# QUALIFICATION FILE

## Senior Technician-Electrical and Electronics

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

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

**NCrF / NSQF Level: 4.5**

**Submitted By:**

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

## Table of Contents

## Section 1: Basic Details

| | | | |
|---|---|---|---|
| **1.** | **Qualification Name** | **Senior Technician-Electrical and Electronics** | |
| **2.** | **Sector/s** | Electrical and Electronics | |
| **3.** | **Type of Qualification: ☑ New ☐ Revised**<br>**☐ Has Electives/Options ☐ OEM** | **NQR Code & version of existing/previous qualification:**<br>*(change to previous, once approved)* | **Qualification Name of existing / ~~previous~~ version:**<br>Senior Technician-Electrical and Electronics |
| **4.** | **a. OEM Name**<br>***b.*** **Qualification Name**(*Wherever applicable)* | NA | |
| **5.** | **National Qualification Register (NQR) Code &Version**<br>(*Will be issued after NSQC approval)* | QG-4.5-EH-01406-2023-V1-NTTF | **6. NCrF /NSQF Level: 4.5** |
| **7.** | **Award (Certificate/Diploma/Advance Diploma/ Any Other**<br>(*Wherever applicable specify multiple entry/exits also & provide details in annexure)* | Certificate | |
| **8.** | **Brief Description of the Qualification** | The Course mainly focus on Power system which includes Generation, Transmission and Distribution, the Course also covers AC and DC machines, Switch Gears, Industrial ElectricalSystems, Industrial Drives, Industrial electronics and PLC, Electronics and Automation Engineering. Trainees are being equipped with recent technology developments in Industries related to Power sector and Automation.<br><br>The subjects covered in this Programme are –<br>Switch Gear and Protection, Power Engineering-II, Power Electronics-I, Embedded System, Applied Control System, Artificial Intelligence and Machine Learning, Power Electronics-II, Industrial Management, Industrial drives and Traction system, Estimation, Costing and Utilization of Energy, Employability Skill, Power Electronics-I Lab, Embedded System Lab, IoT Lab, Applied Control System Lab, Artificial Intelligence and Machine Learning Lab, Industrial Drives Lab, Project, OJT | |
| **9.** | **Eligibility Criteria for Entry for Student/Trainee/Learner/Employee** | **a. Entry Qualification & Relevant Experience:** | |

| Sl. No. | Academic/Skill Qualification (With Specialization - if applicable) | Required Experience (with Specialization - if applicable) |
|---|---|---|
| 1 | Advance Certificate –Technician Industrial Electrical Level 4.0 from NTTF | NA |

<table>
<tr><td>10.</td><td>Credits Assigned to this Qualification, Subject to Assessment (as per National Credit Framework (NCrF))</td><td>Total Credits – 45</td><td>11. Common Cost Norm Category (I/II/III) (Wherever applicable): NA</td></tr>
<tr><td>12.</td><td>Any Licensing requirements for Undertaking Training on This Qualification (wherever applicable)</td><td colspan="2">NA</td></tr>
<tr><td>13.</td><td>Training Duration by Modes of Training Delivery<br>(Specify Total Duration as per selected training delivery modes and as per requirement of the qualification)</td><td colspan="2">☐ Offline ☐ Online ☑ Blended
<table>
<tr><th>Training Delivery Modes</th><th>Theory (Hours)</th><th>Practical (Hours)</th><th>OJT/ Project Mandatory (Hours)</th><th>OJT Recommended (Hours)</th><th>Total (Hours)</th></tr>
<tr><td>Classroom (offline)</td><td>450</td><td>540</td><td>300</td><td>NIL</td><td>1290</td></tr>
<tr><td>Online</td><td>60</td><td>-</td><td>-</td><td>-</td><td>60</td></tr>
</table>
(Refer Blended Learning Annexure for details)</td></tr>
<tr><td>14.</td><td>Aligned to NCO/ISCO Code/s<br>(if no Code is available mention the same)</td><td colspan="2">NCO Code –2015/3113.0101, 2015/3114.0100</td></tr>
<tr><td>15.</td><td>Progression path after attaining the qualification.<br>(Please show Professional and Academic progression)</td><td colspan="2">Professional Progression:<br>After Completion of 3 years of Full Time Programme and after 3 years of Industry Experience the Job holder can work as<br>Supervisor, Maintenance Engineer, and Installation Engineer of Electrical Equipment in Industries, Power Generation, and Transmission and Distribution areas.<br><br>Academic Progression:<br>Post Diploma, B. VoC and B. Tech Degree Course in Relevant areas.</td></tr>
<tr><td>16.</td><td>Other Indian languages in which the Qualification & Model Curriculums are being submitted</td><td colspan="2">Hindi</td></tr>
<tr><td>17.</td><td>Is similar Qualification(s) available on NQR-if yes, justification for this qualification</td><td colspan="2">☐ Yes ☑ No URLs of similar Qualifications: NA</td></tr>
<tr><td>18.</td><td>Is the Job Role Amenable to Persons with Disability</td><td colspan="2">☐ Yes ☑ No If “Yes”, specify applicable type of Disability</td></tr>
<tr><td>19.</td><td>How Participation of Women will be Encouraged</td><td colspan="2">Yes - Admission open to women candidates – (30% reserved)</td></tr>
<tr><td>20.</td><td>Are Greening/ Environment Sustainability Aspects Covered (Specify the NOS/Module which covers it)</td><td colspan="2">☑ Yes ☐ No Industrial Management Module Code: CP23601T</td></tr>
<tr><td>21.</td><td>Is Qualification Suitable to be Offered in Schools/Colleges</td><td colspan="2">Schools ☐ Yes ☑ No Colleges ☐ Yes ☑ No</td></tr>
</table>

| | | | |
|---|---|---|---|
| **22.** | **Name and Contact Details of Submitting / Awarding Body SPOC**<br>*(In case of CS or MS, provide details of both Lead AB & Supporting ABs)* | **Name: Mr. R Rajagopalan**<br>Position in the Organization: **Joint Managing Director**<br>**Email:** rg@nttf.co.in<br>Tel number: 080 - 28390215<br>**Contact Number:** 9844013448<br>**Website: nttftrg.com** | |
| **23.** | **Final Approval Date by NSQC: 30 Nov 2023** | **24. Validity Duration: 3 Years** | **25. Next Review Date: 30 Nov2026** |

## Section 2: Module Summary

**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 to the curriculum document - In Annexure

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

| Sl. No. | NOS/Module Name | NOS/ Module Code & Version | Core/ Non-Core | NCrF/ NSQF Level | Credits as per NCrF | Training Duration (Hours) | | | | | Assessment Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Th. | Pr. | OJT-Man. | OJT-Rec. | Total | Th. | Pr. | Proj. | Viva | Total | Weightage (%) *(if applicable)* |
| **Semester – 5** | | | | | | | | | | | | | | | | |
| 1 | Switch Gear and Protection | CP23501T | Core | 4.5 | 21 | 40 | - | - | - | 40 | 100 | - | - | - | 100 | |
| 2 | Power System Engineering-II | CP23502T | Core | 4.5 | | 60 | - | - | - | 60 | 100 | - | - | - | 100 | |
| 3 | Power Electronics-I | CP23503T | Core | 4.5 | | 60 | - | - | - | 60 | 100 | - | - | - | 100 | |
| 4 | Embedded System | CP23504T | Core | 4.5 | | 60 | - | - | - | 60 | 100 | - | - | - | 100 | |
| 5 | Applied Control System | CP23505T | Core | 4.5 | | 40 | - | - | - | 40 | 100 | - | - | - | 100 | |
| 6 | Artificial Intelligence and Machine Learning | CP23510T | Core | 4.5 | | 40 | - | - | - | 40 | 100 | - | - | - | 100 | |
| 7 | Power Electronics-I Lab | CP23506P | Core | 4.5 | | - | 80 | - | - | 80 | - | 80 | - | 20 | 100 | |
| 8 | Embedded System Lab | CP23507P | Core | 4.5 | | - | 60 | - | - | 60 | - | 80 | - | 20 | 100 | |
| 9 | IoT Lab | CP23508P | Core | 4.5 | | - | 60 | - | - | 60 | - | 80 | - | 20 | 100 | |
| 10 | Applied Control System Lab | CP23509P | Core | 4.5 | | - | 40 | - | - | 40 | - | 80 | - | 20 | 100 | |
| 11 | Artificial Intelligence and Machine Learning Lab | CP23511P | Core | 4.5 | | - | 60 | - | - | 60 | - | 80 | - | 20 | 100 | |
| 12 | Employability Skill | CP23512T | Core | 4.5 | | 30 | - | - | - | 30 | 75 | - | - | 25 | 100 | |
| **Duration (in Hours) / Total Marks** | | | | | **21** | **330** | **300** | **-** | **-** | **630** | **675** | **400** | **-** | **125** | **1200** | |
| **Semester – 6** | | | | | | | | | | | | | | | | |
| 13 | Industrial Management | CP23601T | Core | 4.5 | 24 | 30 | - | - | - | 30 | 100 | - | - | - | 100 | |
| 14 | Industrial drives and Traction system | CP23602T | Core | 4.5 | | 40 | - | - | - | 40 | 100 | - | - | - | 100 | |
| 15 | Estimation, Costing and Utilization of Energy | CP23603T | Core | 4.5 | | 40 | - | - | - | 40 | 100 | - | - | - | 100 | |
| 16 | Power Electronics-II | CP23604T | Core | 4.5 | | 40 | - | - | - | 40 | 100 | - | - | - | 100 | |
| 17 | Industrial Drives Lab | CP23605P | Core | 4.5 | | - | 40 | - | - | 40 | - | 80 | - | 20 | 100 | |
| 18 | Project | CP23606P | Core | 4.5 | | - | 200 | - | - | 200 | - | 80 | - | 20 | 100 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | OJT | CP23607P | Core | 4.5 | | - | - | 300 | - | 300 | - | 75 | - | 25 | 100 | |
| 20 | Employability Skill | CP23608T | Core | 4.5 | | 30 | - | - | - | 30 | 75 | - | - | 25 | 100 | |
| **Duration (in Hours) / Total Marks** | | | | | **24** | **180** | **240** | **300** | **-** | **720** | **475** | **235** | **-** | **90** | **800** | |
| **Total for 1-year Programme** | | | | | **45** | **510** | **540** | **300** | **-** | **1350** | **1150** | **635** | **-** | **215** | **2000** | |

