



QUALIFICATION FILE

Technician-Industrial Electrical

- ☐ 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 Electrical	
2.	Sector/s	Electrical and Electronics	
3.	Type of Qualification: ☒ New ☐ Revised ☐ Has Electives/Options ☐ OEM	NQR Code & version of existing/previous qualification: (change to previous, once approved)	Qualification Name of existing / previous version: Technician-Industrial Electrical
4.	a. OEM Name b. Qualification Name (Wherever applicable)	NA	
5.	National Qualification Register (NQR) Code &Version (Will be issued after NSQC approval)	QG-04-EH-01405-2023-V1-NTTF	6. NCrf /NSQF Level: 4.0
7.	Award (Certificate/Diploma/Advance Diploma/ Any Other (Wherever applicable specify multiple entry/exits also & provide details in annexure)	Advance Certificate	
8.	Brief Description of the Qualification	Able to use the Sensors, Transducers, and their conditioning circuits. Can perform the control of different motors for suitable applications. Analyse and troubleshoot different control system components in process industry. Installing, repairing, and maintaining electrical components of industrial equipment. The subjects covered in this Programme are – Electrical and Electronics Measurement, Digital Electronics, Electrical Machines-I Solar Technology, Computer Programming C, C++, Control System, Electrical Machines-II, Power Systems Engineering-I, Microcontroller and Applications, Wind Energy, Employability Skill, Programmable Logic Controller, Electrical Machines - I Lab, Computer Programming C, C++ Lab, Electrical and Electronics Measurement Lab, Digital Electronics Lab, Solar Technology Lab, Electrical machines-II Lab, Microcontroller and Applications Lab, Electrical Machine Wiring Lab, Wind Energy Lab, Programmable Logic Controller Lab, 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)		
		01	12th Pass with Mathematics OR 10th + 2 years ITI in the following trades: Electrician, Electrician Power Distribution OR 10th + 2 years diploma /pursuing 3rd of diploma in relevant trade OR Certificate - Assistant Technician Electrical Level 3.5 from NTTF.			NA		
10.	Credits Assigned to this Qualification, Subject to Assessment (as per National Credit Framework (NCrF))	Total Credits – 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						
		Training Delivery Modes		Theory (Hours)	Practical (Hours)	OJT/ Project Mandatory (Hours)	OJT Recommended (Hours)	Total (Hours)
		Classroom (offline)		540	510	90	NIL	1140
		Online		60	-	-	-	60
		(Refer Blended Learning Annexure for details)						
14.	Aligned to NCO/ISCO Code/s (if no Code is available mention the same)	NCO Code –2015/3113.0101, 2015/7411.0301						
15.	Progression path after attaining the qualification. (Please show Professional and Academic progression)	After Completion of 1 year of Full Time Programme can work as Technician Industrial Electrical After Completion of 3 years of Full Time Programme and after 5 years of Industry Experience the Job Holder can work as						

		R&D Power Engineer, Power distribution Service Engineer, Power distribution Maintenance Engineer, Engineer Renewable energy and Engineer power distribution. Academic Progression: Diploma in Electrical & Electronics Engineering (Level 4.5), Post Diploma, B. VoC and B.Tech Degree Course in Relevant field.	
16.	Other Indian languages in which the Qualification & Model Curriculums 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% reserved)	
20.	Are Greening/ Environment Sustainability Aspects Covered (Specify the NOS/Module which covers it)	☐ Yes ☒ No	
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 Email: rg@nttf.co.in Tel number: 080 - 28390215 Contact Number: 9844013448 Website: nttftrg.com	
23.	Final Approval Date by NSQC: 30 Nov 2023	24. Validity Duration: 3 Years	25. Next Review Date: 30 Nov 2026

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 – 3																
1	Electrical & Electronics Measurement	CP23301T	Core	4.0	20	60	-	-	-	60	100	-	-	-	100	
2	Digital Electronics	CP23302T	Core	4.0		80	-	-	-	80	100	-	-	-	100	
3	Electrical Machines-I	CP23303T	Core	4.0		40	-	-	-	40	100	-	-	-	100	
4	Solar Technology	CP23304T	Core	4.0		40	-	-	-	40	100	-	-	-	100	
5	Computer Programming C, C++	CP23305T	Core	4.0		30	-	-	-	30	100	-	-	-	100	
6	Electrical and Electronics Measurement Lab	CP23306P	Core	4.0		-	60	-	-	60	-	80	-	20	100	
7	Electrical Machines - I Lab	CP23307P	Core	4.0		-	60	-	-	60	-	80	-	20	100	
8	Computer Programming C, C++ Lab	CP23308P	Core	4.0		-	80	-	-	80	-	80	-	20	100	
9	Digital Electronics Lab	CP23309P	Core	4.0		-	80	-	-	80	-	80	-	20	100	
10	Solar Technology Lab	CP23310P	Core	4.0		-	40	-	-	40	-	80	-	20	100	
11	Employability Skill	CP23311T	Core	4.0		30	-	-	-	30	75	-	-	25	100	
Duration (in Hours) / Total Marks					20	280	320	-	-	600	575	400	-	125	1100	
Semester – 4																
12	Control System	CP23401T	Core	4.0	20	40	-	-	-	40	100	-	-	-	100	
13	Electrical Machines-II	CP23402T	Core	4.0		60	-	-	-	60	100	-	-	-	100	
14	Power System Engineering-I	CP23403T	Core	4.0		60	-	-	-	60	100	-	-	-	100	
15	Microcontroller and Applications	CP23404T	Core	4.0		60	-	-	-	60	100	-	-	-	100	
16	Wind Energy	CP23405T	Core	4.0		30	-	-	-	30	100	-	-	-	100	
17	Programmable Logic Controller	CP23406T	Core	4.0		40	-	-	-	40	100	-	-	-	100	
18	Electrical machines-II Lab	CP23407P	Core	4.0		-	50	-	-	50	-	80	-	20	100	
19	Microcontroller and Applications Lab	CP23408P	Core	4.0		-	30	-	-	30	-	80	-	20	100	
20	Electrical Machine Wiring Lab	CP23409P	Core	4.0		-	40	-	-	40	-	80	-	20	100	
21	Wind Energy Lab	CP23410P	Core	4.0		-	30	-	-	30	-	80	-	20	100	
22	Programmable Logic Controller Lab	CP23411P	Core	4.0		-	40	-	-	40	-	80	-	20	100	
23	Employability Skill	CP23412T	Core	4.0		30	-	-	-	30	75	-	-	25	100	
24	OJT	CP23413P	Core	4.0		-	-	90	-	90	-	75	-	25	100	
Duration (in Hours) / Total Marks					20	320	190	90	-	600	675	475	-	150	1300	
Total					40	600	510	90	-	1200	1250	875	-	275	2400	

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

Section 5: Evidence of the need for the Qualification*Provide Annexure/Supporting documents name.*

