Government of Pakistan

National Vocational and Technical Training Commission

Prime Minister's Hunarmand Pakistan Program

"Skills for All"

Course Contents / Lesson Plan

Course Title: INDUSTRIAL AUTOMATION (PLC)
Duration: 6 Months

<u>Course Details / Description & Preliminaries</u>

Course Title	INDUSTRIAL AUTOMATION (PLC)
Objectives and Expectations	<u>**Employable skills for DAE in Electrical / Electronics through an intensive course on industrial Automation (PLC)**</u> This is a special course designed to address unemployment in the youth. The course aims to achieve the above objective through hands on practical training delivery by a team of dedicated professionals having rich market/work experience. This course is therefore not just for developing a theoretical understanding/back ground of the trainees. Contrary to that it is primarily aimed at equipping the trainees to perform commercially in a market space in independent capacity or as a member of a team. The course therefore is designed to impart not only technical skills but also soft skills (i.e interpersonal/communication skills; personal grooming of the trainees etc) as well as entrepreneurial skills (i.e marketing skills; free lancing etc). The course also seeks to inculcate work ethics to foster better citizenship in general and improve the image of Pakistani work force in particular. <u>**Main Expectations:**</u> In short, the course under reference should be delivered by professional instructors in such a robust hands- on manner that the trainees are comfortably able to employ their skills for earning money (through wage/self-employment) at its conclusion. This course thus clearly goes beyond the domain of the traditional training practices in vogue and underscores an expectation that a market centric approach will be adopted as the main driving force while delivering it. The instructors should therefore be experienced enough to be able to identify the training needs for the possible market roles available out there. Moreover, they should also know the strengths and weaknesses of each individual trainee to prepare them for such market

Key Features of Training& Special Modules	roles during/after the training.
	i. Specially designed practical tasks to be performed by the trainees have been included in the Annexure-I to this document. The record of all tasks performed individually or in groups must be preserved by the management of the training Institute clearly labeling name, trade, session etc so that these are ready to be physically inspected/verified through monitoring visits from time to time. The weekly distribution of tasks has also been indicated in the weekly lesson plan given in this document.
	ii. In order to materialize the main expectations, a special module on **Job Search & Entrepreneurial Skills** has been included in the later part of this course (5th & 6th month) through which, the trainees will be made aware of the Job search techniques in the local as well as international job markets (Gulf countries). Awareness around the visa process and immigration laws of the most favored labour destination countries also forms a part of this module. Moreover, the trainees would also be encouraged to venture into self-employment and exposed to the main requirements in this regard. It is also expected that a sense of civic duties/roles and responsibilities will also be inculcated in the trainees to make them responsible citizens of the country.
	iii. A module on **Work Place Ethics** has also been included to highlight the importance of good and positive behavior at work place in the line with the best practices elsewhere in the world. An outline of such qualities has been given in the Appendix to this document. Its importance should be conveyed in a format that is attractive and interesting for the trainees such as through PPT slides +short video

	documentaries. Needless to say that if the training provider puts his heart and soul into these otherwise non-technical components, the image of Pakistani workforce would undergo a positive transformation in the local as well as international job markets.
	In order to maintain interest and motivation of the trainees throughout the course, modern techniques such as:
	• Motivational Lecture
	• Success Stories
	• Case Studies
	These techniques would be employed as an additional training tool wherever possible (these are explained in the subsequent section on Training Methodology).
	Lastly, evaluation of the competencies acquired by the trainees will be done objectively at various stages of the training and proper record of the same will be maintained. Suffice to say that for such evaluations, practical tasks would be designed by the training providers to gauge the problem solving abilities of the trainees.
Training Tools/ Methodology	**(i) Motivational Lectures**
	The proposed methodology for the training under reference employs motivation as a tool. Hence besides the purely technical content, a trainer is required to include elements of motivation in his/her lecture to inspire the trainees to utilize the training opportunity to the full and strive towards professional excellence. Motivational lectures may also include general topics such as the importance of moral values and civic role & responsibilities as a Pakistani. A motivational lecture should be delivered with enough zeal to produce a deep impact on the trainees. It may comprise of the following:
	• Clear Purpose to convey message to trainees effectively.
	• Personal Story to quote as an example to follow.

- Trainees Fit so that the situation is actionable by trainees and not represent a just idealism.
- Ending Points to persuade the trainees on changing themselves.

A good motivational lecture should help drive creativity, curiosity and spark the desire needed for trainees to want to learn more.