## Elective Modules/NOS/s: NA

| Sl. 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

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

## Assessment - Minimum Qualifying Percentage

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

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

Minimum 40% in each Theory module, 50% in each Practical module and 60% in Project

## 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<br>B. Tech or BE with 2 years 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<br>B. Tech or BE with 5 years of trainer + 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<br>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<br>B. Tech or BE with 3 years as trainer or industry experience |
| 4. | **Assessment Mode** *(Specify the assessment mode)* | Blended theory (online and offline in the center) and practical |
| 5. | **Tools and Equipment Required for Assessment** | Same as for training ☑ Yes ☐ No<br>*(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:**<br>The following reports establish the Skilled Resource requirement for the Electrical and Electronics Engineering,<br><br>1. MSDE Annual Report 2021- 2022 predicts skilled manpower requirement in the Power and Renewable energy sectors.<br>2. Annual report 2021-22 from Ministry of new and Renewable Energy has projected requirement of skilled manpower in the area.<br>3. Annual report 2021- 2022 Ministry of Power has projected energy demand for various sectors.<br>The above two will lead to Higher requirement in Electrical and Electronics Engineers in large numbers in the Future.<br>4. Annual reports 2021 – 22 of Ministry of Heavy Industries Government of India<br>The above studies has found Higher growth in Manufacturing, Capital Goods and Automotive Industries which will require Qualified Technicians in Electrical and Electronics skills. |
| 2. | **Latest Market Research Reports or any other source (not older than 2 years) (Yes/No):**<br>The following reports establish the Skilled Resource requirement for the Manufacturing, Capital Goods and Automotive Industries<br>1. Indian Skills Report 2021-22 by **Wheebox** - partnered **CII** predicts skill requirement in Engineering and Manufacturing sectors and Energy and Core sectors.<br>2. 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 –**<br>1. Study on Job Role of the Future by Indian Institute of Skills.<br>2. National Policy for skill Development and Entrepreneurship 2015 by MSDE has predicted skilled manpower requirement across key sectors by 2022 and has framed many initiatives. |
| 4. | **Number of Industry validation provided: 33** |
| 5. | **Estimated nos. of persons to be trained and employed: 250 / year** |
| 6. | **Evidence of Concurrence/Consultation with Line Ministry/State Departments:** (Letter to be sent to the concerned ministry and copy attached) If “No”, why: 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) | Yes |
| 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** | Configure, setup and Troubleshoot Industrial Electrical Systems consisting of Control panels, Cables, and Electrical drive systems.<br><br>Capability to work in Power Generation, Transmission and Distribution Sector.<br><br>Apply Automation in Power Generation, Transmission and Distribution. | Job Holder Understand Safety and Health aspects and Ensures Compliance with Health and Safety regulations.<br><br>Job holder will Select measuring instruments, circuit protective elements, control elements and accessories for Operating Electrical devices and Equipment.<br><br>Job Holder can apply his/her Skill and knowledge in Power Generation, Transmission and Distribution Sector.<br><br>Job Holder Can Design and Troubleshoot in electrical systems. | **4.5** |
| **Professional and Technical Skills/ Expertise/ Professional Knowledge** | Describe electrical power system - Generation Transmission and Distribution.<br><br>Explain PLC, SCADA and HMI in Electrical Power Generation, Transmission and Distribution.<br><br>Explain Mechanical and Electrical Drives.<br><br>Explain the working principle of AC and DC machines.<br><br>Explain renewable energy power sources. (Solar and Wind energy)<br><br>Knowledge on Artificial Intelligence and Machine learning. | Job holder requires to demonstrate knowledge of facts, principles process, installations and general concepts in the field of work or study related to different types of protective devices, AC and DC machines, renewable energy sources.<br><br>Work on Electrical, Electronic Component/ Equipment.<br><br>Describe Mechanical and Electrical drives and their application.<br><br>Work on renewable energy power sources.<br><br>Describe the role of PLC, SCADA and HMI in Electrical Power Generation, Transmission and Distribution areas. | **4.5** |

| | | | |
|---|---|---|---|
| **Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill** | Good Knowledge on Organization, ethical and moral values, and Practice Time Management.<br><br>Able to Analyse solutions Critically and Logically for fine decision making.<br><br>Able to work Effectively in a Team and lead a Team.<br><br>Knowledge of the latest Technologies and Industrial Trends.<br><br>Will have good Ingenuity and Creativity.<br><br>Will have good Leadership Skills and have an entrepreneurial for small startup. | Good Communication with Peers, Superiors both verbal and written, Good on Presentation Skills, QC, 5S and KAIZEN.<br><br>Can Analyse situations Critically and Logically.<br><br>Adopt latest Technologies emerging in the Domain.<br><br>Can lead a group to work Effectively.<br><br>Can solve, adapt to new Situations Creatively. | **4.5** |
| **Broad Learning Outcomes/Core Skill** | Safety and standard operating Procedures and Practices in the work area.<br><br>Communicate with Peers and Superiors.<br><br>Critical Thinking, Creativity and Logical thinking.<br><br>Data collection, analysis, decision making ability.<br><br>Solve problems using QC tools and contribute for Kaizen in the work areas.<br><br>Knowledge on effective 5S, TPM and TQM activities. | Will follow all safety norms and standard operating Procedures in the work area.<br><br>Verbal and written communication, computer literacy. Maintain Good Relationship with Peers and Superiors and Will be able to Win Good will and Trust of Peers.<br><br>Analyse Critical problems in work area and real life.<br><br>Decision Making ability.<br><br>Process improvement, Problem Solving and Troubleshooting skills. | **4.5** |

| | | | |
|---|---|---|---|
| **Responsibility** | Aware of Personal/Industrial goals.<br><br>Adapt to changes in the work area.<br><br>Thorough understanding of safety Procedures and SOPs in the relevant work area.<br><br>Supervise, evaluate and improve the activities of team in the shop floor. | Able to Carry out Design and Integration of Electrical and Electronics Systems Under Minimum Supervision.<br><br>Responsible for testing electrical and electronic components, systems, and equipment to ensure they meet specifications and standards. Troubleshoot and diagnose issues when problems arise.<br><br>Installation and maintenance of electrical and electronic systems, both in industrial settings and residential areas.<br><br>Guide Junior Technicians in Fulfilling tasks Assigned to them. | **4.5** |

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

### Tools and Equipment requirement for a batch of 30 Trainees

### Embedded Systems and IoT Lab

| Sl. No. | Equipment | Specification | Quantity |
|---|---|---|---|
| 1 | IoT Trainer Kit | Node MCU, Arduino, Raspberry Pi | 3 |
| 2 | Sensor Trainer Kit with Assorted Sensors | | 1 |
| 3 | PIC Development Board | With Interfacing modules | 5 |
| 4 | PIC Kit 3 Programmer | | 5 |
| 5 | Proteus Software | 10 user licenses | 1 |

### Power Electronics Equipment

| Sl. No. | Equipment | Specification | Quantity |
|---|---|---|---|
| 1 | Digital Storage Oscilloscope with Current Probe | 0-100 MHz, 2-Channel | 3 |
| 2 | DC motor speed control trainer | | 1 |
| 3 | Inverter trainer kit | | 1 |
| 4 | Function Generator | 230v, 50Hz | 5 |
| 5 | Pulse Generator | 20MHz | 2 |

| PROJECT LAB | | | |
|---|---|---|---|
| **Sl. No.** | **Equipment** | **Specification** | **Quantity** |
| 1 | Soldering Station | | 1 |
| 2 | Digital Oscilloscope | No of Channels - 2, Bandwidth: DC - 20 MHz | 5 |
| 3 | Dual - Power Supplies Regulated Power Supply, Adjustable | 0-30V/1A | 5 |
| 4 | Function Generator | Frequency Range: 0.3 Hz to 3MHz, Functions: Sine, Square, Triangle, DC Sweep | 5 |

**Note:**

- The Tools and Equipment and other lab facilities are shared between Qualifications and batches.
- During the admission the trainees are supplied with toolkit containing DMM, soldering rod, Breadboard, and other tools for conducting experiments in different labs.
- Trainees are provided with Laptop.
- Microcontroller Lab, IoT Lab will form a part of Digital Electronics Lab.
- Instrumentation and Measurement and Industrial Electronics will form a part of the Electronics lab.

