h
2	Design and winding of an inductor	2h
3.A	Magnetization and demagnetization of L load using diode	4h
3.B	Magnetization and demagnetization of L load using diode and resistor	
4	Switching characteristics of IGBT	4h
5	Reverse recovery characteristics of power diode	2h
6.A	VI characteristics of SCR	4h
6.B	VI characteristics of TRIAC	
7.A	Resistance triggering of SCR	5h
7.B	RC triggering of SCR	
8	UJT as a relaxation oscillator	4h
9	Chopper fed DC motor driver	4h
10	Half bridge converter	4h
11	Full bridge converter	4h
12	Case study of buck converter	3h
13	Case study of boost converter	4h
14	Familiarization of bridge inverter	6h
15	Familiarization of pulse-width modulator IC SG3524	3h
16	Case study of cyclo-converter	4h
17	Familiarization and case study of UPS circuit	4h
18	Case study of DC motor drive	4h
19	Case study of AC motor drive	4h

Semester - 3		Module Name: PCB Design and Fabrication Lab	Module code: CP15309P
Sl. No	Module Details	Practical Hours 60	
1	BASICS OF EAGLE SOFTWARE	3h	
1.1	Introduction		
1.2	Schematic window		
1.3	Board window		
2	PROPERTIES OF COPPER CLAD LAMINATES	3h	

2.1	Electrolytic copper foil	
2.2	Fabrication of prepreg by Treating process	
2.3	Flowchart of Manufacturing of copper clad laminates	
2.4	Laminate build-up	
2.5	Laminate pressing	
2.6	Types of laminates	
3	LAYOUT GENERAL RULES & PARAMETERS	3h
3.1	Layout definition	
3.2	Wave soldering	
3.3	SMT Technology	
4	PCB LAYOUT DESIGN	4h
4.1	Introduction	
4.2	Solder mask	
4.3	Multi-layer design	
4.4	Automation and computers in PCB design	
5	PCB DESIGNING EXPERIMENTS	
5.1	Design a PCB layout for the 5v power supply circuit	2h
5.2	Design a PCB layout for the given multi-vibrator circuit.	2h
5.3	Design a PCB layout for Water Level Indicator	2h
5.4	Design a PCB layout for the given multi-vibrator circuit with SMD.	2h
5.5	Design the PCB layout for Automatic Street Light Circuit	2h
5.6	Design a PCB layout for the given tone generator circuit	2h
5.7	Design a PCB layout for the given IR sensor circuit	2h
5.8	Design a PCB layout for the given preamplifier circuit.	2h
5.9	Design a PCB layout for the clap switch circuit	2h
5.1	Design the PCB layout for the given cyclic lights circuit.	2h
5.11	Design a PCB layout for the given Museum watch dog circuit	2h
5.12	Design a PCB layout for the given Remote control receiver circuit.	2h
5.13	Design a PCB layout for the given Sensor circuit.	2h

5.14	Fabricate the single sided PCB for the power supply circuit	4h
6	LAYOUT PLANNING	
6.1	Generation of Design	1h
6.2	Signal coupling at High frequencies	1h
7	PHOTO PRINTING	
7.1	Photo Printing	3h
7.2	Dry film structure	
7.3	Trouble shooting of PCB's	
8	PLATING	
8.1	Electroless Copper plating process	3h
8.2	Plating techniques	
8.3	Immersion plating	
8.4	Electroless Plating	
8.5	Electro plating	
8.6	Copper plating	
8.7	Tin Plating	
8.8	Nickel Plating	
8.9	Gold plating	
9	ETCHING	
9.1	Etchants Solutions	3h
9.2	Types of Etching	
9.3	Bubble Etching	
9.4	Splash Etching	
9.5	Spray Etching	
9.6	Ferric Chloride Etchant	
9.7	Cupric Chloride Etchant	
9.8	Chromic acid Etchant	
9.9	Alkaline Ammonia Etchant	
10	MECHANICAL MACHINING OPERATIONS	3h

10.1	Introduction	
10.2	Punching Hole	
10.3	Blanking	
10.4	Shearing	
10.5	Sawing	
10.6	Routing	
10.7	Drilling	
10.8	CNC/ LASER Drilling	
10.9	LASER & System concept	
11	MULTILAYER PCB	3h
11.1	Multilayer PCB design Definition	
11.2	Layer Stack Up	
11.3	Types of Via holes	
11.4	Core Layer	
11.5	Board Lay Up	
11.6	MLB Construction	
11.7	Multilayer Press	
11.8	Multilayer Laminating Process	