Impact of a successful motivational strategy is amongst others commonly visible in increased class participation ratios. It increases the trainees' willingness to be engaged on the practical tasks for longer time without boredom and loss of interest because they can clearly see in their mind's eye where their hard work would take them in short (1-3 years); medium (3 -10 years) and long term (more than 10 years).

As this tool is expected that the training providers would make arrangements for regular well planned motivational lectures as part of a coordinated strategy interspersed throughout the training period as suggested in the weekly lesson plans in this document.

(ii)   Success Stories

Another effective way of motivating the trainees is by means of Success Stories. Its inclusion in the weekly lesson plan at regular intervals has been recommended till the end of the training.

A success story may be disseminated orally, through a presentation or by means of a video/documentary of someone that has risen to fortune, acclaim, or brilliant achievement. A success story shows how a person achieved his goal through hard work, dedication and devotion. An inspiring success story contains compelling and significant facts articulated clearly and easily comprehendible words. Moreover, it is helpful if it is assumed that the reader/listener knows nothing of what is being revealed. Optimum impact is created when the story is revealed in the form of:-

- Directly in person (At least 2-3 cases must be arranged by the training institute)

- Through an audio/ videotaped message (2-3 high quality videos must be arranged by the training institute)

It is expected that the training provider would collect relevant high quality success stories for inclusion in the training as suggested in the weekly lesson plan given in this document.

Suggestive structure and sequence of a sample success story and its various shapes can be seen at annexure III.

(iii)   Case Studies

Where a situation allows, case studies can also be presented to the trainees to widen their understanding of the real life specific problem/situation and to explore the solutions.

In simple terms, the case study method of teaching uses a real life case example/a typical case to demonstrate a phenomenon in action and explain theoretical as well as practical aspects of the knowledge related to the same. It is an effective way to help the trainees comprehend in depth both the theoretical and practical aspects of the complex phenomenon in depth with ease. Case teaching can also stimulate the trainees to participate in discussions and thereby boost their confidence. It also makes class room atmosphere interesting thus maintaining the trainee interest in training till the end of the course.

Depending on suitability to the trade, the weekly lesson plan in this document may suggest case studies to be presented to the trainees. The trainer may adopt a power point presentation or video format for such case studies whichever is deemed suitable but it's important that only those cases are selected that are relevant and of a learning value. The Trainees should be required and supervised to carefully analyze the cases.

For the purpose they must be encouraged to inquire and collect specific information / data, actively participate in the discussions and intended solutions of the problem / situation.

Case studies can be implemented in the following ways: -

	i. A good quality trade specific documentary (At least 2-3 documentaries must be arranged by the training institute) ii. Health &Safety case studies (2 cases regarding safety and industrial accidents must be arranged by the training institute) iii. Field visits(At least one visit to a trade specific major industry/ site must be arranged by the training institute)
Intake to the Training	Since intake level is DAE in Electrical / Electronic so expectations from the trainees are: • understanding of basics electrical wiring • Interpretation of basics of engineering drawing & standard symbols • Interpretation of basics of electrical measuring instruments & their uses • Should have concept of Basic Electronics • Should have concept of fundamentals of Digital & Industrial Electronics • Should have concept of Electrical machines & its applications • Should have concept of Computer system
Learning Outcome of the Course	After completion of this course, the trainees must be able to demonstrate their underpinning knowledge of: • Occupational Health & Safety. • Interpretation of number systems, logic gates & Boolean algebra. • Understanding the function & uses/applications of different types of switches, Push buttons, fuses/circuit breakers, Relays, Contactors, Timers, counters, sensors, Transducers etc. • To gain knowledge of basic concepts of control systems & automation. • Demonstration of different types of control systems like on/off Control • PLC, its components & Types. • Types of PLC based machines and their applications • Fundamentals of ladder logic diagram • Translate the logic implementation into PLC coding.

	- Translate relay ladder diagram into PLC coding. - Assign real I/O and internal addresses to inputs and outputs. - Review machine logic of operation and optimize when possible. - Understand the actual process or machine function. - Motor control switchgear and its applications with PLC - Should be able to interpret manufacturer's instructional manual in order to install and connect the PLC system according to the functional diagram - Knowledge & understanding to install, operate & repair PLC systems. - Interpretation of circuit diagrams, service manuals, technical sketches, graphic symbols, wiring diagrams and manufacturer's specifications etc. - Can locate/trace and repair/replace the faulty components of PLC system and also carry out the function tests. - Trouble shooting of the faults in the PLC system, input/output devices and PLC based machines - Common faults in industrial PLC based machines - Knowledge of ADC, DAC and data acquisition systems. - Must be able to make HMI for industrial control room.
Course Execution Plan	Total Duration of Course: 6 Months (26 Weeks)
	Class Hours: 4 Hours per day (06 Days/Week)
	Theory: 20% Practical: 80%
	Weekly Hours: 24 Hours Per week
	Total Contact Hours: 600 Hours