1.	Research Reports: The following reports establish the Skilled Resource requirement for the Electrical and Electronics Engineering, 1. MSDE Annual Report 2021- 2022 predicts skilled manpower requirement in the Power and Renewable energy sectors. 2. Annual report 2021-22 from Ministry of new and Renewable Energy has projected requirement of skilled manpower in the area. 3. Annual report 2021- 2022 Ministry of Power has projected energy demand for various sectors. The above two will lead to Higher requirement in Electrical and Electronics Engineers in large numbers in the Future. 4. 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 Electrical and Electronics skills.
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 1. Indian Skills Report 2021-22 by Wheebox - partnered CII predicts skill requirement in Engineering and Manufacturing sectors and Energy and Core sectors. 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 – 1. Study on Job Role of the Future by Indian Institute of Skills. 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	Describe Measuring Systems, Sensors and Transducers. Describe the Number systems, Codes and Logic gates. Explain the logical circuit reduction techniques, combinational and Sequential circuits, Timers & Counters, Registers and Flip-Flops, Data converters. Define laws governing to Motors and Generators. Explain the principle and operation of a Solar technology. Define and use the syntax and semantics of the C, C++ programming language. Explain Wind turbine technology.	Able to use the Sensors, Transducers, and their conditioning circuits. Identify, analyse and trouble shoot different Logical circuits. Explain the structure of Power system (generation, transmission and distribution and voltage levels) Can perform the control of different motors for suitable applications. Apply the concepts of Class, Inheritance, Data Encapsulation and Polymorphism using Python. Ability to draw electrical circuits using Autodesk Electrical	4.0
Professional and Technical Skills/ Expertise/ Professional Knowledge	Explain the construction and working principle of DC Generators and Motors, Explain the working principle of single phase and three phase induction motor. Explain the construction of synchronous motors and its characteristics. Explain the working of UPS and Home inverter. Explain ON delay/OFF delay timer and latching circuits Explain the principle of operation of alternator, voltage regulation, losses / efficiency.	Analyse and troubleshoot different control system components in process industry. Select different panel safety appliances as per the required ratings. Able to develop simple control programs using PLC for industrial applications. Can troubleshoot and maintain UPS and inverters of different applications. Operate the DC motors and generators. Able to conduct prescribed tests for synchronization	4.0

	Explain Solar power generation and processing.	and determination of performance of the alternators. Installation Maintenance and operation of solar technology.	
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	Safety and standard operating Procedures and Practices in the work area. Hands-on on working with different unconventional sources of power. Hands-on with PLC, HMI. Knowledge on IoT. Practical hands-on experience on Power electronics,	Programming different Microcontroller - interfacing different Input/ Output devices to perform the desired tasks. Installation and maintenance of unconventional power systems. Installing and troubleshooting electrical systems, Able to perform inspections of the electrical systems and maintain a record of the same.	4.0
Responsibility	Collaborating with other technicians, engineers, and supervisors on projects, maintenance tasks, and safety initiatives. Adapt to changes in the work area. Identify, Monitor and Report occurrences in the work area.	Can work independently. Installing, repairing, and maintaining electrical components of industrial equipment. Ensuring that all electrical work is conducted in compliance with electrical codes and safety regulations.	4.0

Annexure 2: Tools and Equipment (Lab Set-Up)**Tools and Equipment requirement for a batch of 30 Trainees****Microcontroller Lab Equipment**

Sl. No.	Equipment	Specification	Quantity
1	Digital Trainer Kit		10
2	Microcontroller Trainer Kit	8051 AT89S52 Development Board with Interfacing Modules	3

Electrical and Electronics Measurement Equipment

Sl. No.	Equipment	Specification	Quantity
1	Digital Oscilloscope	No of Channels - 2, Bandwidth:DC - 20 MHz	6
2	Dual - Power Supplies Regulated Power Supply, Adjustable	0-30V/1A	5
3	Dual - Fixed Power Supply	15-0-15 V/2A	3
4	LVDT Trainer Kit		1
5	Strain Gauge Kit		1
6	LCRQ Meter		1
7	Digital Trainer Kit		6
8	Potential Transformer (Training Kit)		1
9	Current Transformer (Training Kit)		1
10	Kelvin Double bridge		1
11	Load Cell		1
12	Schering Bridge		1
13	Anderson Bridge		1
14	RTD		2
15	Thermocouple		3
16	Decade Resistance box - 6 Dials	0.1 to 1 M Ω	2
17	Decade Capacitive box - 5 Dials	0.1 to 10 μ f/63V	2

Electrical Machine Equipment

Sl. No.	Equipment	Quantity
1	Starting process of Induction motors through different logic Trainer Kit	1
2	Characteristics of DC shunt motor Trainer Kit	1
3	Brake test of DC motor Trainer Kit	1
4	V and Inverted V curve Trainer Kit	1
5	Cut model of synchronous motors	1
6	DC Compound motor characteristics Trainer Kit	1
7	Testing of Transformer Trainer kit	1
8	DC shunt motor and DC Generator set Trainer kit	1
9	Single phase power factor and RLC measurement Trainer kit	1
10	Single and three phase power measurement Trainer kit	1
11	Speed control and performance of wound rotor Inductionmotor Trainer kit	1
12	Induction motor starting and testing Trainer kit	1
13	Parallel operation of two Alternators	1
14	Regulation of an alternator by synchronous impedance method Trainer kit	1
15	Starting of single-phase Induction motor Trainer kit	1
16	Measure of speed and speed control of AC motor Trainer kit	1
17	Digital Wattmeter, Ammeter, and Voltmeter	2 each

Automation Lab Equipment

Sl. No.	Equipment	Specification	Quantity
1	PLC Trainer Kit with HMI & SCADA -2 Analog I/O and 8 Digital I/O	6 License	1

Power Engineering Lab

Sl. No.	Equipment	Specification	Quantity
1	Generation Trainer kit		1
2	Transmission Trainer kit		1
3	Double Bus bar Trainer kit		1

Solar / Wind Lab Equipment

Sl. No.	Equipment	Specification	Quantity
1	Solar Power Generation Training System		1
2	Renewable Wind Energy Training System		1

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	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 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. Rashtrapal		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.in	
8	SPICER	Mr. Krishna kumar		QR73+GC5, Sipcot Ph. I, Bangalore, Tamil Nadu 635126	7090621333	krishnakumar.rao@dana.com	
9	VOLVO EICHER	Mr. Anirudh dongre		22/2, Yeshwant Niwas Rd, New Palasia, Indore, Madhya Pradesh 452003	9893286207	adongre@vecv.in	
10	FOX SOLUTION	Mr. Vishal		M9, MIDC 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	rksingh@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@acemicromatic.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. Anupma		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@essprout.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:**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>

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 - 3					
Electrical and Electronics Measurement	Measurement Theory and Classification-Definition, Classification, Instrument characteristics	12	-	-	-
	Measurement of Voltage, Current and Resistance-PMMC, MI instruments, Ohmmeter, multimeter	26	-	-	-
	Measurement of Power and Energy- watt meter, energy meter-application	20	-	-	-
	Special Instruments- Power analyzer, CRO,	22	-	-	-
	Transducers and Industrial Instrumentation-Types, construction, usage, measurement methods	20	-	-	-
	Total Marks	100			
Digital Electronics	Introduction to digital electronics-Digital systems, Analog/digital signals,	4	-	-	-
	Number systems and Code conversions- Decimal, Binary, Octal , Hexadecimal	12.5	-	-	-
	Logic gates- Types, implementation	7.5	-	-	-
	Boolean algebra and Boolean function implementation	13.5	-	-	-
	Combinational logic circuits -types, implementation, Encoder, Decoder	17.5	-	-	-
	Timers and timing circuits- IC 555 timer, multi vibrators	6	-	-	-
	Latches and flip-flops- Sequential logics, Types of latches, types of flip-flops	7.5	-	-	-
	Sequential logic circuits-Counters,	18	-	-	-
	Data converters-Digital & analog	6	-	-	-
	Integrated logic families-Significance, types	7.5	-	-	-
	Total Marks	100			