**Classroom Aids**

The aids required to conduct sessions in the classroom are:

1. Black / white board
2. Projector with screen / Display 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 | Representative Name | Designation | Contact Address | Contact Phone No. | E-mail ID | LinkedIn Profile *(if available)* |
|---|---|---|---|---|---|---|---|
| 1 | TATA STEEL | Ms. Charu Khullar | | Bistupur, Jamshedpur-831001, Jharkhand | 7763807838 | charukhullar@tatasteel.com | |
| 2 | LOHIACORP | Mr. Umesh Kumar Trivedi | | D-3/A, Panki Industrial Estate, Kanpur-208022, India | 7570009687 | umesh.trivedi @lohiagroup.com | |
| 3 | MAKINO | Mr. Sudhakar S | | No 11, Whitefield Main Rd, EPIPZone, Whitefield, Bengaluru, Karnataka 560066 | 8028412830 | sudhakars@makino.co.in | |
| 4 | CONTROLPRINT | Mr. Rashtralpal | | C-106, Hind Saurashtra Industrial Estate, Marol Naka, Andheri East, Mumbai 400059, | 9892330112 | rashtrapal@controlprint.com | |
| 5 | RAMKRISHNA FORGINGS LTD | Mr. Sunil Agarwall | | Phase-VII, PlotNo M 15,16 NS 26 Industrial Area, Gamharia, Jamshedpur, Jharkhand 832109 | 9900987772 | sunil.agrawall@ramkrishnaforgings.com | |
| 6 | FANUC | Mr. Ravinder | | 41-A, Electronics City, Hosur Road, Bengaluru | 0900620356 | ravinder.kumar@fanucindia.com | |
| 7 | ITC | Mr shivaprasad majlekar | | No.18, Banaswadi Main Road, Maruthiseva Nagar, Bengaluru – 560005 | 8600211234 | Shivaprasad. Majlekar@itc.i n | |
| 8 | SPICER | Mr. Krishna kumar | | QR73+GC5, Sipcot Ph. I, Bangalore, Tamil Nadu 635126 | 7090621333 | krishnakumar. rao@dana.co m | |
| 9 | VOLVO EICHER | Mr. Anirudh dongre | | 22/2, Yeshwant Niwas Rd, New Palasia, Indore, Madhya Pradesh 452003 | 9893286207 | adongre@ve cv.in | |
| 10 | FOX SOLUTION | Mr. Vishal | | M9, M I D C Area, Ambad, Nashik, Maharashtra 422010 | 9922935373 | pralhad.dhumal@foxindia.net | |
| 11 | UNITED AIR EXPRESS | Mr. Ravindra K Singh | | 12, Diagonal Rd, South Park, Bistupur, Jamshedpur, Jharkhand 831001 | 7763807812 | rkrsingh@tatasteel.com | |
| 12 | GABRIEL INDIA LIMITED | Ms. Richa | | Gabriel India Ltd., 29, Milestone Village Kuruli, Pune Nasik Highway, Taluk Khed, Pune 410501, Maharashtra | 9958076660 | pooja.wadera @gabriel.co.in | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 13 | BIL ENERGY | Mr. Harsh Choudhry | | B-11, Viral Shopping Center, Mantriwadi, Sainath Road, Malad West, Mumbai – 400064 | 9820430884 | harsh@bilenergy.com | |
| 14 | ZF | Mr. Sudhir Patil | | Industrial Area, Adityapur, Jamshedpur, Jharkhand 832108 | 9860026919 | factory@zfindia.com | |
| 15 | Nuvoco Vistas Corp. Ltd. | Ms. Maya Tiwary | | Jojobera, Jamshedpur, Jharkhand | 9771415148 | maya.tiwari@nuvoco.in | |
| 16 | GE | Mr. Ruddy | | 713206, Industrial Area, Durgapur, West Bengal 713201 | 8877810737 | Ranganatha.GR@ge.com | |
| 17 | ACE MICROMATICS | Mr. Tarun J singh | | Plot no 240, 3rd Stage, 241, 11th Main Rd, Yeshwanthpur Suburb II Stage, Peenya, Bengaluru, Karnataka 560058 | 8040200555 | taruns@ace micromatic.com | |
| 18 | M.V.P ENTERPRISES | Mr. Subham Behera | | House No. 16, Shop No. 7 Line, Bistupur Market, Jamshedpur, Jharkhand 831001 | 9110973145 | mvpbatteries@gmail.com | |
| 19 | CAREFINE WOODWORKS | Mr. Avnish | | Gat No. 906/8, Village, Shirur Taluka, Sanaswadi, Maharashtra 412208 | 9860093700 | carefine@gmail.com | |
| 20 | LEONINE ENGINEERS PVT LTD | Mr. Kiran Gadre | | 6XJF+9HV, Manpada, Thane West, Thane, Maharashtra | 9322227502 | kirangadre@live.com | |
| 21 | NEW ERA INDUSTRIAL CORPORATION | Mr. Gandhi | | Kamani Centre, 39-41-43, 2nd Floor, Bistupur Main Rd, Jamshedpur, Jharkhand 831001 | 9835178660 | info@neicjsr.com | |
| 22 | EAPRO GLOBAL LTD | Mr. Anuj | | Khasra No. 103, Salempur, Rajputana, Industrial Area, Roorkee, Uttarakhand 247667 | 9999771699 | | |
| 23 | CENTUM ELECTRONICS | Mr. Sujjendra | | KHB Industrial Area, 44, 1st Main Rd, Yelahanka New Town, Bengaluru, Karnataka 560064 | 7259249307 | | |
| 24 | SSC PVT LTD | Mr. Venktesh | | No. 201, 2nd Floor, Mota Chambers, Millers Road, Vasant Nagar, Bangalore 560052 | 9342578007 | per.admi@sscpltd.com | |
| 25 | YAZAKI INDIA PVT LTD | Ms. Sunita J | | Global Technology Park, Tower C, 2nd Floor Smartworks, Bellandur, Bengaluru, Karnataka 560103 | 9940634361 | j.sunita@layamweb.com | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 26 | PULSE MAGNETIC & POWER ELECTRONICS PVT LTD | Ms. Annupma | | 49, Udyog Vihar Phase 1, Dundahera Village, Sector 20, Gurugram, Haryana 122016 | 9971399553 | anu@pmpe.in | |
| 27 | CYBER INFO SERVICES PVT LTD | Mr. Sanil Kumar | | A-529, Pocket 40/203, Block A, Kalkaji, New Delhi – 110019 | 9811106938 | cyberinfoservices@gmail.com | |
| 28 | RSB global | Mr.Pankaj | | No.201/2/3/4,Pentagon 1,Second Floor, Magarpatta City, Pune - 411013 | 7260894810 | pankaj.parida@rsbglobal.com | |
| 29 | ESSPROUT Technologies pvt ltd | Mr. Gouri Shankar | | 20, Vasanthapura Main Rd, Mango Garden Layout, Bengaluru, Karnataka 560078 | 9361515434 | gowrishankar@esspr out.com | |
| 30 | Tesseract | Mr. Aman Modi | | Sonari, Jamshedpur, Jharkhand | 9930550709 | | |
| 31 | Chandan Steel Limited | Mr. Rohan Lapsiwala | | C899+FG5, Nannur Chawk, S.S. Bari Road, Midnapore, West Bengal 721101 | 8000936260 | hrd@chandansteel.net | |
| 32 | Schwing setter India pvt ltd | Mr. Jaypal | | Unit Number 620/621, Corporate Centre, Lal Bahadur Shastri Marg, Mumbai, Maharashtra 400080 | 9884068927 | jaypal.t@schwingstetterindia.com | |
| 33 | Aditya Birla | Mr. Pankaj Baranwal | | Aditya Birla, Jawahar Nagar, Hatma, Ranchi, Jharkhand | | pankaj.baranwal@adityabirla.com | |

## Annexure 4: Training & Employment Details

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

| Year | Total Candidates | | Women | | People with Disability | |
|---|---|---|---|---|---|---|
| | Estimated Training # | Estimated Employment Opportunities | Estimated Training # | Estimated Employment Opportunities | Estimated Training # | Estimated Employment Opportunities |
| 2023 | 150 | More than 2000 | 45 | More than 200 | - | |
| 2024 | 250 | More than 2000 | 75 | More than 200 | - | |
| 2025 | 400 | More than 2000 | 120 | More than 200 | - | |

**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 |
| Electrical and Electronics Engineering | 2017- 2020 | 43 | 37 | 37 | 37 | 5 | 5 | 5 | 5 | | | | |
| | 2018 - 2021 | 42 | 38 | 36 | 36 | 15 | 12 | 12 | 12 | | | | |
| | 2019 - 2022 | 41 | 40 | 40 | 40 | 21 | 18 | 18 | 18 | | | | |

*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:**
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*

| SL. 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, 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, Video recording, Simulators | 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, Quiz tests, Project | 75:25 |
| 7 | On the Job Training (OJT)/ Project Work Internship/ Apprenticeship Training | Industry | 100:00 |

## Annexure 6: Detailed Assessment Criteria

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

| NOS/Module Name | Assessment Criteria for Performance Criteria/Learning Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|---|
| **Semester – 5** | | | | | |
| Switch Gear and Protection | Introduction to protection systems | 5 | - | - | - |
| | Fuses and circuit breakers | 17.5 | - | - | - |
| | Protective relay | 25 | - | - | - |
| | Protection of equipment's | 20 | - | - | - |
| | Over voltage protection | 17.5 | - | - | - |
| | Special Purpose Motors | 15 | - | - | - |
| | **Total Marks** | 100 | | | |
| Power Engineering - II | Overhead transmission lines | 20 | - | - | - |
| | Corona-power loss & effect of corona | 10 | - | - | - |
| | Design of overhead lines-components, main structure | 22.5 | - | - | - |
| | Insulators | 12.5 | - | - | - |
| | Substation | 12.5 | - | - | - |
| | Distribution systems-primary & secondary | 7.5 | - | - | - |
| | Per unit system | 7.5 | - | - | - |
| | Faults | 7.5 | - | - | - |
| | **Total Marks** | 100 | | | |
| Power Electronics - I | Introduction to Power Electronics | 5 | - | - | - |
| | Power Semiconductor Devices | 25 | - | - | - |
| | Thermal Management and Protection Circuits | 8 | - | - | - |
| | AC to DC Converters: Rectifiers | 30 | - | - | - |
| | DC to DC Converters: Choppers | 8 | - | - | - |
| | Applications | 20 | - | - | - |
| | Case Study of Regulated DC Power Supply using Step-Down Transformer, FWR, Filter and Zener Diode | 4 | - | - | - |
| | **Total Marks** | 100 | | | |