Companies Offering Jobs in the respective trade	Most of Pakistani industries are moving their processes to automatic systems so a person having this knowledge& skill, will have all the industrial opportunities at his choice and can secure job with ease. It is expected that by acquiring sufficient knowledge and skills, the prospects of employability of passed out graduates increases many folds.
Job Opportunities	• PLC/SCADA Technician in industry (Textile, Leather, Pharmaceuticals, Food Processing, Automotive, Cement etc.) • PLC/SCADA consultant for industry and commerce. • Automation trainer for workers and lower management of industries.
No of Students	25
Learning Place	Classroom / Lab / Workshop / Industry

WEEKLY SCHEDULE OF TRAINING

Scheduled Week	Module Title	Learning Units	Remarks
Week 1	Introduction	• Course Introduction • Motivational Lecture(*For further detail please see Page No: 4*) • Course Applications • Institute/Work ethics (*For further detail please see Annexure-III at the end*) • Health & Safety • Job market	**Home Assignment No. 1** *Details may be seen at Annexure-II*
Week 2	Logic Gates & Boolean Algebra	• Binary Number System • Review of Arithmetic Operation of Binary Numbers • Logic Gates (Symbol, Truth Table etc.) • Boolean Algebra • K-Map • Success story (*For further detail*	**Task No. 1** *Details may be seen at Annexure-I* **Home Assignment No. 2** *Details may be seen*

		please see Page No: 5 and Annexure-IV at the end)	at Annexure-II
Week 3	Basic Components, their symbols and Applications	• Motivational Lecture(*For further detail please see Page No: 4)* • Control Transformer • Fuses& Circuit Breakers • Switches • Push Buttons • Indicators	**Task No. 2** *Details may be seen at Annexure-I* **Home Assignment No. 3** *Details may be seen at Annexure-II*
Week 4	Relays & Contactors	• Relay: Construction, Operation/working Principal, Types & Applications. • Contactors: Construction, Operation/working Principal, Types & Applications. • Case Study-1 (Health & Safety) (*For further detail please see Page No: 6)*	**Task No. 3** *Details may be seen at Annexure-I* **Monthly Test 1**
Week 5	Timers & Counters	• Motivational Lecture(*For further detail please see Page No: 4)* • Timers: Construction, Operation/working Principal, Types & Applications. • Counters: Construction, Operation/working Principal, Types & Applications.	**Task No. 4** *Details may be seen at Annexure-I* **Home Assignment No. 4** *Details may be seen at Annexure-II*
Week 6	Industrial Automation	• Institute/Work ethics (*For further detail please see Annexure-III at the end)* • Control System • Types of Industrial Automation • Advantages of Industrial Automation • Role of PLC in Automation • Success story (*For further detail please see Page No: 5 and*	**Home Assignment No. 5** *Details may be seen at Annexure-II*

		Annexure-IV at the end)	
Week 7	Introduction to PLC	• Definition. • History. • Types. • Configuration. • Sizes & Brands. • Applications. • Advantages. • Case Study-2 (*For further detail please see Page No: 6)*	**Home Assignment No. 6** *Details may be seen at Annexure-II*
Week 8	PLC Hardware	• Motivational Lecture(*For further detail please see Page No: 4)* • Block Diagram of PLC • Components of PLC • Analog & Digital I/O Modules • Special Modules • RS232 and 485 Communication Protocols	**Home Assignment No. 7** *Details may be seen at Annexure-II* **Monthly Test 2**
Week 9	PLC Software	• System Requirement • Installation of PLC Software • Integrate the simulator in PLC Software • Configure Software for Desired Task • Industrial Simulation (Online and Offline) • Success story (*For further detail please see Page No: 5 and Annexure-IV at the end)*	**Task No. 5** *Details may be seen at Annexure-I* **Home Assignment No. 8** *Details may be seen at Annexure-II*

Week 10	PLC Languages	- Motivational Lecture(*For further detail please see Page No: 4)* - Introduction to PLC Languages - Types of PLC Languages Ladder Diagram (LD) Function Block Diagram (FBD) Sequential Function Chart (SFC) Instruction List (IL) Structured Text (ST) - Ladder Logic (LL)	**Task No. 6** *Details may be seen at Annexure-I*
Week 11	Ladder Logic Programming	- Master control reset - Latching - Interlocking - Logic Gates Ladder Logic Programming - On-Delay Timer Ladder Logic Programming - Off-Delay Timer Ladder Logic Programming - Retentive On-Delay Timer Ladder Logic Programming - Retentive Off-Delay Timer Ladder Logic Programming - Pulse Timer Ladder Logic Programming - Online and Offline Simulation of Above tasks - Real Time Clock - Case Study-3 (*For further detail please see Page No: 6)*	**Task No. 7** *Details may be seen at Annexure-I*