Electrical Machines - I	Concepts of induced EMF and laws-Induced EMF-static & dynamic, Fleming's rule	10	-	-	-
	DC generator-Construction, types, characteristics, working principles.	40	-	-	-
	DC motor- Construction, types, characteristics, working principles.	50	-	-	-
	Total Marks	100			
Solar Technology	Basic principle in Solar Technology-Introduction, objectives	10	-	-	-
	Solar Cooker- Introduction, objectives, advantages	7.5	-	-	-
	Domestic and Industrial water heater	7.5	-	-	-
	Solar dryer- Types,	7.5	-	-	-
	Solar distillation plant	7.5	-	-	-
	Solar Photovoltaic lighting system- Introduction, objectives, principles	20	-	-	-
	Solar water pumping- Introduction, objectives, SPV	7.5	-	-	-
	Installation of solar panel	20	-	-	-
	General maintenance of PV system-Safety, trouble shooting	12.5	-	-	-
	Total Marks	100			
Computer Programming C, C++	Introduction to Computer programming	2.5	-	-	-
	Introduction to C programming language	15.0	-	-	-
	Operators and Expressions	7.5	-	-	-
	Control statements	15	-	-	-
	Arrays	7.5	-	-	-
	Functions	10	-	-	-
	Pointers and Miscellaneous Topics	12.5	-	--	-
	Structure and Union	5	-	-	-
	C++ Introduction and Oops Concepts	25	-	--	-

	Total Marks	100			
Employability Skills	Diversity and Inclusion, Gender sensitivity PwD etc.	15	-	-	5
	Career development and Goal setting	20	-	-	10
	Entrepreneurship	15	-	-	5
	Analytical thinking and Adaptive Thinking	25	-	-	5
	Total Marks	100			
Electrical and Electronics Measurement Lab	Calibration of Single phase, Three phase energy meter	-	7	-	2
	Measurement of power in three phase circuit using two wattmeter method (Balanced and Unbalanced Loads)	-	4.5	-	-
	Measurement of Reactive power in three phase balanced circuit using one wattmeter method, Measurement of Low resistance using Kelvin's Double Bridge	-	17.5	-	6
	Measurement of inductance using Anderson's Bridge, capacitance using Desauty Bridge	-	17.5	-	6.0
	Use of LCR-Q meter for measuring inductance, capacitance, resistance and Q factor, Electrical methods for measurement of liquid level	-	7	-	2
	Displacement measurement by LVDT	-	4.5	-	-
	Study and verification of characteristics of pressure Transducers, strain gauge	-	7	-	2
	Extension of instrument range: ammeter, voltmeter, watt meter using CT,PT	-	7	-	2
	Measurement of Temperature of water using thermometer	-	4	-	-
	Measurement of Temperature using Thermocouple	-	4	-	-
	Total Marks	100			
Electrical machines - I Lab	To plot the open circuit characteristic of separately excited DC generator	-	10	-	2
	To plot the open circuit characteristic of self-excited DC generator	-	10	-	2
	To plot external characteristics curve of self-excited DC generator	-	10	-	2
	Plot the speed, torque and current curve for shunt motors, series motors, compound motor	-	16	-	5

	Speed control of DC shunt motor using Armature control method, field control method	-	10	-	2
	Brake test, Swinburne's test on DC shunts Motor	-	16	-	5
	Study of Servo, Stepper, PMDC and BLDC motors	-	8	-	2
	Total Marks		100		
Computer Programming C, C++ Lab	Introduction to Visual studio 2019. Menu and sub menu.	-	4	-	-
	Write a C program to declare suitable variables and initialize values for printing:, Write a program to print bytes required for short, integer, float, char	-			
	Write a program to declare int x, y, float k, m and char chk[10].	-	6	-	2
	Write a program to read (scanf) marks of a subject and display if marks more than or less than 50, using 'if' statement.	-	4	-	-
	Write a program to calculate square and also square root of any number., Write a program using while loop to print first 10 numbers of Fibonacci series	-	6	-	2
	Write a c program using do-while loop, to read integer numbers between 1 and 99, Write a program with infinite while loop.	-	6	-	2
	Write a program to input 6 integers and store them in an array, Write a program to input two 3x3 matrix using two dimensional array.	-	6	-	2
	Declaration of an array as global or local.	-	4	-	-
	Write a program to input a sentence, Write a C Program to input a number and print the factorial of that number.	-	6	-	2
	Write a function to input a number. Declare the variables to store marks of 10 students.	-	6	-	2
	Program to input 80 characters	-	6	-	2
	Write a C Program to create a structure called student, with members name, token number and age and display the details for one student.	-	8	-	2
	Write a C++ program by having class name	-	18	-	4
	Total Marks		100		
Digital Electronics Lab	Familiarization of Logic gate IC's- a) 7404 b) 7408 c) 7432 d) 7400 e) 7402 f) 7486	-	4	-	-

	Implementation of NOT, AND, OR, NOR, EX-OR and EX-NOR using NAND gate & NOR gate.	-	8	-	2
	Simplify and Design SOP Expressions using Basic Logic Gates., K-map, Simplify and Design POS Expressions using Basic Logic Gates., K-map.	-	8	-	2
	Implement Binary to Gray Code Converter using K-map method, Implement Gray Code to Binary Converter using K-map method.	-	4	-	-
	Design and Implement Half Adder and Full Adder circuits, Half Subtractor and Full Subtractor circuits.	-	6	-	2
	Implement 4-bit Parallel Adder and Subtractor using IC 7483, 4-bit Comparator using IC 7485	-	6	-	2
	Familiarization of Priority Encoder IC 74147, Decoder IC 74138, MUX IC 74151, DEMUX IC 74138	-	8	-	2
	Design a Monostable Circuit using IC 555, Design a Astable Circuit using IC 555	-	4	-	-
	Familiarize Octal D-Latch IC 74373., Octal D-FF IC 74374, D-FF IC 7474, JK-FF IC 7476	-	8	-	2
	Implement 3-bit Ripple Up and 3-bit Ripple Down Counter using IC 7474	-	4	-	-
	Design and Implement Mod-6 and Decade Counter, 3-bit SISO and PIPO SRG, 3-bit Ring and Johnson Counters using IC 7474	-	16	-	8
	Familiarize Decade Counter IC 7490 and 4-bit Ripple Counter IC 7493	-	4	-	-
	Total Marks		100		
Solar Technology Lab	To understand the Functioning of all Resource Panel (XPO-STT)	-	8	-	2
	To perform experiment to study- I-V characteristics of SPV modules, series combination of SPVS, parallel combination of SPVS	-	24	-	6
	To perform experiment to study- effect of tilt angle on SPV module power output	-	8	-	2
	To perform experiment to demonstrate the effect of shading on SPV module output power	-	8	-	2
	To perform experiment to locate and verify MPP by using resistive loads	-	8	-	2
	To understand and determine the DC flow in a solar system	-	8	-	2
	Workout power flow calculation of standalone PV system of DC load with battery	-	8	-	2

	To perform experiment to study, working of Inverter and calculate the efficiency of inverter	-	8	-	2
	Total Marks		100		
Semester - 4					
Control System	Introduction and modeling of systems-Types, signal flow graphs	32.5	-	-	-
	Time response of feedback control systems-Standard test signals	15	-	-	-
	Stability analysis-Concepts, criterion,	20	-	-	-
	Frequency domain analysis-Correlation, concept	22.5	-	-	-
	State variable analysis-Concepts , solution	10	-	-	-
	Total Marks	100			
Electrical Machines - II	Transformers-Working principles, Construction & types,	25	-	-	-
	Alternators- Working principles, Construction & types,	16	-	-	-
	Synchronous Motors- Principles of operation, V-curves, comparison	25	-	-	-
	Three Phase Induction Motor- Working principles, Construction & types,	20	-	-	-
	Single Phase Induction Motor- Working principles, Construction & types,	14	-	-	-
	Total Marks	100			
Power Engineering - I	Thermal Power Plant-Site selection, parts & working	17	-	-	-
	Hydro Power Plant- Site selection, parts & working	17	-	-	-
	Nuclear Power Plant-Classification of reactors, application	12	-	-	-
	Diesel and Gas Power Plant- Site selection, choice & characteristics	17	-	-	-
	Non-Conventional Power Plant	17	-	-	-
	Power transmission and distribution-structure of power system, distribution	20	-	-	-
	Total Marks	100			
	Introduction to Microprocessors and Microcontrollers- evolution, comparison	10	-	-	-