Semester - 4		Module Name: Microcontroller and Applications	Module code: CP15401T
Sl. No	Module Details	Theory Hours 40	
1	Introduction to Microprocessors & Microcontrollers	4h	
2	Study of Memory	4h	
3	8051 Microcontrollers	6h	
4	Peripheral Interface Controller – PIC16F877A	8h	
5	PIC 16F877A Peripheral Features	12h	
6	Special Microcontroller Features	6h	

Semester - 4	Module Name: Computer Programming - Python and Data Base	Module code: CP15402T
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Sl. No	Module Details	Theory Hours 30
1	Basics of Management	2h
2	Python Data type, Decision Making and Loops	4h
3	Tuples, Dictionaries, and Data Processing	4h
4	Functions and Files	4h
5	Python Object Oriented Programming	4h
6	Database concept	2h
7	SQL	10h

Semester - 4 Module Name: Pneumatics and Hydraulics Module code: CP15403T		
Sl. No	Module Details	Theory Hours 30
1	Basics of Management	2h
2	Properties of Fluids	3h
3	Compressed Air Production and Preparation	7h
4	Pneumatic Working Elements	6h
5	Hydraulic Working Elements	5h
6	Hydro-Pneumatic Systems	2h
7	Electrical Control in Pneumatics and Hydraulics	3h
8	Maintenance and Trouble Shooting	2h

Semester - 4 Module Name: Programmable Logic Controller -1 Module code: CP15404T		
Sl. No	Module Details	Theory Hours 30
1	PLC Basics	2h
2	Basic PLC programming	6h
3	Basic PLC functions	6h
4	Intermediate functions	6h
5	Data handling functions	5h
6	PLC functions working with bits	5h

Semester - 4 Module Name: Measurement and Instrumentation Module code: CP15405T		
Sl. No	Module Details	Theory Hours 40
1	Introduction to Measuring System	6h
2	Electronic Instrumentation	3h
3	Temperature Measurement	8h
4	Pressure Measurement	6h
5	Displacement Measurement	8h
6	Force, Weight and Flow Measurement	5h
7	Speed Measurement	2h
8	Ultrasonic Measurement	2h

Semester - 4 Module Name: Applied Mechanics Module code: CP15406T		
Sl. No	Module Details	Theory Hours 30
1	Force and moment of Inertia	10h
2	Strength of Materials	12h
3	Material Handling	8h

Semester - 4 Module Name: Artificial Intelligence and Machine Learning Module code: CP15412T		
Sl. No	Module Details	Theory Hours 40
1.	Introduction to Artificial Intelligence & Machine Learning	1h
2.	Data Preprocessing and Visualization-Excel & Python	4h
3.	Supervised Learning – Regression	4h
4.	Supervised Learning – Classification	4h
5.	Unsupervised Learning	4h
6.	Model Selection and Validation	4h
7.	Introduction to Deep Learning	4h
8.	Convolutional Neural Networks (CNN)	4h
9.	Recurrent Neural Networks (RNN)	2h

10.	Model Deployment and AI Ethics	2h
11.	Case Studies on AI/ML techniques to a real-world problem	7h

Semester - 4 Module Name: Employability Skills Module code: CP15413T		
Sl. No	Module Details	Theory Hours 30
1	Financial and Legal Literacy	8h
2	Occupation safety, Health, and Environment education.	10h
3	Digital Literacy Skills	8h
4	Essential skills for success.	4h

Semester - 4 Module Name: Microcontroller and Applications Lab Module code: CP15407P		
Sl. No	Module Details	Practical Hours 60
1	8051 PROGRAMMING	
1.1	Familiarization to Keil Software and Embedded C Programming	1h
1.2	Arithmetic and Logical operations	3h
1.3	LED and Switch interfacing	3h
1.4	D.C Motor Interfacing	2h
1.5	SSD Interfacing	3h
2	PIC MICROCONTROLLER PROGRAMMING	
2.1	Getting Started	2h
2.2	Pic Microcontroller Compilers	2h
2.3	MikroC PRO for PIC	2h
2.4	LED Blinking	2h
2.5	Upload Code with PICKit3	1h
2.6	Running Traffic light system - PIC Programming in C	3h
3	DISPLAYS INTERFACING	
3.1	7 Segment Display	3h
3.2	Scrolling Text on LCD	3h