Week 12	Ladder Logic Programming	• Motivational Lecture(*For further detail please see Page No: 4)* • Counters Ladder Logic Programming • Up Counter • Down Counter • Up down Counter • Special Instructions • Online and Offline Simulation of Above tasks • Practical industrial applications	**Task No. 8** *Details may be seen at Annexure-I* **Midterm Assessment**
Week 13	**Overview of the previous weeks & Mid Term Examination**		**Task No. 9** *Details may be seen at Annexure-I*
Week 14	Comparators Programming	• Greater than and equal to Comparator Programming • Less than and equal to Comparator Programming • Equal to Comparator Programming • Online and Offline Simulation of Above tasks • Timers Comparison Programming • Counters Comparison Programming • Data Registers Comparison Programming • Online and Offline Simulation of Above tasks • Demonstrate the basic function of Proximity sensors • Demonstrate the basic function of limit switch • Success story (*For further detail please see Page No: 5 and Annexure-IV at the end)*	**Task No. 10** *Details may be seen at Annexure-I*
Week 15	Analog data	• Motivational Lecture(*For further detail please see Page No: 4)* • ADC and DAC • Analog Values Scaling • Related Problems • Case Study-4 (*For further detail please see Page No: 6)*	**Task No. 11** *Details may be seen at Annexure-I*

Week 16	Analog Programming	• Motivational Lecture(*For further detail please see Page No: 4)* • Analog IOs Programming • Applications of Analog Programming in Industry • Online and Offline Simulation of Analog Programming • Practical industrial scenarios for Analog I/Os	**Task No. 12** *Details may be seen at Annexure-I*
Week 18	Analog Sensors II Job Search	• Motivational Lecture(*For further detail please see Page No: 4)* • Interfacing Load cell with PLC Automation of Load cell via PLCs Programming for Automation of Load cell • Interfacing Level Sensor with PLC Automation of Level Sensor via PLCs Programming for Automation Level Sensor • Session on CV Building. • How to make notable CV. • Dos and Don'ts of CV making.	**Task No. 14** *Details may be seen at Annexure-I*
Week 19	HMI Programming	• Overview of HMIs • Types of HMIs • Planning and Designing of HMIs • Recipes of HMI • Case Study-5 (*For further detail please see Page No: 6)*	**Task No. 15** *Details may be seen at Annexure-I*

Week 20	Project Design	• Success story (*For further detail please see Page No: 5 and Annexure-IV at the end*) • PLC based mini Projects • Idea generation and Planning for project etc. • Discussions for selection of project and assessing requirements etc. • Groups formation • Problems indented solution • Commissioning testing etc • Session on Self-Employment • How to start a Business. • Requirements (Capital, Physical etc) • Benefits/Advantages of self-employment	**Task No. 16** *Details may be seen at Annexure-I*
	Business Development & entrepreneurship		
Week 21	Employable Project/Assignment (6 weeks i.e. 21-26) in addition of regular classes.	• Guidelines to the Trainees for selection of employable project like final year project (FYP) • Assign Independent project to each Trainee • A project based on trainees acquired skills and interests. • Designed by keeping in view the emerging trends in the local market as well as across the globe. • The project idea may be based on Entrepreneurship. • Leading to the successful employment. • The duration of the project will be 6 weeks • The project will be presented in front of Industrialists for commercialization • The best business idea will be placed in NAVTTC business incubation center for commercialization.	**Task No. 17** *Details may be seen at Annexure-I* • **Project**