Microcontroller and Applications	Study of Memory-memory storage memory map	7	-	-	-
	8051 Architecture- function. I/O ports	12	-	-	-
	Programming of 8051- instruction, language programming	16	-	-	-
	Timers and interrupts of 8051	15	-	-	-
	8051 Application examples	20	-	-	-
	Introduction to 8051 programming in C	20	-	-	-
	Total Marks	100			
Wind Energy	Introduction- objectives, advantages.	5	-	-	-
	Wind Resource and Wind Energy in India-Fundamentals, wind energy potential	20	-	-	-
	Wind Turbine Technology	25	-	-	-
	Generation of Electricity	20	-	-	-
	Life cycle assessment and Environmental impacts of Wind Energy	20	-	-	-
	Wind Economics, Growth Trends and the future of Wind Energy	10	-	-	-
	Total Marks	100			
Programmable Logic Controller	PLC basics	7.5	-	-	-
	Basic PLC programming	17.5	-	-	-
	Basic PLC functions	17.5	-	-	-
	Intermediate functions	15	-	-	-
	Data handling functions	10	-	-	-
	PLC functions working with bits	20	-	-	-
	Advanced PLC functions	7.5	-	-	-
	Introduction to HMI and SCADA	5	-	-	-
	Total Marks	100			
Employability Skills	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			
Electrical Machines - II Lab	Conduct Open Circuit (OC) and Short Circuit (SC) test on single phase transformer to determine its parameters	-	6	-	-

	Study of polarity test (both additive and subtractive) with two single phase transformers	-	18	-	6
	Study of parallel operation of two single phase transformers under equal voltage ratio	-			
	Study of parallel operation of two single phase transformers under unequal voltage ratio	-			
	Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations. Outcome Based Exercise	-	6	-	-
	Load test on three phase alternator	-	8	-	4
	Study the relationship between voltage and load of an alternator keeping excitation and speed constant	-	6	-	-
	Determine the regulation and efficiency of an alternator by conducting open circuit and short circuit test	-	8	-	4
	Synchronize two alternators by appropriate method (lamp / Synchroscope)	-	6	-	-
	Demonstrate the effect of a capacitor on the starting and running of a single phase induction motor and Reverse the direction of rotation of single phase induction motor	-	6	-	-
	Determine the efficiency of three phase induction motor by conducting suitable test(No load / Blocked rotor)	-	10	-	6
	Plot the speed torque characteristics of three phase Induction motor using brake d rum apparatus	-			
	Start, run and reverse the direction of rotation of synchronous motor Conduct an experiment to plot the V curves and Inverted V curves of a synchronous motor	-	6	-	-
	Total Marks		100		
Microcontroller and Applications Lab	8051 Microcontroller Lab	-	40	-	10
	Interfacing programs with 8051	-	20	-	5
	Interfacing programs with 8051 using C	-	20	-	5
	Total Marks		100		
Electrical Machine Wiring Lab	Study of different panel safety appliances like MCB, MCCB, RCCB, FUSES, OVERLOAD, relay, Contactor, timer, CT and PT etc. and finding out the specific rating for a given circuit	-	8	-	2
	Concept of single and three phase circuits with load	-	4	-	-
	Study of ON delay/OFF delay timer., Study of latching circuits	-	4	-	-
	Identification of 6 terminals of a AC motor – Start and finish terminals of three windings	-	5	-	-

	Understanding panel layout using Autodesk Electrical for DOL, and Star delta starter	-	15	-	6
	Wiring and panel layout of Direct On Line starter and connecting it with motor	-	8	-	2
	Wiring and panel layout of Reverse-forward Direct On Line starter and connecting it with motor	-	5	-	-
	Wiring and panel layout of Star Delta starter and connecting it with motor	-	10	-	6
	Wiring and panel layout of Star Delta with reverse forward starter and connecting it with motor	-	8	-	2
	Application of 3-point and 4 point starter for DC circuits	-	8	-	2
	To study circuit and working of UPS and home Inverter		5	-	-
	Total Marks		100		
Wind Energy Lab	To understand the Functioning of all Resource Panel (XPO-WET)	-	8	-	2
	To study characteristics of wind velocity and generator power	-	8	-	2
	To analyse effect of pitching (blade angles) on performance of wind turbine	-	8	-	-
	To study yawing due to change in direction of wind	-	12	-	4
	To perform experiment to study working of inverter and calculate its efficiency	-	12	-	4
	To study VI characteristics of wind turbine	-	12	-	4
	To study working of MPPT charge controller	-	12	-	4
	To study working of DC application (load)	-	8	-	-
	Total Marks		100		
Programmable Logic Controller Lab	Basic Programming	-	18	-	6
	Digital Programming	-	10	-	2
	Familiarization of different Timers	-	15	-	4
	Familiarization of different Counters	-	18	-	4
	Familiarization of Analog and jump function	-	8	-	2
	Any Real time application projects	-	8	-	2
	Familiarization of different programmable controller	-	3	-	-
	Total Marks		100		
OJT	On the Job Training in the relevant sector	-	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:

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

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

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.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 White 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 - 3 Module Name: Electrical and Electronics Measurement Module Code: CP23301T		
Sl. No.	Module Details	Theory Hours 60
1	Measurement Theory and Classification	6h
2	Measurement of Voltage, Current and Resistance	16h
3	Measurement of Power and Energy	12h
4	Special Instruments	14h
5	Transducers and Industrial Instrumentation	12h
Semester - 3 Module Name: Digital Electronics Module Code: CP23302T		
Sl. No.	Module Details	Theory Hours 80
1	Introduction to digital electronics	3h
2	Number systems and Code conversions	10h
3	Logic gates	6h
4	Boolean algebra and Boolean function implementation	9h
5	Combinational logic circuits	14h
6	Timers and timing circuits	5h
7	Latches and flip-flops	6h
8	Sequential logic circuits	16h
9	Data converters	6h
10	Integrated logic families	5h
Semester - 3 Module Name: Electrical Machines - I Module Code: CP23303T		
Sl. No.	Module Details	Theory Hours 40

1	Concepts of induced EMF and laws	4h
2	DC generator	16h
3	DC motor	20h

Semester - 3		Module Name: Solar Technology	Module Code: CP23304T
Sl. No.	Module Details	Theory Hours 40	
1	Basic principle in Solar Technology	4h	
2	Solar Cooker	3h	
3	Domestic and Industrial water heater	3h	
4	Solar dryer	3h	
5	Solar distillation plant	3h	
6	Solar Photovoltaic lightning system	8h	
7	Solar water pumping	3h	
8	Installation of solar panel	8h	
9	General maintenance of PV system	5h	

Semester - 3		Module Name: Computer Programming C, C++	Module Code: CP23305T
Sl. No.	Module Details	Theory Hours 30	
1	Introduction to Computer programming	1h	
2	Introduction to C programming language	4h	
3	Operators and Expressions	2.5h	
4	Control statements	4h	
5	Arrays	2.5h	
6	Functions	3h	