3.3	LED DOT matrix	3h
4	MOTORS INTERFACING	
4.1	PIC DC Motor	2h
4.2	PIC Stepper Motor	3h
4.3	PIC Servo Motor	3h
5	INTERNALS	
5.1	PIC ADC Module	4h
5.2	PIC Timers	4h
6	SENSORINTERFACING	
6.1	PIC Line Tracking Module	4h
6.2	PIC PIR Sensor PIC Relay Module	4h
6.3	PIC HC-05 Ultrasonic sensor	3h

Semester - 4 Module Name: Computer Programming – Python and Data Base Lab Module code: CP15408P		
Sl. No	Module Details	Practical Hours 40
1	Python Program to Add Two Numbers	1h
2	Python Program to Solve Quadratic Equation	
3	Python Program to Swap Two Variables	1h
4	Python Program to Check if a Number is Positive, Negative or 0	1h
5	Python Program to Find the Largest Among Three Numbers	1h
6	Python Program to Check Prime Number	1h
7	Python Program to Find the Factorial of a Number	
8	Python Program to Print the Fibonacci sequence	1h
9	Python Program to Find Armstrong Number in an Interval	1h
10	Python Program to Find the Sum of Natural Numbers	1h

11	Python Program to Display Powers of 2 Using Anonymous Function	1h
12	Python Program to Find Numbers Divisible by Another Number	1h
13	Python Program to Convert Decimal to Binary, Octal and Hexadecimal	1h
14	Python Program to Find HCF or GCD	1h
15	Python Program to Find LCM	
16	Python Program to Make a Simple Calculator using elif statement	1h
17	Python Program to Display Fibonacci Sequence Using Recursion	1h
18	Python Program to demo on class.	1h
19	Python Program to demo on Inheritance.	1h
20	Python Program to demo on Data Encapsulation	1h
21	Python Program to demo on Polymorphism	1h
22	Python Program to Add Two Matrices	1h
23	Python Program to Multiply Two Matrices	
24	Python Program to Check Whether a String is Palindrome or Not	1h
25	Python Program to Remove Punctuations from a String	1h
26	Python Program to Sort Words in Alphabetic Order	1h
27	Python Program to Illustrate Different Set Operations	1h
28	Python Program to Count the Number of Each Vowel	1h
29	Python Program to Merge Mails	1h
	DATABASE- POSTGRESQL	
30	Demo on database - Creating Databases	1h
31	Demo on database - Viewing a Database	1h
32	Demo on database - Deleting Database	1h

33	Demo on Creating Tables	1h
34	Demo on Creating tables with constraints	1h
35	Demo on Data Manipulation Language with different types Inserting values	1h
36	Demo on Data Manipulation Language with different types updating values	1h
37	Demo on Data Manipulation Language with different types Deleting Rows	1h
38	Demo on Deleting a Table	1h
39	Demo on Truncating a Table	1h
40	Writing a basic select statement	1h
41	Writing a basic select statement using where clause	1h
42	Writing a basic select statement to perform on joins	1h
43	Writing a basic select statement to perform on Sub queries	1h
44	Demo on to create view for the table	1h

Semester - 4		Module Name: Pneumatics and Hydraulics Lab	Module code: CP15409P
Sl. No	Module Details	Practical Hours 40	
1	PNEUMATICS		
1.1	Exercises on Direction control	4h	
1.1.1	Actuation of single acting cylinder by 3/2 D.C. valve		
1.1.2	Actuation of double acting cylinder by 5/2 D.C. valve		
1.1.3	Direct control of DAC by 5/2 D.C. valve		
1.1.4	Indirect control of DAC by 5/2 D.C. valve		
1.2	Exercises on Flow control	2h	
1.2.1	Speed control of SAC by throttle valve		
1.2.2	Speed control of DAC by Flow control valve		