| | | | | | |
|---|---|---|---|---|---|
| Embedded System | Introduction | 10 | - | - | - |
| | Black Box (Block Diagram of Embedded Systems) | 5 | - | - | - |
| | Requirements in Embedded Systems | 10 | - | - | - |
| | Process of Embedded Systems Development | 6 | - | - | - |
| | Introduction to PIC Microcontrollers | 5 | - | - | - |
| | PIC16F877A Architecture and Pin Diagram, Memory Organization, I/O Ports | 16 | - | - | - |
| | PIC16F877A Instructions Set and Simple Programming, Interrupts, Timers | 20 | - | - | - |
| | PIC16F877A Capture, Compare and PWM Module, ADC Module, Serial Communication Module | 16 | - | - | - |
| | PIC16F877A Applications | 12 | - | - | - |
| | **Total Marks** | 100 | | | |
| Applied Control System | Introduction to SCADA system | 20 | - | - | - |
| | SCADA hardware | 15 | - | - | - |
| | Software and Protocols | 20 | - | - | - |
| | Power system automation | 15 | - | - | - |
| | Detailed applications of SCADA | 15 | - | - | - |
| | HMI and its application | 15 | - | - | - |
| | **Total Marks** | 100 | | | |
| Artificial Intelligence and Machine Learning | Introduction to Artificial Intelligence and Machine Learning | 10 | - | - | - |
| | Data Preprocessing and Visualization - Excel & Python | 15 | - | - | - |
| | Supervised Learning - Regression | 10 | - | - | - |
| | Supervised Learning - Classification | 10 | - | - | - |
| | Unsupervised Learning | 10 | - | - | - |
| | Model Selection and Validation | 10 | - | - | - |

| | | | | | |
|---|---|---|---|---|---|
| | Deep Learning | 15 | - | - | - |
| | Case Studies on AI/ML techniques to a real-world problem | 20 | - | - | - |
| | **Total Marks** | **100** | | | |
| Employability Skills | Essential Skills for Success | 20 | - | - | 5 |
| | Quality Management | 20 | - | - | 5 |
| | Critical thinking and Problem solving | 15 | - | - | 10 |
| | Getting ready for Entrepreneurship | 20 | - | - | 5 |
| | **Total Marks** | 100 | | | |
| Power Electronics - I Lab | Familiarization of digital storage Oscilloscope | - | 15 | - | 5 |
| | Design and winding of an Inductor | - | | | |
| | Switching characteristic of Power diode | - | | | |
| | Transistor characteristics in CE configuration | - | | | |
| | Magnetization and demagnetization of L- load using diode, diode and resistor | - | 8 | - | 2 |
| | Switching characteristic of IGBT | - | 4 | - | - |
| | VI characteristics of SCR , TRIAC | - | 15 | - | 5 |
| | Resistance Triggering, RC-Triggering of SCR | - | | | |
| | UJT as a relaxation Oscillator | - | 4 | - | - |
| | Chopper fed DC Motor Driver | - | 4 | - | - |
| | DC-DC Half wave converter , Full wave converter | - | 15 | - | 4 |
| | Familiarization of Pulse width modulator IC 3524 Bridge Inverter | - | | | |
| | Case study of DC-DC Buck Converter , Boost Converter | - | 15 | - | 4 |
| | Case study of Cyclo-Converter | - | | | |
| | Familiarization and Case study of UPS circuit | - | | | |

| | | | | | |
|---|---|---|---|---|---|
| | **Total Marks** | | 100 | | |
| Embedded System Lab | Revision of Keil vision 3, MP LAB and Proteus 8 simulation software. | - | 4 | - | - |
| | Traffic Light System Module | - | 4 | - | - |
| | Electronic Dice using 8051 | - | 25 | - | 10 |
| | Robot Car | -- | | | |
| | Waveform Generator | - | | | |
| | DC Motor Speed Control using PWM | - | 16 | - | 5 |
| | Stepper Motor Control for desire Angle | - | | | |
| | Metal Shorting Module | - | 8 | - | |
| | Strength Monitoring System | - | 15 | - | 5 |
| | Temperature Monitoring System | -- | | | |
| | Digital Clock | - | 8 | - | - |
| | **Total Marks** | | 100 | | |
| IoT Lab | IoT – Introduction | - | 7 | - | - |
| | Introduction to Python | - | 14 | - | 4 |
| | Advanced Microcontrollers | - | 25 | - | 10 |
| | Cloud Computing | - | 5 | - | - |
| | Introduction to various software for IoT | - | 8 | - | 2 |
| | Application of IoT – Practical | - | 8 | - | 2 |
| | Introduction to machine learning and Artificial Intelligence | - | 5 | - | |
| | Mini project, Case studies | - | 8 | - | 2 |
| | **Total Marks** | | 100 | | |
| Applied Control System Lab | Getting Familiar with Step 7 Tia Portal and the S7-1200 PLC Programming Guide Line | - | 4 | - | - |

| | | | | | |
|---|---|---|---|---|---|
| | Water Level Controller using Programmable Logic Controller | - | 4 | - | - |
| | Batch Process Reactor using Programmable Logic Controller | - | 8 | - | 2 |
| | Processing of Analog Values using Potentiometer to PLC Analog Input Module | - | 4 | - | - |
| | Speed Control of AC Servo Motor using Programmable Logic Controller | - | 8 | - | 2 |
| | Getting familiar with Siemens WINCC SCADA interface | - | 28 | - | 10 |
| | Design a Logic Using PLC for Boiling operation using two tanks along with interfaced SCADA Graphic Design | - | | | |
| | Design a Logic Using PLC for Sequential Control of Motor along with interfaced SCADA Graphic Design | - | | | |
| | To Design the PLC Logic for Food Processing Industry, also SCADA Graphics Layout | - | | | |
| | Getting Familiar with Siemens HMI (KTP 700) | - | 12 | - | 4 |
| | Develop a Control VFD with PLC using Ladder Logic, also Design SCADA and HMI based Graphic Layout | - | | | |
| | Develop a PLC Logic for Status indication of Motor (Normal State, Running State, Error State) | - | 4 | - | - |
| | Projects | - | 8 | - | 2 |
| | **Total Marks** | | 100 | | |
| Artificial Intelligence and Machine Learning Lab | Python for Data Science | - | 20 | - | 5 |
| | Data Preprocessing and Visualization-Excel and Python | - | 15 | - | 5 |
| | Supervised Learning - Regression | - | 15 | - | 3 |
| | Supervised Learning - Classification | - | 10 | - | 3 |
| | Unsupervised Learning | - | 10 | - | 2 |
| | Model Selection and Validation | - | 10 | - | 2 |
| | **Total Marks** | **100** | | | |
| **Semester – 6** | | | | | |
| Industrial Management | Basics of Management | 7 | - | - | - |

| | | | | | |
|---|---|---|---|---|---|
| | Pollution Prevention and Waste Management | 7 | - | - | - |
| | Industrial Safety Management | 7 | - | - | - |
| | Inspection and Quality Control | 16 | - | - | - |
| | Modern Production Management | 7 | - | - | - |
| | Lean Management | 12 | - | - | - |
| | Total Productive Maintenance and Total Quality Management | 30 | - | - | - |
| | Human Resource Management | 7 | - | - | - |
| | Industrial Relation Legislation management | 7 | - | - | - |
| | **Total Marks** | 100 | | | |
| Industrial drives and traction system | Introduction to Electric Drives | 20 | - | - | - |
| | Industrial Drives | 20 | - | - | - |
| | Heating and Power rating of Drive motors | 22.5 | - | - | - |
| | Traction | 37.5 | - | - | - |
| | **Total Marks** | 100 | | | |
| Estimation, Costing and Utilization of Energy | Economics Aspects | 15 | - | - | - |
| | Estimation and costing | 30 | - | - | - |
| | Energy Management | 7.5 | - | - | - |
| | Power Factor correction | 10 | - | - | - |
| | Refrigeration and Air conditioning | 10 | - | - | - |
| | Electric welding | 10 | - | - | - |
| | Illumination | 17.5 | - | - | - |
| | **Total Marks** | 100 | | | |
| Power Electronics - II | Thyristor Family | 15 | - | - | - |

| | | | | | |
|---|---|---|---|---|---|
| | DC to AC Converters: Inverters | 20 | - | - | - |
| | AC to AC Converters | 42.5 | - | - | - |
| | Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) | 12.5 | - | - | - |
| | Case study of an Inverter circuit using power MOSFET and step down transformer | 10 | - | - | - |
| | **Total Marks** | 100 | | | |
| Employability Skills | Labour Welfare and Legislation | 20 | - | - | 5 |
| | Customer Interaction/ Service | 15 | - | - | 10 |
| | Conflict resolution and Negotiation | 20 | - | - | 5 |
| | Job readiness and Exam Preparation | 20 | - | - | 5 |
| | **Total Marks** | 100 | | | |
| Industrial Drives Lab | DC speed control device | - | 15 | - | 4 |
| | AC speed control drive - 3 phase induction motor- squirrel cage - Voltage / frequency control | - | 8 | - | 2 |
| | Study of four quadrant chopper operated – DC motor drive (used in hoist/elevators) | - | 8 | - | 2 |
| | Study of solar trainer kit (Solar plant, Light filters, Battery, LED/CF lights, Circuitry and accessories involved for monitoring and control) | - | 12 | - | 4 |
| | Single phase induction motor speed drive | - | 8 | - | 2 |
| | Study of over current Relay trainer kit | - | 5 | - | - |
| | Study of Frequency (over/under) measuring kit | - | 8 | - | 2 |
| | Regenerative braking | - | 12 | - | 4 |
| | Familiarization of CNC machine with SERVO Mechanism | - | 4 | - | - |
| | **Total Marks** | | 100 | | |
| Project | Internal Practical | - | 25 | - | - |
| | Semester Practical | - | 55 | - | 20 |
| | **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 and Evaluation Dept.

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

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

**Assessment comprises the following components**:

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

## 2. ASSESSORS

Evaluation of Theory and 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 and requirements and perform Soft Skills effectively:
    - Videos/photos of Trainees during OJT
    - Suggestions / Kaizens from trainees
    - Rewards and appreciation to trainees as applicable
3. Assessment will ensure the following:
    - Effective engagement with the customers
    - Understand the working of various tools and equipment.