7	Pointers and Miscellaneous Topics	4h
8	Structure and Union	1.5h
9	C++ Introduction and Oops Concepts	7.5h
Semester - 3 Module Name: Electrical and Electronics Measurement Lab Module Code: CP23306P		
Sl. No.	Module Details	Practical Hours 60
1	Calibration of Single phase energy meter at different power factors	3h
2	Calibration of Three phase static energy meter at unity Power factor	3h
3	Measurement of power in three phase circuit using two wattmeter method (Balanced and Unbalanced Loads)	3h
4	Measurement of Reactive power in three phase balanced circuit using one wattmeter method	6h
5	Measurement of Low resistance using Kelvin's Double Bridge	3h
6	Measurement of inductance using Anderson's Bridge	6h
7	Measurement of capacitance using Desauty Bridge	3h
8	Use of LCR-Q meter for measuring inductance, capacitance, resistance and Q factor	3h
9	Electrical methods for measurement of liquid level	3h
10	Displacement measurement by LVDT	3h
11	Study and verification of characteristics of pressure Transducers	6h
	Study the working of strain gauge	
12	Extension of instrument range: ammeter, voltmeter, watt meter using CT	3h
13	Extension of instrument range: ammeter, voltmeter, watt meter using PT	3h
14	Measurement of Temperature of water both using thermometer (platinum resistance)	3h
15	Measurement of Temperature using Thermocouple	3h
16	Revision	6h

Semester - 3		Module Name: Electrical Machines - I Lab	Module Code: CP23307P
Sl. No.	Module Details	Practical Hours 60	
1	To plot the open circuit characteristic of separately excited DC generator	8h	
	Outcome based exercise		
2	To plot the open circuit characteristic of self-excited DC generator	8h	
	Outcome based exercise		
3	To plot external characteristics curve of self-excited DC generator	8h	
	Outcome based exercise		
4	Plot the speed, torque and current curve for shunt motors	4h	
5	Plot the speed, torque and current curve for series motors	4h	
6	Plot the speed, torque and current curve for compound motor	4h	
7	Speed control of DC shunt motor using Armature control method	4h	
8	Speed control of DC shunt motor using field control method	4h	
9	Brake test on DC Shunt motor	4h	
10	Swinburne's test on DC shunts Motor	8h	
11	Study of Servo, Stepper, PMDC and BLDC motors	4h	

Semester - 3		Module Name: Computer Programming C, C++ Lab	Module Code: CP23308P
Sl. No.	Module Details	Practical Hours 80	
1	Introduction to Visual studio 2019. Menu and sub menu. Install and configure. Learn to create a project, empty project, add a c file Write "Hello world" program	1h	
2	Write a C program to declare suitable variables and initialize values for printing: Name, token number, section, present SGPA, mobile number. 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. Write Code to x= x+y; m+= k; k=k+y; printf("%s",chk); ii. Insert toggle break point on x=x+y; iii. Add watch for all variables.	3h
5	Declare 3 alphabets and 3 single digit (0 to 9) as char. Printf all of them using %c and also as %d. Swap any of the two alphabets. Declare any two numbers integer or float as variables. Swap the numbers.	3h
6	Write a program to read (scanf) marks of a subject and display if marks more than or less than 50, using 'if' statement. 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. Modify program to display grades using nested if else statements.	3h
7	Write a program to calculate square and also square root of any number. Number to be read using scanf. Print the answer using printf. Modify the Code using different methods	3h
8	Write a program using while loop to print first 10 numbers of Fibonacci series; modify the program using different methods	3h
9	Write a c program using do-while loop, to read integer numbers between 1 and 99; exit from loop for 0. 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) using switch case. Other example programs, Modify the Code to use while loop instead of do-while.	3h
10	Write a program with infinite while loop. Use ESC (ASCII Code of ESC) to exit loop. Use switch case for branching. Display the number in Binary / Octal / Hexadecimal based on menu option input. Write Code using while loop.	3h
11	Write a program to input 6 integers and store them in an array, Arrange these numbers in ascending order, Modify the above program to input 6 names, Arrange them in alphabetical order	3h
12	Write a program to input two 3x3 matrix using two dimensional array. Perform the following operations i. Sum of matrices ii. Determinant of matrices iii. Modify the program to find area of triangle with vertices (0, 1), (2, 5) and (3, -3)	3h
13	Declaration of an array as global or local. Declare and define a function to calculate and Return (Value/argument) average value of these numbers.	3h

	The function should return the variance. d. Call both the functions from main (). Modify the program to call variance function from average function. 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?	
14	Write a program to input a sentence (gets). Open another c file. Display length of the sentence in that file. Copy first 10 characters to another string. Reverse the string and print.	3h
15	Write a C Program to input a number and print the factorial of that number. Use while loop. Use multiplication in reverse order to find factorial. Modify the program to use recursive function	3h
16	Write a function to input a number. Write a function doubler(), to double the number and store back in same variable Modify the program to pass variable by reference	3h
17	Declare the variables to store marks of 10 students. Declare an array of integer pointers and store the address of the above variables in it. Add 5 grace marks to all students using address stored in pointer array. Print the marks using address stored in pointer array.	2h
18	Write a program and define a macro to calculate area of a rectangle and another macro to calculate area of a triangle.	1h
19	Write a C program to implement the concept of enum.	1h
20	Exercise programs to open, read, write, delete and remove a file Open this file in Excel and check.	6h
21	Write a C Program to create a structure called student, with members name, token number and age and display the details for one student. Declare an array of pointers to store address for the above structure. Modify the Code to use typedef for the structure declared.	5h

22	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. Move the function declaration of function for data input also to the header file.	1h
23	Copy the example Code and execute in Visual studio.	1h
24	Copy the example Code and execute in Visual studio.	1h
25	Write a C++ program by having the class name "Personal Details" Perform the following operations Write two member functions - GetData(); & PutData(); Declare an array of above class to store details of 3 students Modify the Code to include default constructor and destructor	
26	Write a program to create a class land. Create 3 member functions with name "Area" inside a class and find the area for 1) Square 2) rectangle 3) Circle (Function Overloading) 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 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 members variables. c. Declare two objects of the class. d. Write a function to overload ++ & overload +	5h
29	a. Write a program with a class department having Dept_name, subject, subject_hours as its members. b. Examples for Class inheritance and object class	5h
Semester - 3 Module Name: Digital Electronics Lab Module Code: CP23309P		
Sl. No.	Module Details	Practical Hours 80

1	Familiarization of Logic gate IC's	4h
	a) 7404 b) 7408 c) 7432 d) 7400 e) 7402 f) 7486	
2	Implementation of NOT, AND, OR, NOR, EX-OR and EX-NOR using NAND gate.	4h
3	Implementation of NOT, OR, AND, NAND, EX-OR and EX-NOR using NOR gate.	4h
4	Simplify and Design SOP Expressions using Basic Logic Gates.	4h
	Simplify and Design POS Expressions using Basic Logic Gates.	
5	Simplify and Design SOP Expressions using K-map.	4h
	Simplify and Design POS Expressions using K-map.	
6	Implement Binary to Gray Code Converter using K-map method.	4h
	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 and Subtractor using IC 7483	4h
10	Implement 4-bit Comparator using IC 7485	4h
11	Familiarization of Priority EnCoder IC 74147, Familiarization of DeCoder IC 74138	4h
12	Familiarization of MUX IC 74151, Familiarization of DEMUX IC 74138	4h
13	Design a Monostable Circuit using IC 555, Design a Astable Circuit using IC 555	4h
14	Familiarize Octal D-Latch IC 74373, Familiarize Octal D-FF IC 74374	4h
15	Familiarize D-FF IC 7474, Familiarize JK-FF IC 7476	4h
16	Implement 3-bit Ripple Up and 3-bit Ripple Down Counter using IC 7474	4h
17	Design and Implement Mod-6 and Decade Counter using IC 7474	4h
18	Familiarize Decade Counter IC 7490 and 4-bit Ripple Counter IC 7493	4h
19	Design and Implement 3-bit SISO and PIPO SRG using IC 7474	4h