1.2.3	Speed control of DAC by Quick exhaust valve	
1.3	Logic conditions	3h
1.3.1	Use of OR logic to actuate DAC	
1.3.2	Use of AND logic to actuate DAC	
1.3.3	Circuits using logical conditions	
1.4	Advanced Circuit Design	4h
1.4.1	Retraction of DAC after pre-set pressure is reached	
1.4.2	Memory circuit and speed control of DAC	
1.4.3	Examples for using Time delay valve	
1.4.4	Actuation of DACs with A+B=A-B- logic	
1.5	Electro- Pneumatics	4h
1.5.1	Actuation of SAC by solenoid operated valve	
1.5.2	Actuation of DAC by solenoid operated valve	
1.5.3	Actuation of SAC using OR Logic by solenoid operated valve	
1.5.4	Actuation of SAC using AND Logic by solenoid operated valve	
2.0.	HYDRAULICS	
2.1	Pressure Control	4h
2.1.1	Use of pressure relief valve in DAC	
2.1.2	Use of pressure regulating valve in DAC	
2.2	Flow Control	4h
2.2.1	Use of 1 -way flow control valve	
2.2.2	Use of 2- way flow control valve	
2.3	Direction control	4h

2.3.1	Actuation by 2/2 or 3/2 DC valve	
2.3.2	Actuation by check valve	
2.3.3	Actuation by solenoid operated valve	
3	DRIVING OF PNEUMATIC CIRCUIT WITH PLC	4h
3.1	Exercises on various driving Pneumatic circuit with PLC	
4	DESIGN ASSIGNMENTS AND SIMULATION	7h
4.1	Exercises on various circuit design and simulation	

Semester - 4		Module Name: Measurement and Instrumentation Lab	Module code: CP15410P
Sl. No	Module Details	Practical Hours 60	
1	CONVERTERS	6h	
a.	V to F Converter using ICL 8038		
b.	F to V Converter using LM2907		
2	THERMOCOUPLES & RTD	6h	
a.	Study of types of Thermocouple and characteristics Of Thermocouple.		
b.	Study of RTD and Characteristics of RTD.		
3	SENSORS	6h	
a.	Temperature sensing using Diodes.		
b.	Using LM35 and AD590 as Temperature sensor		
4	Temperature Controllers - Study of ON OFF control using temperature Controller using Thermocouple and RTD.	6h	
5	PRESSURE GAUGES	6h	
a.	Finding error in the given pressure gauge with Respect to Digital Gauge.		
b.	Finding error in the given pressure gauge with Respect to Dead Weight Tester.		
6	Measurement of Displacement using LVDT.	6h	

7	Designing a counter circuit using Proximity Sensor.	6h
8	Measurement of load by using Load cell	6h
a.	Expansion Method	
b.	Compression method.	
9	MEASUREMENT OF SPEED	6h
a.	Contact type (Tachometer)	
b.	Non- Contact Type (Proximity Sensor & Stroboscope).	
10	Familiarization of Proximity switch - Inductive Proximity, Capacitive Proximity, IR and Reed Switch.	6h