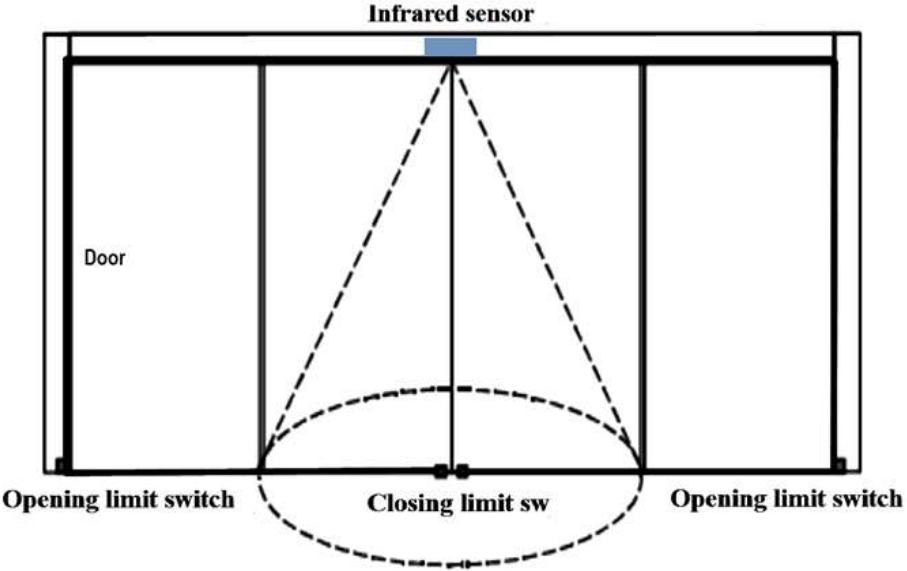| Week 22	Case Study 01: General Oversees Employment	Automation in Textile sector • Demonstration of Site Visit/ by Laboratory Trainer • Survey • Feasibility Report • Model Simulation (Prototype) • Motivational Lecture(*For further detail please see Page No: 4)* • Session on General Overseas Employment opportunities. • Job search Avenues. • Visa Processes and other necessary requirements. • Immigration Information (Legal age requirements, Health Certificate, Police Clearance &Travel Insurance)	**Task No. 18** *Details may be seen at Annexure-I* **Project Continued…** **Monthly Test 5**
Week 23	Case Study 02:	Automation in Batching sector • Demonstration of Site Visit/ by Laboratory Trainer • Survey • Feasibility Report • Model Simulation (Prototype)	**Task No. 18** *Details may be seen at Annexure-I* **Project Continued…**
Week 24	Case Study 03: Oversees Employment	Automation in Manufacturing sector • Demonstration of Site Visit/ by Laboratory Trainer • Survey • Feasibility Report • Model Simulation (Prototype) Motivational Lecture(*For further detail please see Page No: 4)* • Selection of two countries of destination (Gulf Countries, Malaysia, South Korea etc)focusing on:- I. Trade specific Job Prospects and Earning levels in that country. II. Country Specific Labor laws, entry and exit requirements (Legal age requirements, Health Certificate, Police Clearance & Travel Insurance etc.).	**Project Continued…**