20	Design and Implement 3-bit Ring and Johnson Counters using IC 7474	4h
Semester - 3 Module Name: Solar Technology Lab Module Code: CP23310P		
Sl. No.	Module Details	Practical Hours 40
1	To understand the Functioning of all Resource Panel (XPO-STT)	4h
2	To perform experiment to study I-V characteristics of SPV modules	4h
3	To perform experiment to study series combination of SPVS	4h
4	To perform experiment to study parallel combination of SPVS	4h
5	To perform experiment to study effect of tilt angle on SPV module power output	4h
6	To perform experiment to demonstrate the effect of shading on SPV module output power	4h
7	To perform experiment to locate and verify MPP by using resistive loads	4h
8	To understand and determine the DC flow in a solar system	4h
9	Workout power flow calculation of standalone PV system of DC load with battery	4h
10	To perform experiment to study, working of Inverter and calculate the efficiency of inverter	4h
Semester - 3 Module Name: Employability Skills Module Code: CP23311T		
Sl. No.	Module Details	Theory Hours 30
1	Diversity and Inclusion, Gender sensitivity PwD etc.	7h
2	Career development and Goal setting	8h
3	Entrepreneurship	8h
4	Analytical Thinking and Adaptive Thinking	7h
Semester - 4 Module Name: Control System Module Code: CP23401T		
Sl. No.	Module Details	Theory Hours 40
1	Introduction and modeling of systems	13h

2	Time response of feedback control systems	6h
3	Stability analysis	8h
4	Frequency domain analysis	9h
5	State variable analysis	4h
Semester - 4 Module Name: Electrical Machines - II Module Code: CP23402T		
Sl. No.	Module Details	Theory Hours 60
1	Transformers	15h
2	Alternators	10h
3	Synchronous Motors	15h
4	Three Phase Induction Motor	12h
5	Single Phase Induction Motor	8h
Semester - 4 Module Name: Power System Engineering - I Module Code: CP23403T		
Sl. No.	Module Details	Theory Hours 60
1	Thermal Power Plant	10h
2	Hydro Power Plant	10h
3	Nuclear Power Plant	8h
4	Diesel and Gas Power Plant	10h
5	Non-Conventional Power Plant	10h
6	Power transmission and distribution	12h
Semester - 4 Module Name: Microcontroller and Applications Module Code: CP23404T		
Sl. No.	Module Details	Theory Hours 60
1	Introduction to Microprocessors and Microcontrollers	6h
2	Study of Memory	4h

3	8051 Architecture	7h
4	Programming of 8051	10h
5	Timers and interrupts of 8051	9h
6	8051 Application examples	12h
7	Introduction to 8051 programming in C	12h
Semester - 4 Module Name: Wind Energy Module Code: CP23405T		
Sl. No.	Module Details	Theory Hours 30
1	Introduction	1.5h
2	Wind Resource and Wind Energy in India	6h
3	Wind Turbine Technology	7.5h
4	Generation of Electricity	6h
5	Life cycle assessment and Environmental impacts of Wind Energy	6h
6	Wind Economics, Growth Trends and the future of Wind Energy	3h
Semester - 4 Module Name: Programmable Logic Controller Module Code: CP23406T		
Sl. No.	Module Details	Theory Hours 40
1	PLC basics	3h
2	Basic PLC programming	7h
3	Basic PLC functions	7h
4	Intermediate functions	6h
5	Data handling functions	4h
6	PLC functions working with bits	8h
7	Advanced PLC functions	3h
8	Introduction to HMI and SCADA	2h

Semester - 4		Module Name: Electrical Machines - II Lab	Module Code: CP23407P
Sl. No.	Module Details	Practical Hours 50	
1	Conduct Open Circuit (OC) and Short Circuit (SC) test on single phase transformer to determine its parameters	3.5h	
2	Study of polarity test (both additive and subtractive) with two single phase transformers	3.5h	
3	Study of parallel operation of two single phase transformers under equal voltage ratio	3.5h	
4	Study of parallel operation of two single phase transformers under unequal voltage ratio	3.5h	
5	Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations. Outcome Based Exercise	3.5h	
6	Load test on three phase alternator	8h	
7	Study the relationship between voltage and load of an alternator keeping excitation and speed constant	3.5h	
8	Determine the regulation and efficiency of an alternator by conducting open circuit and short circuit test (use appropriate method)	2.5h	
9	Synchronize two alternators by appropriate method (lamp / Synchroscope)	2.5h	
10	Demonstrate the effect of a capacitor on the starting and running of a single phase induction motor and Reverse the direction of rotation of single phase induction motor	2.5h	
11	Determine the efficiency of three phase induction motor by conducting suitable test (No load / Blocked rotor)	8h	
12	Plot the speed torque characteristics of three phase Induction motor using brake drum apparatus	3h	
13	Start, run and reverse the direction of rotation of synchronous motor Conduct an experiment to plot the V curves and Inverted V curves of a synchronous motor	2.5h	

Semester - 4		Module Name: Microcontroller and Applications Lab	Module Code: CP23408P
Sl. No.	Module Details	Practical Hours 30	
1	8051 Microcontroller Lab	13h	
2	Interfacing programs with 8051	10h	
3	Interfacing programs with 8051 using C	7h	

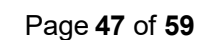
Semester - 4			Module Name: Electrical Machine Wiring Lab	Module Code: CP23409P
Sl. No.	Module Details	Practical Hours 40		
1	Study of different panel safety appliances like MCB, MCCB, RCCB, FUSES, OVERLOAD, relay, Contactor, timer, CT and PT etc. and finding out the specific rating for a given circuit	4h		
2	Concept of single and three phase circuits with load	2h		
3	Study of ON delay/OFF delay timer., Study of latching circuits	2h		
4	Identification of 6 terminals of a AC motor – Start and finish terminals of three windings	2h		
5	Understanding panel layout using Autodesk Electrical for DOL, and Star delta starter	8h		
6	Wiring and panel layout of Direct On Line starter and connecting it with motor	4h		
7	Wiring and panel layout of Reverse-forward Direct On Line starter and connecting it with motor	2h		
8	Wiring and panel layout of Star Delta starter and connecting it with motor	6h		
9	Wiring and panel layout of Star Delta with reverse forward starter and connecting it with motor	4h		
10	Application of 3-point and 4 point starter for DC circuits	4h		
11	To study circuit and working of UPS and home Inverter	2h		
Semester - 4			Module Name: Wind Energy Lab	Module Code: CP23410P
Sl. No.	Module Details	Practical Hours 30		
1	To understand the Functioning of all Resource Panel (XPO-WET)	3h		
2	To study characteristics of wind velocity and generator power	3h		
3	To analyse effect of pitching (blade angles) on performance of wind turbine	4h		
4	To study yawing due to change in direction of wind	4h		
5	To perform experiment to study working of inverter and calculate its efficiency	4h		
6	To study VI characteristics of wind turbine	4h		
7	To study working of MPPT charge controller	4h		
8	To study working of DC application (load)	4h		