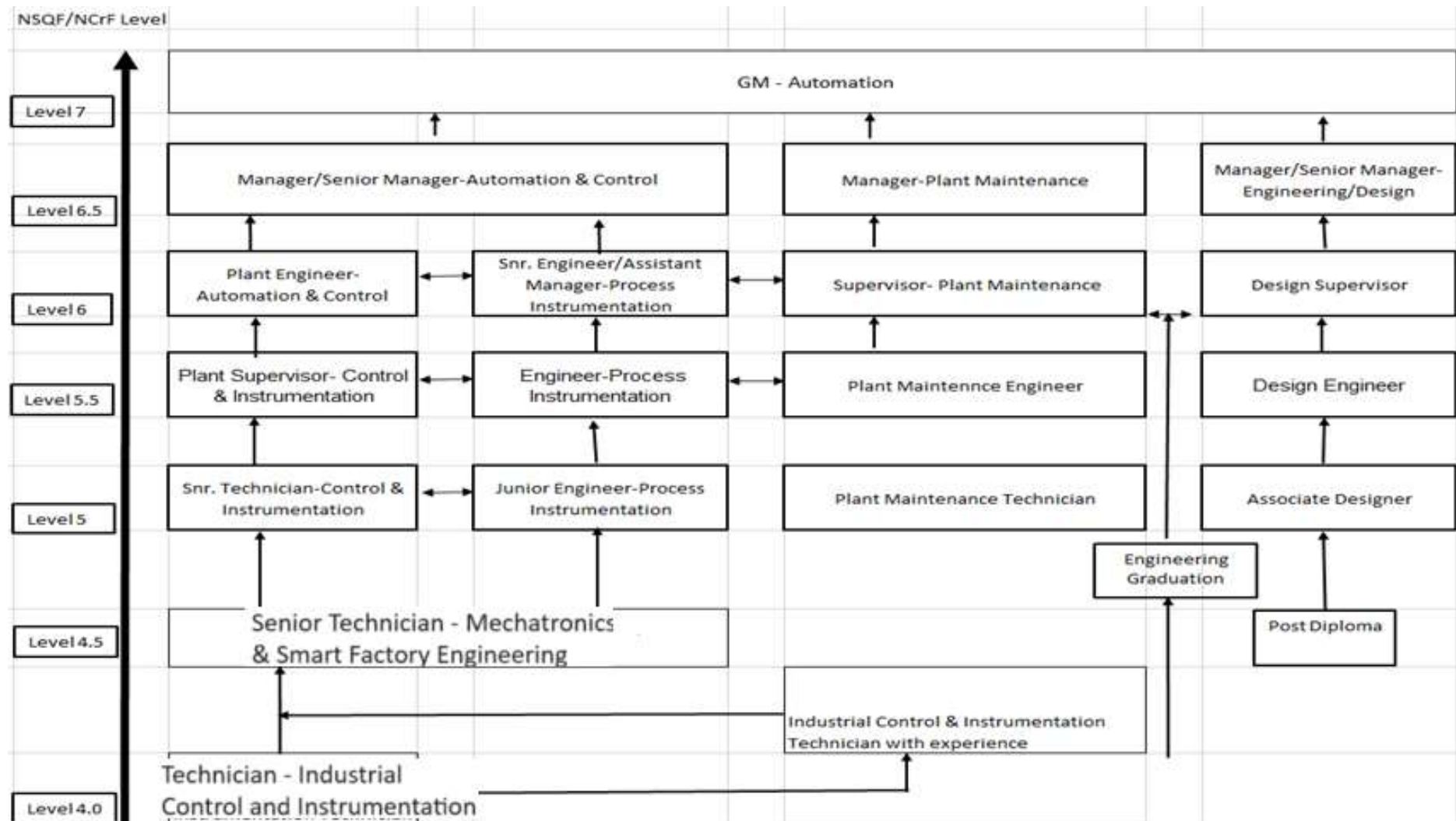
Semester - 4		Module Name: Programmable Logic Controller- I Lab	Module code: CP15411P
Sl. No	Module Details	Practical Hours 70	
1	BASIC PROGRAMMING		
a	Design a PLC Program for the following condition	2h	
	a. Switch – ON Light – Glows		
	b. Switch – OFF Light - Puts Off		
b	Design a program DOL Starter for motor.	2h	
c	Design a program for forward – Reverse – stop with mutual interlock.	2h	
d	Design a program for forward – Reverse – stop with direct reversal.	2h	
e	Design a program for start – stop – jog.	2h	
f	Design an Alarm system.	2h	
g	Design a program for motor start & stop by using Set & Reset Function	2h	
h	Design a program for switching on & off of light using Flip-flop	2h	
i	Design a program that there are three machines, each with its own start and stop functions, only one may run at a time	3h	