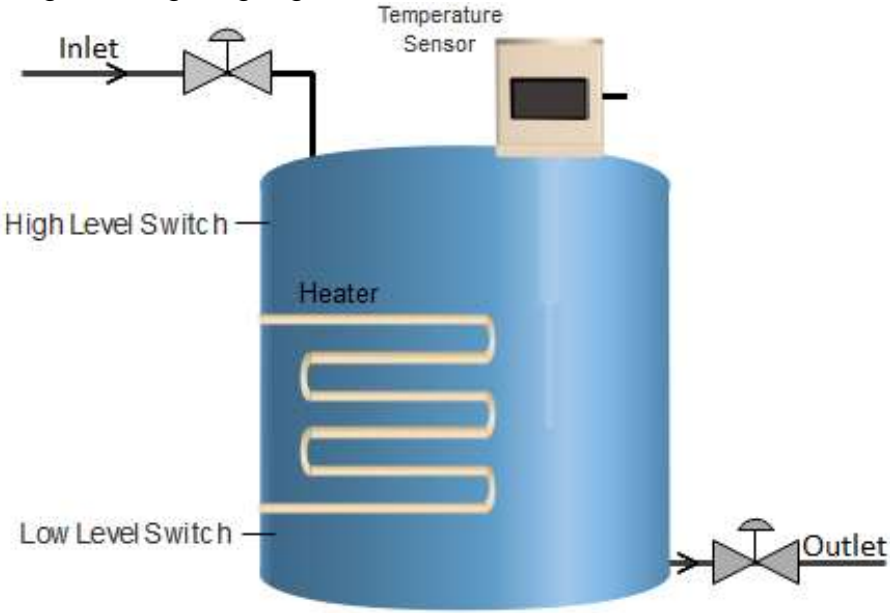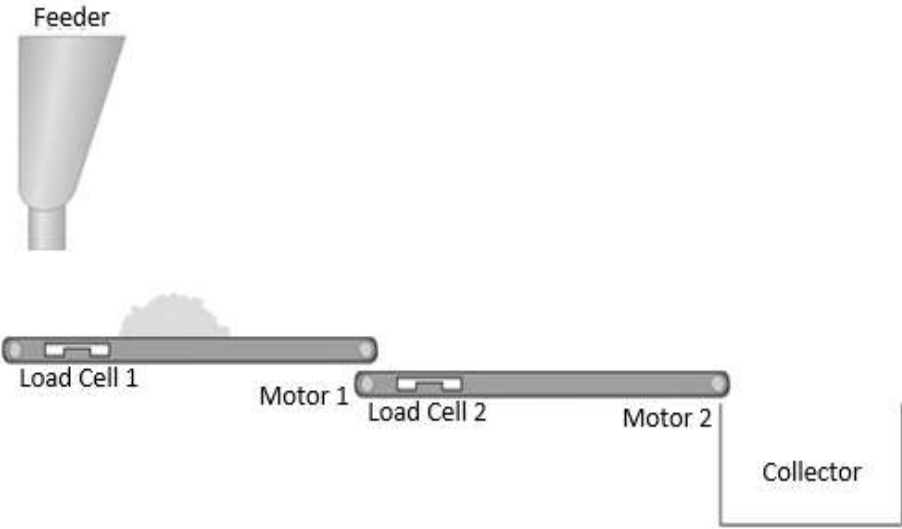| Week 25	Oversees Employment	• Selection of two countries of destination (Gulf Countries, Malaysia, South Korea etc)focusing on:- III. Trade specific Job Prospects and Earning levels in that country. IV. Country Specific Labor laws, entry and exit requirements (Legal age requirements, Health Certificate, Police Clearance & Travel Insurance etc.).	**Project Continued…**
	Case Study 04:	• Automation in Pharma sector • Demonstration of Site Visit/ Laboratory Trainer • Survey • Feasibility Report • Model Simulation (Prototype) • Success story (*For further detail please see Page No: 5 and Annexure-IV at the end*)	
Week 26	Entrepreneur ship and Final Assessment in project	• Fundamentals of Business Development • Entrepreneurship&Startup Funding • Business Incubation and Acceleration • Business Value Statement • Business Model Canvas • Sales and Marketing Strategies • How to Reach Customers and Engage CxOs • Stakeholders Power Grid • RACI Model, SWOT Analysis, PEST Analysis • SMART Objectives • OKRs • Cost Management (OPEX, CAPEX, ROCE etc.) • Final Project • Final Assessment	• **Project completion and testing/launching** • **Final Assessment**

<u>ANNEXURES</u>

<u>Annexure-I</u>

<u>TASKS FOR INDUSTRIAL AUTOMATION (PLC</u>)

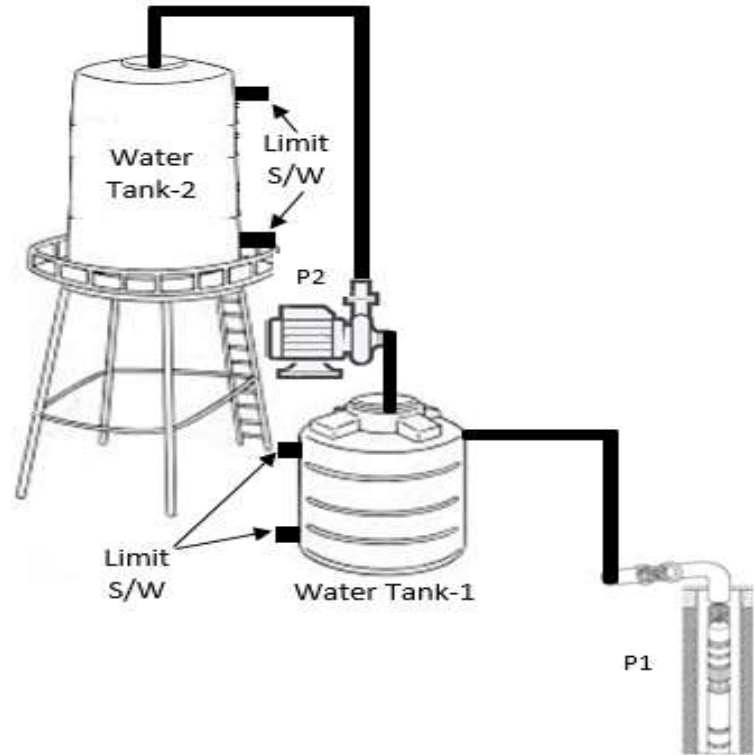| Task No.	Task	Description
1	Make an OR & AND circuits.	Make an OR & AND circuit, draw it logic and circuit diagrams, also draw the truth table for this circuit.
2	Controlling of a lamp/LED from two different places.	Make a circuit to control one lamp/LED from two different places using SPDT switch and also draw, Circuit diagram, logic diagram and truth table.
3	Operating lamp/LED & buzzer using Relay & Contactor logic.	Make a circuit using Relay & Contactor logic to control a lamp & buzzer in the following way, When the lamp is "ON" the buzzer remaining deactivated. When the lamp turned "OFF" the buzzer circuit is then activated automatically until the lamp is again operated. Draw logic, circuit diagrams and truth table.
4	Circuit to control 2 lamps automatically.	Make a circuit to control 2 lamps. First, L1 is "ON" for 7 sec then turned "OFF" automatically & at that instant L2 become energized and remained "ON" for 3 sec, this cycle is repeated until interrupted. Draw circuit, logic diagrams and truth table.
5	Implement given Boolean Functions with the help of PLC Program.	Simulate PLC Program to implement the following Boolean functions with Don't Care Condition. $F(A,B,C,D)=\sum m(0,1,5,9,13,14,15) + d(3,4,7,10,11)$
6	Using PLC Program to make Forward- Reverse Circuit (with limit switches) for a 3-Phase Motor.	Run a 3-phase motor in the Forward and Reverse direction with the help of PLC using Ladder Diagram programming language. This circuit is used to change the direction of rotation of a 3-Phase induction motor (i.e. forward &backward or upward & downward). Forward-Reverse movement of a 3-Phase motor can be obtained by changing its phase sequence. Also draw its electrical and Ladder Logic diagrams.
7	PLC Program to Latch and Unlatch Output With Time Delay.	Prepare, execute, and demonstrate a PLC Program to implement Latching and Unlatching of output with a particular time delay in PLC using Ladder Diagram.
8	Operating Seven Segment Display using PLC Program.	Prepare, execute, and demonstrate a PLC Program to displaying 0-9 digits using 7 Segment LED Display interfacing with PLC using Ladder Diagram programming language.
Task No.	Task	Description