Semester - 4		Module Name: Programmable Logic Controller Lab	Module Code: CP23411P
Sl. No.	Module Details		Practical Hours 40
1	Basic Programming		12h
2	Digital Programming		4h
3	Familiarization of different Timers		8h
4	Familiarization of different Counters		8h
5	Familiarization of Analog and jump function		3h
6	Any Real time application projects		3h
7	Familiarization of different programmable controller		2h

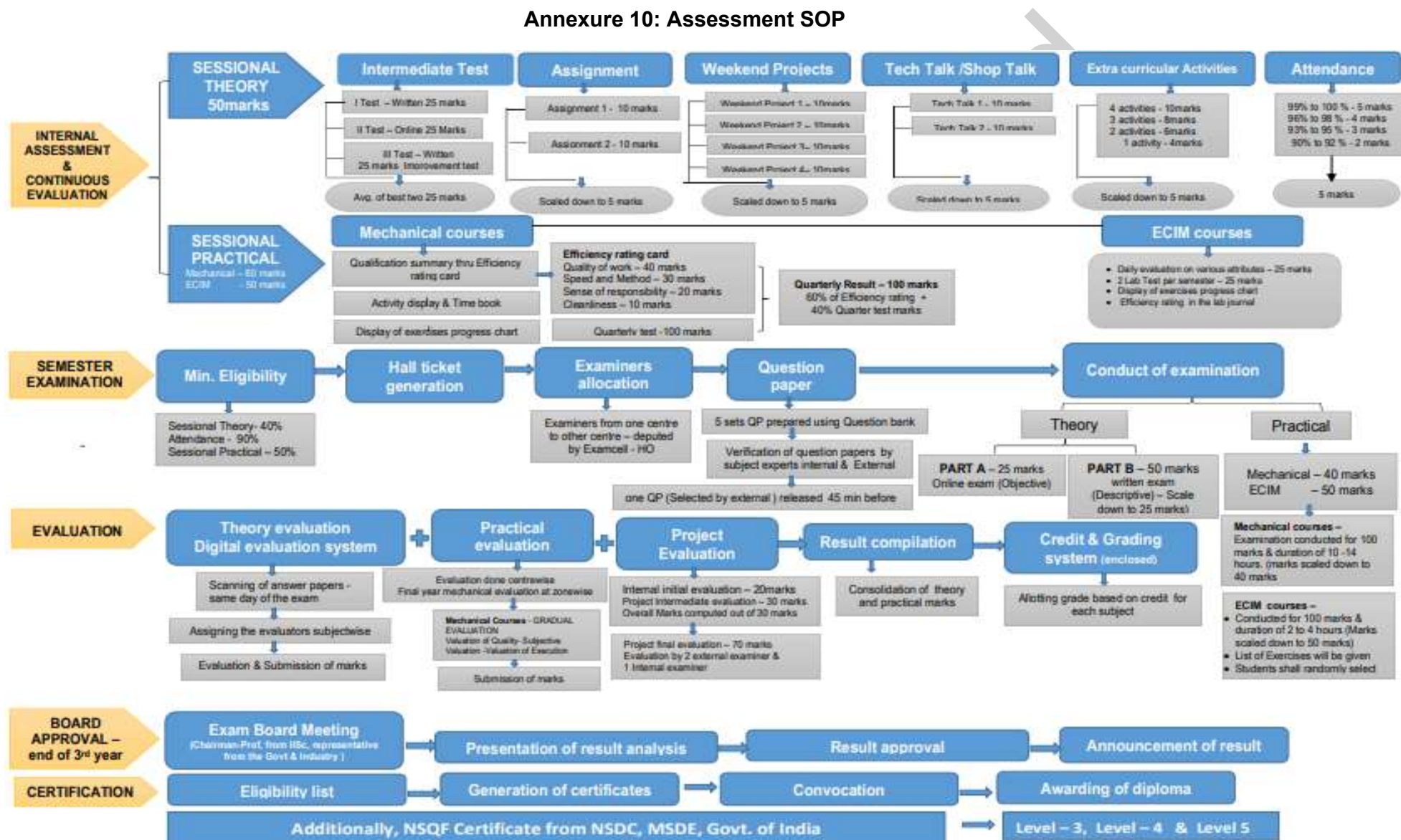
Semester - 4		Module Name: Employability Skills	Module Code: CP23412T
Sl. No.	Module Details		Theory Hours 30
1	Financial and Legal Literacy		8h
2	Occupation safety, Health, and Environment education.		7h
3	Digital Literacy Skills		8h
4	Essential skills for success.		7h

Semester – 4		Module Name: OJT	Module Code: CP23413P
Sl. No.	Module Details		Practical Hours 90
1	On the Job Training in the relevant sector		90h
	Total Hours		90h

Sector: Electrical and Electronics



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 crosscutting 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 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	1120	Managing Director	Managing Director	Managing Director
Level 7.0	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	1321 2151 2152	GM - Production/Plant Head	GM - Production/Plant Head	GM - Production/Plant Head

	5. Responsibility: Business Management (like GM/ CEO / CXO, etc.)				
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 & Mind-set: Leadership, effective resource management 4. Broad Learning Outcomes: Judgement in complex problems 5. Responsibility: Vertical/ Business unit management –Manager or Senior Manager	3115 1321	Manager/Senior Manager Electives - overall incharge of Installation, Assembly of electrical /electronics systems of equipment and machinery, Power Systems, Training Options - Power generation, Distribution, Transmission, Renewable energy.	Manager/Senior Manager Electives - responsible for maintaining status of continuous running of equipment and machinery control and monitoring devices Options - Power generation, Distribution, Transmission, Renewable energy.	Manager/Senior Manager Electives - Verify Design of Electrical generation/distribution equipment, plant, R&D of new products, Estimation Options - Power generation, Distribution, Transmission, Renewable energy.
Level 6.0	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, selfmanagement 4. Broad Learning Outcomes: Judgement / decision making – specialized 5. Responsibility: Team leader – Junior technical supervisor, Technical supervisor or junior/ deputy manager	3122 3123 3115	Supervisor/Assistant manager Electives -Supervise Installation, Assembly of electrical /electronics systems of equipment and machinery, Power Systems, Verify Estimation & costing, Training Options - Power generation, Distribution, Transmission, Renewable energy.	Supervisor/Assistant manager Electives - Responsible for Maintenance of electrical /electronics systems of equipment and machinery Options - Power generation, Distribution, Transmission, Renewable energy.	Design Engineer Electives - Verify Design of Electrical generation/distribution equipments, plant, R&D of new product, Estimation Options - Power generation, Distribution, Transmission, Renewable energy.