j	Design a program that the circuit consist of two start and stop button, when any one button is pressed, the motor runs, even it is released, and the stop button is used to stop the motor	2h
2	DIGITAL PROGRAMMING	
2.1	Design a program	3h
	a. AND, OR and NOT gate.	
	b. NAND and NOR gate.	
	c. c. Ex-or and Ex-nor Gate	
2.2	Design a conveyer control system in which conveyer 'C' is to run when any one of the 4 inputs is ON & it should stop when any one of the 4 other inputs are ON.	3h
2.3	Write a program that a fan 'P' will run the equation is getting satisfied. $(I1) (I2+I3) (I5.I6) = P$	3h
2.4	Draw a program file for following expression $(L+M+N) + (Q.R) R = S$	3h
3	FAMILIARIZATION OF DIFFERENT TIMERS	
3.1	a. Design a program to start a machine after 5 seconds.	3h
	b. Design a program to start 3 machines consequently after 3 seconds	
3.2	a. Design a program, when input A is on, Light L should on for 10 seconds, later it will off	4h
	b. Design a program, when input A is on, Light L should on for 10 seconds, later it will off for 2 seconds and again it will turn on continuously, until a stop button is pressed.	
3.3	Design a program for the grinding operation of a metal part, the coolant flow on the part must be on for an interval before the grinding process starts. When the process circuit is turned on, the coolant motor is turned on. 8 seconds later the grinding process starts.	3h
3.4	Design program, when a switch is turned on, C goes on immediately and D goes on 9 sec later. Opening the switch turn both C and D off	3h
3.5	A wood saw, W, a fan F and a lubricating pump P, all go on when a start button is pressed. A stop button stops the saw only. The fan has to run additional 5 sec to blow off the chips away. The lube pump is to run for 8sec after the shutdown of W.	3h
3.6	Write a program, to flash an LED with 1 sec interval (1 second off and 1second on) continuously until a stop button is pressed	3h
4	FAMILIARIZATION OF DIFFERENT COUNTERS	
4.1	When a sensor had sensed 5 bottles the machine should ON.	3h
4.2	Design a program such that the output indicator should go on when 6 of part C and 8 of part D are on the conveyor.	3h

4.3	After the count of 15 from a sensor, a paint spray is to run for 25 sec	3h
4.4	Design a program such that Counting starts 10 min after the process starts.	3h
4.5	Write a program, when a machine M goes on, either when A goes on up to 11 or when B goes on up to 16, stop button is to reset the entire process	3h
4.6	Write a program, an indicating light is to go on, when a count reaches 23 and the light goes off, when a count reaches 31	3h

Semester - 4		Module Name: OJT	Module code: CP15414P
Sl. No	Module Details	Practical Hours 90	
1	OJT- On the Job Training in the Industry	90h	

Annexure 9 Career Progression
 Job Roles Progression Path
 Sector: Capital Goods and Manufacturing



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 developments 2. 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: Advanced multidisciplinary and specialized knowledge 2. Professional and Technical Skills/ Expertise: Advanced Technical and Managerial Skills 3. Employment Readiness & Entrepreneurship Skills	1321, 3114, 3155	Manager/ Sr. Manager - Instrumentation & Control, Power Electronics & Systems, Process Automation, Industrial Automation Engineering,	Manager/Senior Manager- Engineering Process planning/ Product development, Industrial Automation.
		2144, 1223, 2151,		

	& 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 Supervisor - 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	2152, 2512, 3114, 3122, 3139, 3155, 7412.	Technician - Instrumentation & Control, Power Electronics & Systems, Process Automation,	Study Post Diploma

	3. Employment Readiness & Entrepreneurship Skills & Mind-set: Team readiness & Entrepreneurial readiness 4. Broad Learning Outcomes: Carry out Range of tasks and may provide range of solutions 5. Responsibility: Accountable/ responsible - Technician		Industrial Automation Engineering, Industrial Maintenance Engineering, Consumer Electronics. Embedded Developer	
Level 4.0	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 Member-Follow instructions 4. Broad Learning Outcomes: Carry out Range of tasks and may provide range of solutions 5. Responsibility: Accountable/ responsible - Technician/Jr. technician	7311	Industrial Control and Instrumentation Technician	

Annexure-12: Key Learning Outcome

SL. NO.	MODULE NAME	KNOWLEDGE AND UNDERSTANDING	TECHNICAL & PROFESSIONAL SKILLS	APPLICATION OF KNOWLEDGE AND SKILLS
2nd Year				
1	Digital Electronics (CP15301T) Digital Electronics Lab (CP15306P) Ability to apply, Digital circuits in simple applications	Understanding on Number Systems and Codes Logic Gates	Reduction of Logical circuit using Boolean Algebra. Combinational and Sequential Logic Circuits Timers, Latches and Flip- Flops, Data converters	Simplification and Logic circuits using K-Maps. Design and Implementation of Logical circuits - Code converters, Half / Full adders, Half and Full Subtractor, different Multivibrators, Timers and Counters.
2	Control System (CP15302T) Understanding basics of control systems and response characteristics of control systems.	Understanding - control system, Different control systems, Distinguish, Advantage and Disadvantages. Transfer Functions of different control systems, Mathematical modelling, Mechanical and Electrical analogy, Block diagram reduction rules. Components of a control system. Response time analysis of control systems. Process control Systems - Process control methods.	Identifying the Control systems, elements, and parameters	Analyse and troubleshoot different control system components in process industry.
3	Computer Programming-C, C++ (CP15303T) Computer Programming-C,C++ Lab (CP15307P)	Describe how C++ improves C with object-oriented features. Define and use the syntax and semantics of the C, C++ programming language.	Write inline functions for efficiency and performance. Implement copy constructors and class member functions. Execute overload functions and	Apply the concept of data abstraction and encapsulation to ensure that the data is not corrupted due to malfunctioning of any sub-system. Apply the concepts of Class,