## 7. SYSTEM OF GRADING

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

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

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

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

**Awarding of class:**

**a) Awarding of class for semester:**

| SGPA | Classification |
|---|---|
| 8.5 and above<br>7.5 to 8.4<br>6.0 to 7.4<br>5.5 to 5.9 | First class with distinction<br>First class<br>Second class<br>Pass class |

**b) Awarding of class for Programme:**

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

## 8. ASSESSMENT TOOLS

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

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

**List of ICT Tools:**

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

## Annexure 8: Model Curriculum

| Semester - 5 | Module Name: Switch Gear and Protection | Module Code: CP23501T |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 40** |
| 1 | Introduction to protection systems | 2h |
| 2 | Fuses and circuit breakers | 7h |
| 3 | Protective relay | 10h |
| 4 | Protection of equipment's | 8h |
| 5 | Over voltage protection | 7h |
| 6 | Special Purpose Motors | 6h |

| Semester - 5 | Module Name: Power System Engineering - II | Module Code: CP23502T |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 60** |
| 1 | Overhead transmission lines | 12h |
| 2 | Corona | 6h |
| 3 | Design of overhead lines | 13.5h |
| 4 | Insulators | 7.5h |
| 5 | Substation | 7.5h |
| 6 | Distribution systems | 4.5h |
| 7 | Per unit system | 4.5h |
| 8 | Faults | 4.5h |

| Semester - 5 | Module Name: Power Electronics - I | Module Code: CP23503T |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 60** |
| 1 | Introduction to Power Electronics | 3h |

| | | |
|---|---|---|
| 2 | Power Semiconductor Devices | 14h |
| 3 | Thermal Management and Protection Circuits | 5h |
| 4 | AC to DC Converters: Rectifiers | 18h |
| 5 | DC to DC Converters: Choppers | 5h |
| 6 | Applications | 13h |
| 7 | Case Study of Regulated DC Power Supply using Step-Down Transformer, Fwr, Filter and Zener Diode | 2h |

| **Semester - 5** | **Module Name: Embedded System** | **Module Code: CP23504T** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 60** |
| 1 | Introduction | 6h |
| 2 | Black Box (Block Diagram of Embedded Systems) | 2h |
| 3 | Requirements in Embedded Systems | 6h |
| 4 | Process of Embedded Systems Development | 4h |
| 5 | Introduction to PIC Microcontrollers | 3h |
| 6 | PIC16F877A Architecture and Pin Diagram | 3h |
| 7 | PIC16F877A Memory Organization | 3h |
| 8 | PIC16F877A I/O Ports | 3h |
| 9 | PIC16F877A Instructions Set and Simple Programming | 6h |
| 10 | PIC16F877A Interrupts | 3h |
| 11 | PIC16F877A Timers | 3h |
| 12 | PIC16F877A Capture, Compare and PWM Module | 2h |
| 13 | PIC16F877A ADC Module | 3h |
| 14 | PIC16F877A Serial Communication Module | 5h |
| 15 | PIC16F877A Applications | 8h |

| **Semester - 5** | **Module Name: Applied Control System** | **Module Code: CP23505T** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 40** |
| 1 | Introduction to SCADA system | 8h |
| 2 | SCADA hardware | 6h |
| 3 | Software and Protocols | 8h |
| 4 | Power system automation | 6h |
| 5 | Detailed applications of SCADA | 6h |
| 6 | HMI and its application | 6h |

| **Semester-5** | **Module Name: Artificial Intelligence and Machine Learning** | **Module Code: CP23510T** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 40** |
| 1 | Introduction to Artificial Intelligence and Machine Learning | 2h |
| 2 | Data Preprocessing and Visualization - Excel and Python | 8h |
| 3 | Supervised Learning - Regression | 6h |
| 4 | Supervised Learning - Classification | 4h |
| 5 | Unsupervised Learning | 4h |
| 6 | Model Selection and Validation | 4h |
| 7 | Deep Learning | 8h |
| 8 | Case Studies on AI/ML techniques to a real-world problem | 4h |

| **Semester - 5** | **Module Name: Power Electronics-I Lab** | **Module Code: CP23506P** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Practical Hours 80** |
| 1 | Familiarization of digital storage Oscilloscope | 4h |
| 2 | Design and winding of an Inductor | 4h |

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|---|---|---|
| 3 | Switching characteristic of Power diode | 4h |
| 4 | Transistor characteristics in CE configuration | 4h |
| 5 | Magnetization and demagnetization of L- load using diode | 3h |
| 6 | Magnetization and demagnetization of L-load using diode and resistor | 3h |
| 7 | Switching characteristic of IGBT | 4h |
| 8 | VI characteristics of SCR | 4h |
| 9 | VI characteristics of TRIAC | 4h |
| 10 | Resistance Triggering of SCR | 3h |
| 11 | RC-Triggering of SCR | 3h |
| 12 | UJT as a relaxation Oscillator | 4h |
| 13 | Chopper fed DC Motor Driver | 4h |
| 14 | DC-DC Half wave converter | 4h |
| 15 | DC-DC Full wave converter | 4h |
| 16 | Familiarization of Pulse width modulator IC 3524 | 4h |
| 17 | Familiarization of Bridge Inverter | 4h |
| 18 | Case study of DC-DC Buck Converter | 4h |
| 19 | Case study of DC-DC Boost Converter | 4h |
| 20 | Case study of Cyclo-Converter | 4h |
| 21 | Familiarization and Case study of UPS circuit | 4h |

| **Semester - 5** | **Module Name: Embedded System Lab** | **Module Code: CP23507P** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Practical Hours 60** |
| 1 | Revision of Keil vision 3, MP LAB and Proteus 8 simulation software. | 3 h |

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| 2 | **TRAFFIC LIGHT SYSTEM MODULE**<br>Design a Traffic Light Module for a cross road junction of three roads A, B and C in anticlockwise direction having three signal Indicators **Signal 1 (P2.0 to P2.2)**, **signal 2 ( P2.3 to P2.5)** and **Signal 3 (P3.0 to P3.2)** for the road **A, B** and **C** respectively with the Following condition:<br>**a)** Road A to B and B to A has a heavy traffic (more than 10, 000 vehicles) pass through the road per day. So make the traffic light delay for traffic signal 1 and signal 2 is of 50 Sec for green signal.<br>**b)** Whereas the cross road from B to C or A to C is of light traffic (less than 2000 vehicles) pass par day. For signal 3 set the delay time half of the time(15 sec) given for green signal for signal 1 and 2. | 3 h |
| 3 | **ELECTRONIC DICE USING 8051**<br>Using 8051 Microcontroller design an Electronic dice by using LED interfacing with the following conditions:<br>**a)** Initially microcontroller displays 1 on LEDs display just like in real dice.<br>**b)** Then in main while loop it waits for switch attached to pin 0 of port 1 to be pressed.<br>**c)** Until switch remains pressed it generates random number from 1 to 6 and displays it on LEDs.<br>**d)** When button is released it generates and display a new random numberon LEDs.<br>**e)** It repeats from step 2 to step 5 until power is applied to the system. | 6 h |
| 4 | **ROBOT CAR**<br>Using 8051 Microcontroller design the ROBOT CAR by using switch and DC motor interfacing.<br>For Remote section use five switches which will operate themotor in following conditions:<br>**a)** Switch 1 connected on **P2.1** for forward direction.<br>**b)** 2 Switch 2 connected on **P2.2** for Backward Direction.<br>**c)** Switch 3 connected on **P2.3** to STOP.<br>**d)** Switch 4 connected on **P2.4** for Right Turn.<br>**e)** Switch 5 connected on **P2.5** for Left Turn. | 6 h |
| 5 | **WAVEFORM GENERATOR**<br>Using 8051write a program to design waveforms generator depending on the conditions as below.<br>**a)** Square wave when the switch 1 is pressed.<br>**b)** Rectangular wave when switch 2 is pressed.<br>**c)** Saw tooth wave when the switch 3 is pressed. | 6 h |

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| 6 | **DC MOTOR SPEED CONTROL USING PWM**<br>Using 8051 Microcontroller write a program for **PWM** based **DC Motor** speed control to maintain the different duty cycles.<br>**a)** When S/W 1 is pressed slow speed (25% duty cycle).<br>**b)** When S/W 2 is pressed medium speed (50% duty cycle).<br>**c)** When S/W 3 is pressed high speed (75% duty cycle).<br>**d)** When S/W 4 is pressed full speed (100% duty cycle).<br>**e)** When S/W 5 is pressed the Motor should STOP. | 6 h |
| 7 | **STEPPER MOTOR CONTROL FOR DESIRE ANGLE**<br>Write a program by using 8051 Microcontroller when a switch 1 is pressed the system has to monitor the status of 2 switches connected on it,<br>**a)** Whenever s/w 1 is pressed the stepper motor should move 50 steps (for 90 degree) clock wise with a step-angle of 1.8 and a green LED should glow and after complete rotation LED goes OFF.<br>**b)** Whenever the push button 2 is pressed the stepper motor should run in 120 degree anti clock and red LED should glow and after complete rotation LED goes OFF. | 6 h |
| 8 | **METAL SHORTING MODULE**<br>Design the metal shorting module where the three types of metal sensors are sensing three objects (A, B &C) are placed on a conveyor. When all the sensors count are equal to 2 then Motor 1, Motor 2 and Motor 3 starts moving which moves the respective conveyor. When<br>**a)** $10^{th}$ objects of metal A is detected on conveyer, after 10 sec of delay motor1 goes off and all the objects are collected in a box A.<br>**b)** When $15^{th}$ object of metal B is detected on conveyer, after 10 sec of delay motor 2 goes off and all the objects are collected in a box B.<br>**c)** When $20^{th}$ object of metal c is detected after 10sec of delay motor 3 goes off and all the object are collected in a box C. | 6 h |
| 9 | **STRENGTH MONITORING SYSTEM**<br>A hall has a defined strength of 40 with one entry and one exit point. Monitor the strength of the hall continuously when<br>**a)** It is below 40, display the message "Welcome" on LCD and a green indicator (LED) should ON<br>**b)** Whenever it reach to its maximum count of 40, display the message on LCD "Please wait" and a red indicator (LED) should be on for visual indication and the entry gate should be close automatically. | 6 h |