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/Engineer	2151 2152	Engineer-Project/Site Electives -Plan and execute Installation, Assembly of electrical /electronics systems of equipment and machinery, Power Systems, Estimation & costing Options - Power generation, Distribution, Transmission, Renewable energy.	Engineer Electives - Plan, execute periodic Maintenance of electrical /electronics systems of equipment and machinery Options - Power generation, Distribution, Transmission, Renewable energy.	Design Engineer Electives - Design of Electrical generation/distribution equipments, plant, R&D of new products Options - Power generation, Distribution, Transmission, Renewable energy.
Level 5.0		2151 2152 3113 8212	Assistant Engineer Electives - Installation, Assembly of electrical /electronics systems of equipment and machinery, Power Systems, Testing, Estimation and Costing Options - Power generation, Distribution, Transmission, Renewable energy.	Assistant Engineer Electives - Installation, Maintenance of electrical /electronics systems of equipment and machinery Options - Power generation, Distribution, Transmission, Renewable energy.	Associate Designer Electives - Design of Electrical generation/distribution equipments, plant, R&D of new products Options - Power generation, Distribution, Transmission, Renewable energy.
Level 4.5	1. Professional Theoretical Knowledge: Range of knowledge 2. Professional and Technical Skills/ Expertise: Range of technical skills 3. Employment Readiness & Entrepreneurship Skills & Mind-set: Team readiness & Entrepreneurial readiness 4. Broad Learning Outcomes: Carry out Range of tasks and may provide range of solutions	3113 7411 3114	Senior Technician Electrical and Electronics Electives - Installation, Assembly of electrical /electronics systems of equipment and machinery. Power	Senior Technician Electrical and Electronics Electives - Installation, Maintenance of electrical /electronics systems of equipment and machinery. Options - Power	Study Post Diploma

	5. Responsibility: Accountable/ responsible - Senior Technician Electrical and Electronics		Systems, Testing. Options - Power generation, Distribution, Transmission, Renewable energy.	generation, Distribution, Transmission, Renewable energy.	
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 with minimum supervision. 5. Responsibility: Accountable/ responsible - Technician	7411	Technician-Industrial Electrical. Cable laying	Technician-Industrial Electrical. Cable laying and maintenance	

Annexure 12: Key Learning Outcome

SL. NO.	SUBJECT NAME	KNOWLEDGE AND UNDERSTANDING	TECHNICAL & PROFESSIONAL SKILLS	APPLICATION OF KNOWLEDGE AND SKILLS
1	Electrical and Electronics Measurements (CP23301T) Electrical and Electronics Measurement LAB (CP23306P) Understanding the working principles and usage of different Measuring instruments	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.	Explain, demonstrate, and use various Electrical measuring instruments and techniques for measuring special and low values. (Kelvin's double Bridge). Explain, demonstrate, apply and use different transducers, sensing and measurement of various parameters in process industry.	Use of Sensors and Transducers, their conditioning circuits for appropriate applications.
2	Digital Electronics (CP23302T) Digital Electronics Lab (CP23309P) Understanding different Logical operations, applying, analysing Digital circuits and components 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 Multi vibrators, Timers and Counters.
3	Electrical Machine 1 (CP23303T) Electrical machines - I LAB (CP23307P) Electrical Machines-II (CP23402T) Electrical machines - II LAB (CP23407P) Understanding the construction, working	Define laws governing to Motors & Generators Explain the construction and working principle of DC Generators and Motors, Explain the construction of synchronous motors, its characteristics.	Explain the working principle, types and construction of transformer and its characteristics, equations. Implement and test transformer performance and parameters. To demonstrate start-run-and reverse procedures of Synchronous motors. Demonstrate different excitation and commutation, speed control and	Operate the DC motors and generators Conduct prescribed tests for synchronization and determination of performance of the alternators. Draw characteristics and starting and control techniques, and applications

	principle, characteristics, control, and applications of Electrical Machines.	Explain the principle of operation of alternator, voltage regulation, losses / efficiency, and synchronization of alternator. Explain the working principle of single phase and three phase induction motor, equivalent circuit, implement and Explain the concept of shaded pole and Repulsion motors.	braking methods of DC machines and draw their characteristics and applications.	
4	Solar Technology (CP23304T) Solar Technology LAB (CP23310P) Understanding the working principle, benefits of different renewable energy systems.	Explain the principle and operation of a Solar technology, its domestic and industrial applications (Solar cooker and its types, water heaters, dryers, distillation plant). Explain, demonstrate, install, and maintain solar technology systems for domestic and industry applications.	V-I Characteristics of SPV Module, different connections of SPV Modules, effect of shade and tilt, loading of system. Calculation of power of stand-alone PV systems, efficiency of Inverter. Energy conversion – Radiation to Thermal Energy. Identify PV lighting systems, Solar array, Battery bank, electronic controller, inverters, Configurations of PV power systems, Maintenance of Battery Banks.	Installation Maintenance and operation of solar technology system including identification and troubleshooting of faults along with ensuring of safety while installation and operation.
5	Computer Programming – C, C++ (CP23305T) Computer Programming C, C++ LAB (CP23308P) Ability to create C, C++ programs for simple engineering applications.	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.	Apply the concept of data abstraction and encapsulation to ensure that the data is not corrupted due to malfunctioning of any sub-system.

		Explain the concept of data abstraction and encapsulation.	Execute overload functions and 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 ensure that the system is not corrupted, and all the faults and errors are trapped.	Apply the concepts of Class, Inheritance, Data Encapsulation and polymorphism using python.
6	Control System (CP23401T) 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. Process control Systems - Process control methods.	Identifying the Control systems, elements, and parameters Response time analysis of control systems.	Analyse and troubleshoot different control system components in process industry.

7	Power System Engineering- I (CP23403T) Understanding the process of Energy conservation, Power Generation, Transmission and distribution	Understand various types of conventional and non-conventional methods of power generation, preparation and precautions associated with different methods. Define Diesel plant efficiency and heat balance Knowledge on different transmission and distribution methods, substations, advantages and disadvantages Explain high voltage transmission effects such as skin effect, proximity, Ferranti and corona effect.	Implement the structure of power system (generation, transmission & distribution and voltage levels) Apply knowledge on various Transmission and Distribution systems (AC and DC, HVDC, their comparison, efficiency, size of conductor) Explain losses associated with transmission and methods to overcome such losses.	Operation and Maintenance of conventional and non-conventional power stations
8	Microcontroller and Applications (CP23404T) Microcontroller and Applications LAB (CP23408P) Use of 8051 microcontroller 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.	Reading and interpreting the data sheet of different Microcontrollers. Simple Programming on Microcontroller using various programming software.	Programming different Microcontroller - interfacing different Input/ Output devices to perform the desired tasks.
9	Wind Energy (CP23405T) Wind Energy LAB (CP23410P) Understanding the working principle, benefits of different renewable energy systems	Explain the concept of wind energy, source of wind, advantages, efficiency, and challenges faced globally due to climate change. Knowledge on Wind power	Generation of electricity through wind energy, storage, characteristics, Horizontal and vertical axes wind turbines.	Awareness on Wind-Energy-Induced Environmental Issues and Countermeasures Structural and Personal Safety Studies for Wind Turbine Towers.

		estimation, its global and domestic perspective, its future in India, barriers, and aiders Explain Wind turbine technology, aerodynamic concepts, Wind power generation and integration, parameters (life expectancy, safety, economic considerations) and future trends.	Deep understanding on Capital Energetic Costs, Life-Cycle assessments, Energy Costs, energy payback time. Integration of wind power to national grids,	
10	Programmable Logic Controller (CP23406T) Programmable Logic Controller LAB (CP23411P) Ability to create simple projects using PLC/HMI/SCADA to interface and control digital and analog devices.	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). Able to troubleshoot PLC functions Able to control output devices using PLC programs	Creation, Testing, simulation of different Ladder diagrams, Function diagrams using Gates, Timers, counters in a PLC system.
11	Electrical Machine Wiring LAB (CP23409P) Ability to draw electrical circuits using Autodesk Electrical	Knowledge on Electrical wiring in Autodesk Electrical Explain the working of UPS and Home inverter Explain ON delay/OFF delay timer and latching circuits Understand the single and three phase circuits with load	Draw the Wiring and panel layout for DOL and Star delta starter using Autodesk Electrical	Selection of different panel safety appliances as per the required ratings - MCB, MCCB, RCCB, FUSES, OVERLOAD, relay, Contactor, timer, CT and PT etc.

12	Employability Skills (CP23311T) Employability Skills (CP23412T) 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 the 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.
13	OJT (CP23413P)			On the Job Training in the relevant sector

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