	Computer Programming – Python and Data Base (CP15402T) Computer Programming – Python and Data Base (CP15408P) Ability to create C, C++ programs for simple engineering applications	Explain the concept of data abstraction and encapsulation. Understand the Basics of Python Programming Understand the Database Concepts. Explain the basic concepts of DBMS. Explain the Network and Internet terminologies and Design Web page using HTML, CSS and Java script.	operators in C, C++ Perform inheritance and virtual functions implement dynamic binding with polymorphism. Perform design and implement generic classes with C, C++ Implement exception handling in C, C++ and SQL programs and ensure that the system is not corrupted, and all the faults and errors are trapped. Write query on Data base, Table and PL SQL and analyse the data Write programs on python with right syntax and semantics, debug the program	Inheritance, Data Encapsulation and polymorphism using python. Develop an Android apps using Java script Design the database with planning and coding
4	Industrial Electronics - (CP15304T) Industrial Electronics Lab- (CP15308P) Understanding of construction, characteristics, and applications of Power devices.	Distinguish between power electronics over linear electronics. Understanding on Construction, Characteristics and operation of Power Diodes. Understanding on Construction, characteristics and application of Thyristors (TRIAC, SCR, GTO, LASCR etc.). Understanding on functioning of different Power circuits - Snubbers, Rectifiers, Choppers, converters, Inverters, Cyclo converters, Power supplies, AC and DC controlled drives etc.	Identify different Power Electronic components and read and comprehend the Data sheet of different Power components. Rig and analyse, describe various Power electronics circuit applications - Snubbers, Rectifiers, Choppers, converters, Inverters, Cyclo converters, Power supplies, AC and DC controlled drives etc.	Identify and apply appropriate circuits - protection circuits, switching circuits, control circuits, Converters, Inverters for Industrial applications. Trouble shoot problems in power devices - Power supplies, UPS, Motor and Power control drives etc.

5	Mechanics of Machine - (CP15305T) Understanding different drives, drive components, their Maintenance and their applications.	Knowledge and understanding on machines, basics of kinematics, Machine Mechanism, various drives, bearings, lubricants, Guide ways, CAMs and Followers.	Identify Machines, mechanisms, drives, maintenance procedures, of various mechanisms of machines.	Follow SOP for removal and replacement and maintenance of Bearings, drives, Drive systems.
6	PCB Design and Fabrication Lab - (CP15309P) Ability to design and fabricate PCB for simple electronic applications.	Knowledge on use of PCB Design Software, Different copper clad sheets and process of manufacturing. Knowledge on different Layout rules for different layers of Board and soldering technology. Knowledge on layout for Frequency signal handling.	PCB Design and Manufacturing Process of basic PCBs	Layout and design PCB for various industrial and domestic applications. Manufacturing of PCBs for simple applications. Identify defects in different soldering techniques, trouble shoot PCBs for defects in Automatic soldering process.
7	Microcontroller & Applications - (CP15401T) Microcontroller & Applications Lab - (CP15407P) Use of different microcontrollers for programming and interfacing with peripheral devices.	Understanding on RISC and CISC Processors, Types of Memory, Classification and decoding. Understanding Architecture and programming of 8051 Microcontroller. Understanding Architecture, features, of PIC 16F877A Microcontroller.	Reading and interpreting the data sheet of different Microcontrollers. Simple Programming on Microcontrollers using various programming software.	Programming different Microcontroller - interfacing different Input/ Output devices to perform the desired tasks.