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| 10 | **TEMPERATURE MONITORING SYSTEM**<br>Using PIC16f877a Microcontroller write a program to monitor the room temperature.<br>**a)** When Temp < 40, green LED should glow<br>**b)** When Temp = 40, yellow LED should glow<br>**c)** When Temp > 40, red LED should glow. | 6 h |
| 11 | **DIGITAL CLOCK**<br>Design the digital clock by interfacing the RTC DS12C887 with 8051 based on I2C protocol. | 6 h |

| **Semester - 5** | **Module Name: IoT Lab** | **Module Code: CP23508P** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Practical Hours 60** |
| 1 | IoT – Introduction | 4h |
| 2 | Introduction to Python | 14h |
| 3 | Advanced Microcontrollers | 21h |
| 4 | Cloud Computing | 3h |
| 5 | Introduction to various software for IoT | 6h |
| 6 | Application of IoT – Practical | 6h |
| 7 | Mini project, Case studies | 6h |

| **Semester - 5** | **Module Name: Applied Control System Lab** | **Module Code: CP23509P** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Practical Hours 40** |
| 1 | Getting Familiar with Step 7 Tia Portal and the S7-1200 PLC Programming Guide Line | 2h |
| 2 | Water Level Controller using Programmable Logic Controller | 2h |
| 3 | Batch Process Reactor using Programmable Logic Controller | 4h |
| 4 | Processing of Analog Values using Potentiometer to PLC Analog Input Module | 2h |
| 5 | Speed Control of AC Servo Motor using Programmable Logic Controller | 4h |

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|---|---|---|
| 6 | Getting familiar with Siemens WINCC SCADA interface | 2h |
| 7 | Design a Logic Using PLC for Boiling operation using two tanks along with interfaced SCADA Graphic Design | 4h |
| 8 | Design a Logic Using PLC for Sequential Control of Motor along with interfaced SCADA Graphic Design | 4h |
| 9 | To Design the PLC Logic for Food Processing Industry, also SCADA Graphics Layout | 4h |
| 10 | Getting Familiar with Siemens HMI (KTP 700) | 2h |
| 11 | Develop a Control VFD with PLC using Ladder Logic, also Design SCADA and HMI based Graphic Layout | 4h |
| 12 | Develop a PLC Logic for Status indication of Motor (Normal State, Running State, Error State) | 2h |
| 13 | Projects | 4h |

| **Semester - 5** | **Module Name: Artificial Intelligence and Machine Learning Lab** | **Module Code: CP23511P** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Practical Hours 60** |
| 1 | Python for Data Science | 20h |
| 2 | Data Preprocessing and Visualization-Excel & Python | 12h |
| 3 | Supervised Learning - Regression | 10h |
| 4 | Supervised Learning - Classification | 6h |
| 5 | Unsupervised Learning | 6h |
| 6 | Model Selection and Validation | 6h |

| **Semester - 5** | **Module Name: Employability Skills** | **Module Code: CP23512T** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 30** |
| 1 | Essential Skills for Success | 8h |
| 2 | Quality Management | 7h |
| 3 | Critical thinking and Problem solving | 8h |
| 4 | Getting ready for Entrepreneurship | 7h |

| **Semester - 6** | **Module Name: Industrial Management** | **Module Code: CP23601T** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 30** |
| 1 | Basics of Management | 2h |
| 2 | Pollution Prevention and Waste Management | 2h |
| 3 | Industrial Safety Management | 2h |
| 4 | Inspection and Quality Control | 5h |
| 5 | Modern Production Management | 2h |
| 6 | Lean Management | 4h |
| 7 | Total Productive Maintenance and Total Quality Management | 9h |
| 8 | Human Resource Management | 2h |
| 9 | Industrial Relation Legislation management | 2h |

| **Semester - 6** | **Module Name: Industrial Drives and Traction system** | **Module Code: CP23602T** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 40** |
| 1 | Introduction to Electric Drives | 8h |
| 2 | Industrial Drives | 8h |
| 3 | Heating and Power rating of Drive motors | 9h |
| 4 | Traction | 15h |

| **Semester - 6** | **Module Name: Estimation, Costing and Utilization of Energy** | **Module Code: CP23603T** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 40** |
| 1 | Economics Aspects | 6h |
| 2 | Estimation and costing | 12h |
| 3 | Energy Management | 3h |
| 4 | Power Factor correction | 4h |
| 5 | Refrigeration and Air conditioning | 4h |
| 6 | Electric welding | 4h |
| 7 | Illumination | 7h |

| **Semester - 6** | **Module Name: Power Electronics - II** | **Module Code: CP23604T** |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 40** |
| 1 | Thyristor Family | 6h |
| 2 | DC to AC Converters: Inverters | 8h |
| 3 | AC to AC Converters | 17h |
| 4 | Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) | 5h |
| 5 | Case study of an Inverter circuit using power MOSFET and step down transformer | 4h |

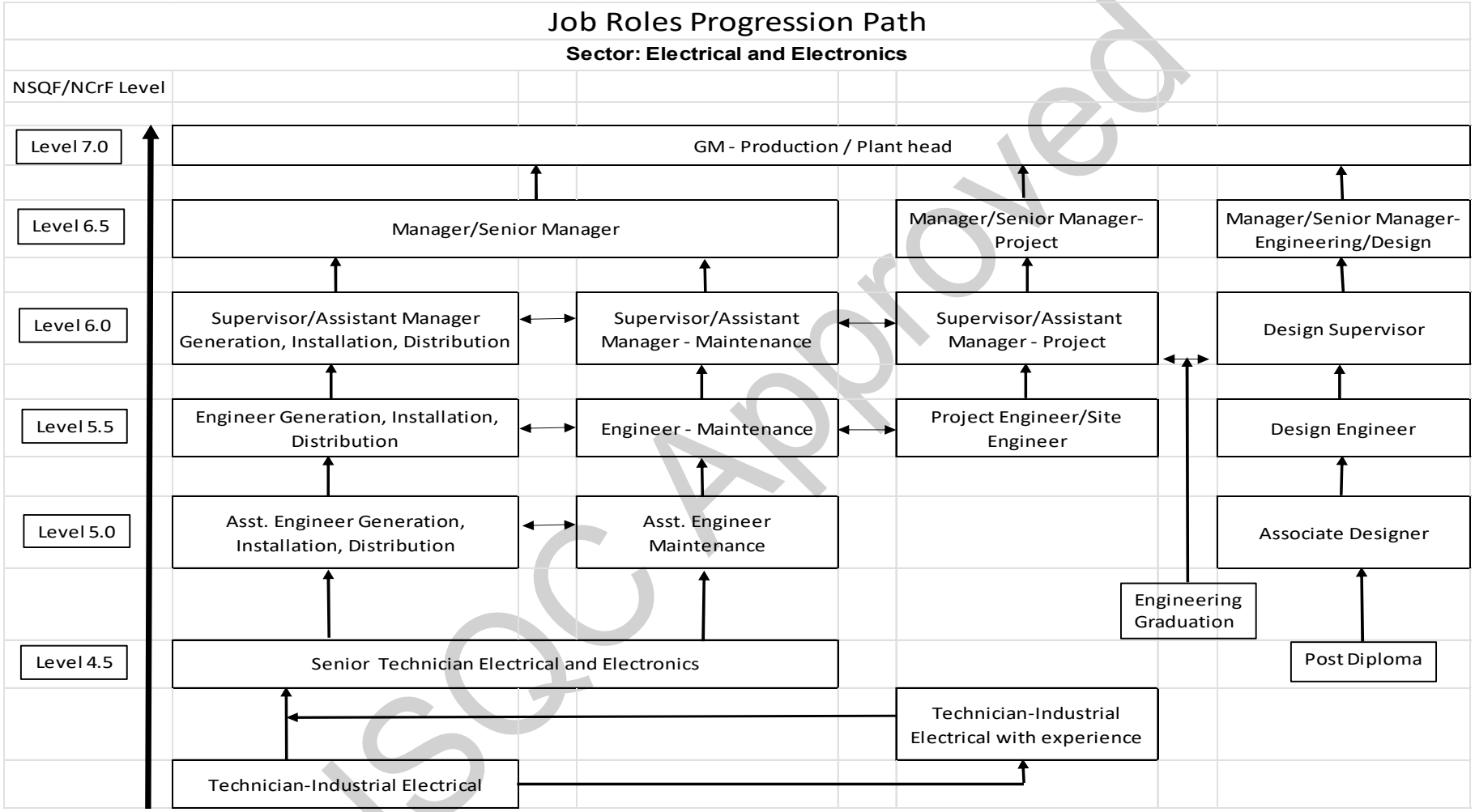
| Semester - 6 | Module Name: Industrial Drives Lab | Module Code: CP23605P |
|---|---|---|
| **Sl. No.** | **Module Details** | **Practical Hours 40** |
| 1 | DC speed control device - Armature control, Field control | 8h |
| 2 | AC speed control drive - 3 phase induction motor- squirrel cage - Voltage / frequency control | 4h |
| 3 | Study of four quadrant chopper operated – DC motor drive (used in hoist/elevators) | 4h |
| 4 | Study of solar trainer kit (Solar plant, Light filters, Battery, LED/CF lights, Circuitry and accessories involved for monitoring and control) | 6h |
| 5 | Single phase induction motor speed drive | 4h |
| 6 | Study of over current Relay trainer kit | 2h |
| 7 | Study of Frequency (over/under) measuring kit | 4h |
| 8 | Regenerative braking | 6h |
| 9 | Familiarization of CNC machine with SERVO Mechanism | 2h |

| Semester - 6 | Module Name: Project | Module Code: CP23606P |
|---|---|---|
| **Sl. No.** | **Module Details** | **Hours** |
| 1 | Project | 200h |