9	Using PLC Program to Drive two Motors Simultaneously with Interlocking.	Two Motors are running in a sequence one by one for a particular time. If the start button is pressed Motors run in sequence such that 1st Motor stays ON for 5secs and then 2nd Motor is turned ON and stays ON for 5secs. And the cycle is repeated until it is interrupted. While motors are running in the sequence, if one motor is running and the button of other motor is pressed, then the running Motor should stop and the other motor should run. Implement this logic in PLC using Ladder Diagram programming language. Also draw its electrical and Ladder Logic diagrams.
10	PLC Program for Burglar Alarm Security System	Prepare, execute, and demonstrate a PLC Program for Burglar Alarm Security System. Consider the design of a Burglar Alarm for a house. This alarm will be activated if an unauthorized person is detected by a Window Sensor or a Motion Detector. Implement this Alarm System in PLC using Ladder Diagram programming language.
11	PLC Program for a Car Parking System	A parking plot has total capacity of Cars. Number of empty spots are displayed on the display outside the Parking Plot and which spots are available is to be indicated by LEDs. Implement this in PLC using Ladder Diagram programming language.
12	Automatic Door Open Close Control System with the help of PLC Program.	Prepare, execute, and demonstrate a PLC Program to implement logic for the automatic door open & close system using ladder diagram programming language.
Task No.	**Task**	**Description**

Task No.	Task	Description
13	PLC Program for Heating water in the Tank by Heater using RTD as temperature detector.	Implement the process to control Heating and maintaining high and low level of water in the tankusing PLC Ladder Diagram programming language.
14	PLC Program to Control the Sequence of Conveyors and Interlocking Them	A feeder drops material on the conveyor which sends the dropped material to collector through one more conveyor. Conveyor must start automatically.When material falls on conveyor belt 1, motor 1 should start, and when material in present on conveyor belt 2, motor 2 remain On.Implement automation of this in PLC using Ladder Diagram programming language.
Task No.	Task	Description

15	PLC Program to Maintain the Capacity of a Particular Classroom using HMI Interface.	A classroom has a capacity of maximum 25 students. There are two doors, one for Entry and the other for Exit. When number of students in the classroom is less than 25, Entry door has a Green light on it which remains ON. When number of students in the classroom is 25 or more than that, Red light goes ON turning OFF the Green light which indicates that the classroom has reached its maximum capacity and is full.

16	**Mini Project:** Making of an ATS Circuit, with the help of PLC Program.	This circuit is widely used in industries. The trainees have to make such circuit with the following options.
		  1. When the main supply goes down, The Generator Will Turn ON automatically after 5 Min.
		  2. When the Generator Turned ON, the load shifts to Generator after 3 min. automatically.
		  3. When the main supply become available, shift load immediately on main while the Generator will then run without load for 3 min. and then turn OFF automatically.
		Implement this logic in PLC using Ladder Diagram programming language. Also draw its electrical and Ladder Logic diagrams.