8	Pneumatics & Hydraulics - (CP15403T) Pneumatics & Hydraulics Lab - (CP15409P) Ability to rig up simple Pneumatic and Hydraulic circuits and troubleshooting of circuits.	Differentiate between pneumatic and hydraulic power. State application, advantages, and disadvantages of Hydraulics State Properties of Fluid State Characteristics of Compressed air, preparation of Distribution of Compressed air.	Selection and applications of Pneumatic actuators and Pneumatic valves. Design, Rig and troubleshoot Pneumatic and Electro pneumatic Circuits State types and Specification and applications of Hydraulic Oils, Hydraulic Hoses, hydraulic Filters. Selection and applications of Hydraulic actuators, and valves. Hydro Pneumatic Systems	Design, implement to control different valves, troubleshoot Pneumatic and electro pneumatic Circuits, Hydraulic and Electrohydraulic Circuits. Use simulation software to rig and simulate Pneumatic, Hydraulic and other Interfaces for proper functioning of systems. PLC interface to provide industrial solutions.
9	Programmable Logic Controller -1 (CP15404T) Programmable Logic Controller -1 Lab (CP15411P) Ability to develop simple programs using PLC to interface and control digital and analog outputs.	Understanding on Basic PLC, its configuration and components. Knowledge on Input/ Output ports, relationship with basic GATES, Knowledge and understanding on Basic Functions (Registers, Timers, Counters)	Creating ladder diagram using different functions (Basic functions, Intermediate functions, Data handling functions etc).	Creation, Testing, simulation of different Ladder diagrams, Function diagrams using Gates, Timers, counters in a PLC system.

10	Measurement & Instrumentation - (CP15405T) Measurement & Instrumentation - (CP15410P) Ability to use the appropriate sensors and transducers in real-time applications.	Understanding Measuring Systems, Sensors and Transducers, their static and dynamic characteristics. Measuring different physical parameters Like - Temperature, Pressure, Displacement, Force, Weight, Flow, Speed and Ultrasonic.	Convert Voltage to Frequency and vice-versa, Identify and select appropriate sensors and Transducers, the signal processing.	Use of Sensors and Transducers, their conditioning circuits for appropriate applications.
11	Applied Mechanics - (CP15406T) Understanding material behaviour with application of force.	Force and Moment of Inertia. Explain types and Importance of stress, Elasticity, Young's Modulus of Elasticity, Stress on different materials, Bending stress, torsional stress. Material Handling - Different conveyors, Industrial Vehicles, Job positioning equipments, racks, Hoists and Cranes.	Analytically determine the Moment of Inertia. Determining the stress on a body. Explain various material handling processes.	Apply the concept of Force, Moment of inertia, strength of Material during the selection of material.
12	Artificial Intelligence and Machine Learning (CP15412T)	Explain the applications of AI and ML Knowledge on Data Processing & visualization Distinguish various methods in supervised Learning Explain the cross validation techniques Differentiate CNN and RNN	Perform data cleaning, transformation and visualisation Implement model deployment and scaling using deep learning Create Evaluation Metrics for Classification Models	Develop the applications or Cloud based AI services using AI and ML methodologies Apply the Supervised learning methods in the appropriate applications

13	Employability Skills (CP15310T) (CP15413T) Understand Entrepreneurship skills Ability to understand financial and legal aspects Understand Occupation safety, Health, and Environment related issues. Ability to use Essential skills.	Knowledge on various schemes and institutions promoting Entrepreneurs. Ways of setting enterprise, legal compliances, marketing, and budgeting etc. Knowledge and understanding on personal finance management, investments, returns, basics of taxes, awareness on financial frauds and prevention. Awareness on fundamental rights under the constitution and facilities available for recourse in the event of breach. Knowledge on Occupation safety and health, at workplace, Occupation Hazards, Accident prevention and PPEs, Environment, Pollution and protection of environment, Energy conservation, Global warming, Conservation of natural resources, waste management and disposal, Disaster Management. Understanding balancing Life and Career, Value based decision making, Types of stress and stress management.	Explain the schemes promoted by various support institutions. Budgeting and evaluations. Explain the Occupations hazards and process of mitigation of such hazards. PPEs. Explain environment conservation, and other factors affecting them.	Apply and impart details to other people in society. Decide, plan and implement various financial management ideas, taxations and benefits and legal compliance in the workplace. Enforce caution against financial frauds and addressal of frauds. Follow all safety norms laid by the industry to develop a safe workplace. Practice stress management techniques to ensure high productivity in the work area.
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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