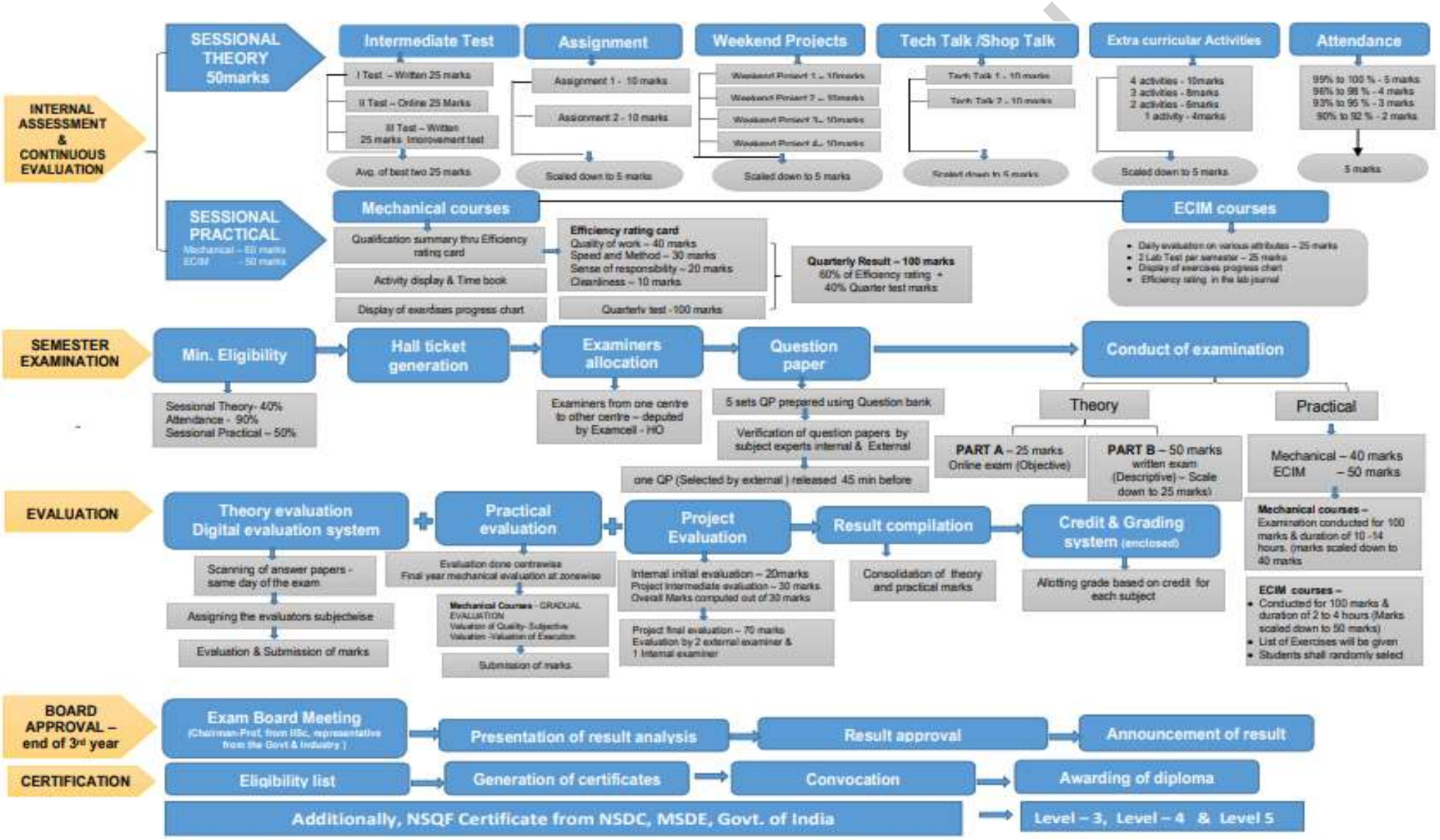
| Semester - 6 | Module Name: OJT | Module Code: CP23607P |
|---|---|---|
| **Sl. No.** | **Module Details** | **Hours** |
| 1 | OJT | 300h |

| Semester -6 | Module Name: Employability Skills | Module Code: CP23608T |
|---|---|---|
| **Sl. No.** | **Module Details** | **Theory Hours 30** |
| 1 | Labour Welfare and Legislation. | 8h |
| 2 | Customer Interaction/ Service. | 7h |
| 3 | Conflict resolution and Negotiation | 8h |
| 4 | Job readiness and Exam Preparation | 7h |

## Annexure 9: Career Progression



## Annexure 10: Assessment SOP



## Annexure 11: Occupational Map

### Sector Name: Electrical and Electronics

| As per NCrF | | As per NCO-2015 | Sub-Sector 1/Electrical generation, Transmission, Power system, Power equipment, Renewable energy | | |
|---|---|---|---|---|---|
| **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/ Power Generation, Installation, distribution** | **Occupation 2/ Maintenance** | **Occupation 3/ Design-Electrical Engineering** |
| **Level 8.0** | **1.** Professional Theoretical Knowledge: **Mastery of knowledge / Innovation driven/ Comprehensive knowledge**<br>**2.** Professional and Technical Skills/ Expertise: **Most advanced Technical and Managerial skills**<br>**3.** Employment Readiness & Entrepreneurship Skills & Mind-set: **Significant authority, transformational leadership, Social intelligence**<br>**4.** Broad Learning Outcomes: **Lead large transformational projects**<br>**5.** Responsibility: **Business Vision Chairperson/ Board Member / CMD** | 1120 | Managing Director | Managing Director | Managing Director |
| **Level 7.0** | **1.** Professional Theoretical Knowledge: **Advanced knowledge with critical understanding of emerging developments**<br>**2.** Professional and Technical Skills/ Expertise: **Highly specialized skills, transdisciplinary skills, leadership skills**<br>**3.** Employment Readiness & Entrepreneurship Skills & Mind-set: **Cross cultural competency, transformational leadership**<br>**4.** Broad Learning Outcomes: **Apply acquired** | 1321<br>2151<br>2152 | GM - Production/Plant Head | GM - Production/Plant Head | GM - Production/Plant Head |

| | | | | | |
|---|---|---|---|---|---|
| | **advanced technical skills, technical appraisal and reviews**<br>**5.** Responsibility: **Business Management (like GM/ CEO / CXO, etc.)** | | | | |
| **Level 6.5** | **1.** Professional Theoretical Knowledge: A**dvanced multidisciplinary and specialized knowledge**<br>**2.** Professional and Technical Skills/ Expertise: A**dvanced Technical and Managerial Skills**<br>**3.** Employment Readiness & Entrepreneurship Skills & Mind-set: **Leadership, effective resource management**<br>**4.** Broad Learning Outcomes: **Judgement in complex problems**<br>**5.** Responsibility: **Vertical/ Business unit management –Manager or Senior Manager** | 3115<br>1321 | Manager/Senior Manager<br>Electives - overall incharge of Installation, Assembly of electrical /electronics systems of equipment and machinery, Power Systems, Training<br>Options - Power generation, Distribution, Transmission, Renewable energy. | Manager/Senior Manager<br>Electives - responsible for maintaining status of continuous running of equipment and machinery control and monitoring devices<br>Options - Power generation, Distribution, Transmission, Renewable energy. | Manager/Senior Manager<br>Electives - Verify Design of Electrical generation/distribution equipments, plant, R&D of new products, Estimation<br>Options - Power generation, Distribution, Transmission, Renewable energy. |
| **Level 6.0** | **1.** Professional Theoretical Knowledge: **Multidisciplinary and specialized knowledge**<br>**2.** Professional and Technical Skills/ Expertise: **Range of skills along with specialized domain skills**<br>**3.** Employment Readiness & Entrepreneurship Skills & Mind-set: **Entrepreneurial mindset, selfmanagement**<br>**4.** Broad Learning Outcomes: **Judgement / decision making – specialized**<br>**5.** Responsibility: **Team leader – Junior technical supervisor, Technical supervisor or junior/ deputy manager** | 3122<br>3123<br>3115 | Supervisor/Assistant manager<br>Electives -Supervise Installation, Assembly of electrical /electronic systems of equipment and machinery, Power Systems, Verify Estimation & costing, Training<br>Options - Power generation, Distribution, Transmission, Renewable energy. | Supervisor/Assistant manager<br>Electives - Responsible for Maintenance of electrical /electronic systems of equipment and machinery<br>Options - Power generation, Distribution, Transmission, Renewable energy. | Design Engineer<br>Electives - Verify Design of Electrical generation/distribution equipment, plant, R&D of new product, Estimation<br>Options - Power generation, Distribution, Transmission, Renewable energy. |

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| **Level 5.5** | **1.** Professional Theoretical Knowledge: **Specialized knowledge**<br>**2.** Professional and Technical Skills/ Expertise: **Specialized skills**<br>**3**. Employment Readiness & Entrepreneurship Skills & Mind-set: **Team readiness, self-entrepreneurship readiness**<br>**4.** Broad Learning Outcomes: **Specialized/ complex jobs/tasks**<br>**5**. Responsibility: **Self and team responsibility – Sr. Technician or Master Technician/Engineer** | 2151<br>2152 | Engineer-Project/Site<br>Electives -Plan and execute Installation, Assembly of electrical /electronics systems of equipment and machinery, Power Systems, Estimation & costing<br>Options - Power generation, Distribution, Transmission, Renewable energy. | Engineer<br>Electives - Plan, execute periodic Maintenance of electrical /electronics systems of equipment and machinery<br>Options - Power generation, Distribution, Transmission, Renewable energy. | Design Engineer<br>Electives - Design of Electrical generation/distribution equipments, plant, R&D of new products<br>Options - Power generation, Distribution, Transmission, Renewable energy. |
| **Level 5.0** | | 2151<br>2152<br>3113<br>8212 | Assistant Engineer<br>Electives - Installation, Assembly of electrical /electronics systems of equipment and machinery, Power Systems, Testing, Estimation and Costing<br>Options - Power generation, Distribution, Transmission, Renewable energy. | Assistant Engineer<br>Electives - Installation, Maintenece of electrical /electronics systems of equipment and machinery<br>Options - Power generation, Distribution, Transmission, Renewable energy. | Associate Designer<br>Electives - Design of Electrical generation/distribution equipments, plant, R&D of new products<br>Options - Power generation, Distribution, Transmission, Renewable energy. |
| **Level 4.5** | **1.** Professional Theoretical Knowledge: **Range of knowledge**<br>**2.** Professional and Technical Skills/ Expertise: **Range of technical skills**<br>**3.** Employment Readiness & Entrepreneurship Skills & Mind-set: **Team readiness & Enterpreurial readiness**<br>**4.** Broad Learning Outcomes: **Carry out Range of tasks and may provide range of solutions**<br>**5**. Responsibility: **Accountable/ responsible - Senior Technician Electrical and Electronics** | 3113<br>7411<br>3114 | Senior Technician Electrical and Electronics<br>Electives - Installation, Assembly of electrical /electronics systems of equipment and machinery. Power Systems, Testing.<br>Options - Power generation, Distribution, Transmission, Renewable energy. | Senior Technician Electrical and Electronics<br>Electives - Installation, Maintenance of electrical /electronics systems of equipment and machinery.<br>Options - Power generation, Distribution, Transmission, Renewable energy. | Study Post Diploma |

## Annexure 12: Key Learning Outcome

| SL. NO. | SUBJECT NAME | KNOWLEDGE AND UNDERSTANDING | TECHNICAL & PROFESSIONAL SKILLS | APPLICATION OF KNOWLEDGE AND SKILLS |
|---|---|---|---|---|
| 1 | **Switch Gear Protection – (CP23501T)**<br>Understanding the construction and functioning and use of various Power Protection devices | Knowledge on construction and working principle of Fuses and Circuit Breakers, Current chopping, various switching operations.<br><br>Knowledge and understanding of Isolator – their types, and function.<br><br>Knowledge on principle, construction and working of Protective relays, Classification of relays.<br><br>Over voltage protection – causes and protection – Lightning arrestor etc.<br><br>Knowledge on special purpose motors, - universal motor, Hysteresis motor, reluctance motor, permanent magnet synchronous motor. | Normal and Fault conditions of an Electrical Circuit.<br><br>Read and interpret specifications of fuses and Circuit breakers.<br><br>Understanding on faults in electrical equipments and Equipment protection methods - Overheating, earth fault, over current, overload, short circuit protection. | Application and comparison of ACB, OCB, SF6CB, VCB, MCB, MCCB, ELCB. |
| 2 | **Power System Engineering – II (CP23502T)**<br>Knowledge on Power transmission, and the losses associated with power transmission, process to minimize power transmission losses. | Understanding power transmission on overhead lines, comparison of different types of conductors for power transmission and their need.<br><br>Understanding on skin effect, proximity effect and Ferranti effect.<br><br>Understanding Corona – loss due Corona effect, Methods to reduce Corona.<br><br>Supporting structure of Overhead lines – Components, factors influencing support, | Explain the transmission parameters.<br><br>Determination of inductance, capacitance in, around and parallel conductors (single phase & 3 phase). Short, medium, and long lines.<br><br>Regulation and percentage regulation in each case.<br><br>Insulators – need, types, suspension insulators, string efficiency, Flashover | Use of conductor tables for determining resistance in solid, ACSR and AAAC conductors, g inductance and capacitance in overhead lines |

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| | | cross arm for HT/LT Lines, Ground clearance, methods of Earthing, types of towers. | puncture, role of arching horns and guard rings. | |
| **3** | **Power Electronics - I (CP23503T)**<br><br>**Power Electronics - I Lab (CP23506P)**<br><br>**Power Electronics - II (CP23604T)**<br><br>Understanding of construction, characteristics, and application of Power devices. | Knowledge on construction, Operation, Characteristics of power Devices, triggering and commutation (GTO, IGBT, SBS, SCS etc)<br><br>Explain various protection circuits associated with power circuits (over voltage protection, snubber circuit) as applicable for various industries.<br><br>Explain and implement the effect of EMI, EMC and prevention methods | Draw and explain power rectifiers (controlled and uncontrolled), Inverters (single phase/three phase, PWM), Choppers (cyclo)<br>Distinguish between power electronics and low power electronics.<br><br>Design linear power supplies, switch mode power supplies, Uninterruptible Power Supplies and their applications | Practice safety<br><br>Implement the effect of EMI, EMC and prevention methods<br>Design, analyse and troubleshoot Power Electronics circuits |
| **4** | **Embedded System (CP23504T)**<br>**Embedded System Lab (CP23507P)**<br><br>Understanding and Programming of simple projects using different Microcontrollers and associated protocols. | Understand the various fields of Embedded system<br><br>Explain the Block diagram and requirements of Embedded system<br><br>Explain the Process of Embedded system development<br><br>Knowledge about the Processor, Memory management, Code optimization, various compilers | Will be able to perform testing on host, testing on target, Environment testing.<br><br>Design an Embedded Product<br><br>Will be able to program and execute to control various output devices using 8051/PIC 16F877A (temperature monitoring systems, traffic light controller etc.<br><br>Interface peripherals to 8051/PIC 16F877A Microcontroller.<br>(Peripherals: Keyboard, LEDs, LCD display, relay and motor, drivers) | Select the Microcontroller/ Sensors/ Peripherals as per the requirement, optimize the Code, use the suitable protocols, test the hardware and firmware in testing unit and Environment in various applications |

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| | | | Perform the use of RS232 and USB interface with Computer interface. | |
| **5** | **Applied Control System (CP23505T)**<br><br>**Applied Control System Lab (CP23509P)**<br><br>Ability to create PLC based process by interfacing HMI and SCADA. | Knowledge on SCADA functions and process, operations, software and protocols associated with communication and control through SCADA (IEC, IED & GUI) | Perform design and implementation of PLC based processes, interfacing with SCADA and HMI for various industrial applications | Competent to work with PLCs from different manufacturers, interface with output devices and troubleshoot. |
| **6** | **IoT Lab (CP23508P)**<br><br>Understanding IoT architecture, cloud computing and their applications. | Basic knowledge on IoT architecture, various development boards and various Cloud services.<br><br>Understand the Basics of Python Programming | Design and Implementation of Cloud based projects<br><br>Use various communication protocols, develop and Implement different IoT applications using sensors<br><br>Write programs on python with right syntax and semantics, debug the program | Develop applications using to control various devices using NODE MCU, Arduino processor and Raspberry pi. |
| **7** | **Artificial Intelligence and Machine Learning (C23510T)**<br>**Artificial Intelligence and Machine Learning Lab (CP23511P)**<br><br>Ability to develop applications and AI Services | Explain the applications of AI and ML<br><br>Knowledge on Data Processing and visualization<br><br>Distinguish various methods in supervised Learning<br><br>Explain the cross validation techniques<br><br>Differentiate CNN and RNN<br><br>Knowledge on Python programming for Data science | Perform data cleaning, transformation and Visualisation<br><br>Implement model deployment and scaling using deep learning<br><br>Create Evaluation Metrics for Classification Models | Develop the applications or Cloud based AI services using AI and ML methodologies<br><br>Apply the Supervised learning methods in the appropriate applications |

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| | | Explain the cross validation techniques | | |
| **8** | **Industrial Management (CP23601T)**<br><br>Understanding Management structure, Safety, Productivity improvement practices, and Factory Acts and regulations. | Understand the basics of management structure and management strategies of an industry<br><br>Understand the impacts of the industrial pollution and waste<br><br>Understand the concepts of Lean manufacturing<br><br>Understand the Importance of industrial & factories | Able to use the tools used in the industry to improve and control the quality of products<br><br>Able to apply the Importance of TPM & TQM Concepts | Apply the importance of the Industrial safety<br><br>Apply the Importance of modern production management system |
| **9** | **Industrial drives and traction system (CP23602T)**<br>**Industrial Drives Lab (CP23605P)**<br><br>Understanding of selection, applications and control of Electrical Machines and Drives | Explain the various electrical drives used in the industry, their selection, applications, control and precautions, advantages, and disadvantages (industrial drives, heating and power rating of drives).<br><br>Understand the servo mechanism, control in CNC machines. | Demonstrate the speed control methods of DC motor, single phase and three phase induction motors and breaking methods. Heating and cooling methods.<br><br>Electric traction system, load, speed control, time – speed characteristics. | Selection of an electric motor for a particular application, Load analysis for any application. |
| **10** | **Estimation, Costing and Utilization of Energy (CP23603T)**<br><br>Understanding the Economics of power generation, Transmission and Distribution, Power Audits and Management. | Knowledge on the economic aspects, factors, and parameters to be considered for design, Estimation and costing involved in power generation to distribution. | Explain the Energy Management needs, types of audits and energy audits, power factor, economics of power factor improvements and tariff computation | Handle power management-refrigeration, air conditioning, electrical welding and illumination systems. |

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|---|---|---|---|---|
| **11** | **Project (CP23606P)**<br><br>Ability to create a working model using the skill developed during their training. | Prepare Electrical and Electronics Engineering circuit and interface. | Project should comprise of Hardware, Software as well as Display/ User Interface systems. The Hardware shall be based on Electrical/ Electronic Circuits for Motor/Power control controlled by PLC or Microcontroller/IoT.<br>Manufacture and assemble Mechanical sub system.<br>Develop and download PLC / Embedded program. | Perform project work on application of Electrical and Electronics.<br><br>Integrate, Test project for functionality. |
| **12** | **Employability Skills (CP23512T)**<br>**Employability Skills (CP23608T)**<br><br>Understand Labour Welfare and Legislation.<br><br>Understand the concept of Quality Management Getting ready for Employment/ Entrepreneurship.<br><br>Learn to interact with customers/ provide service. | Knowledge on benefits guaranteed under various Acts, legislations, Factories act, Apprenticeship Act, ESI, EPF Acts, Payment of wages act, women's compensation Act, POSH, and other industrial laws.<br><br>Understanding of Quality concepts, QMS, PDCA QC Tools, 5S, Kaizen. ISO Process.<br>Distinguishing between Job and Career, Awareness of different job roles in the related sector.<br><br>Understanding the pathway and progression. Creating resume and apply for Jobs. | Explain various Acts enacted for labour welfare by various Governments.<br><br>Attend mock interviews, create Resume documents.<br><br>Body language, relationship building, probing techniques. | Use of various QC tools and Kaizen for problem solving and Quality improvement themes.<br><br>Customer handling from greeting, grievance handling. |

# Annexure: Acronym and Glossary

## Acronym

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

## Glossary

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