17	Making in Automatic Star-Delta Starter with the help of PLC Program.	3-phase induction motors (squirrel cage) are needed some suitable starting mechanism/arrangement because at the time of starting it draw a huge amount of current and when such large machines are started directly, it ultimately can cause damage to the machine or attached equipment. Implement the logic in PLC using Ladder Diagram programming language. Also draw its electrical and Ladder Logic diagrams.

18	PLC Program to Control Level of Two Tanks	A deep well pump (P1) is used to fill tank-1 mounted on first floor, while a 0.25hp pumping motor (P2) is used to pump the water from tank-1 to tank-2 which is at some further height from tank-1. Both the Tanks are defined to store water between upper & lower limits.
		
		When the operating switch is turned "ON", one of the following action will take plece,
		
		  1. If water in tank-1 is adequately above the lower limit or it is filled, P2 starts pumping water to tank-2 till upper limit of tank-2 or lower limit of tank-1 whichever reach first, once the water level reaches to upper limit of Tank-2 or lower limit of Tank-1, P2 stops and P1 start to fill tank-1 and then stop automatically.
		
		  2. If water level in tank-1 is not sufficient, P1 is operated to

fill it and then stop automatically. In order to fill tank-2, the main switch needs to reoperated manually. After tank-2 get filled, P2 stops and P1 start to complete the less water level of tank-1 and then stop autmatically.

Implement this logic in PLC using Ladder Diagram programming language. Also draw its electrical and Ladder Logic diagrams.

ASSIGNMENTS FOR INDUSTRIAL AUTOMATION (PLC)

Assign . No.	Assignment

1	Prepare safety charts. Showing general & Trade specific safety measure (text/pictorial). Each trainee will prepare different chart.
2	Simplify the following Boolean expression using K-Map, also draw logic diagrams (Before & after simplification) $f(W,X,Y,Z) = \sum (1,3,4,6,9,11,12,14)$
3	Draw neat & clean sketches (along with their symbols) of various components you have learnt in this week on drawing sheet(s)/Chart(s).
4	What is the difference between timers & counters? Explain function of Timer & Counter in PLC, enlist different types of timers and counters and draw their symbols, also write down its advantages.
5	What do you mean by automation? What are their types? Write down advantages of industrial automation with examples.
6	What is PLC? Enlist different the different sizes & brands of PLC, also write down the uses and advantages of PLC.
7	What do you mean by physical protocol of communication? What is the difference between RS232 and 485? How & why we can convert RS232 to 485? Draw the Block diagram of PLC and Pinout of RS232 & 485 connector (both male, female) on drawing sheet(s)/Chart(s).
8	Enlist the complete step by step procedure to install PLC software. Also write the method to configure PLC software for desired task. Evident screenshots is mandatory.

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Annexure-III

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Workplace/Institute Ethics Guide

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Work Ethics is a standard of conduct and values for job performance. The modern definition of what constitutes good work ethics often varies. Different businesses have different expectations. Work

ethic is a belief that hard work and diligence have a moral benefit and an inherent ability, virtue or value to strengthen character and individual abilities. It is a set of values centered on importance of work and manifested by determination or desire to work hard.

The following ten work ethics are defined as essential for employee's success:

1. **Attendance:**

   Be at work every day possible, plan your absences don't abuse leave time. Be punctual every day.

2. **Character:**

   Honesty is the single most important factor having a direct bearing on the final success of an individual, corporation, or product. Complete assigned tasks correctly and promptly. Look to improve your skills.

3. **Team Work:**

   The ability to get along with others including those you don't necessarily like. The ability to carry your own weight and help others who are struggling. Recognize when to speak up with an ideas and when to compromise by blend ideas together.

4. **Appearance:**

   Dress for success, set your best foot forward, personal hygiene, good manner, remember that the first impression of who you are, can last a life time

5. **Attitude:**

   Listen to suggestions and be positive, accept responsibility. If you make a mistake, admit it. Values workplace safety rules and precautions for personal and co-worker safety. Avoids unnecessary risks. Willing to learn new processes, systems and procedures in light of changing responsibilities.

6. **Productivity:**

   Do the work correctly, quality and timelines are prized. Get along with fellows, cooperation is the key to productivity. Help out whenever asked, do extra without being asked. Take pride in your work, do things the best you know how. Eagerly focuses energy on accomplishing tasks, also referred to as demonstrating ownership. Takes pride in work.

7. **Organizational Skills:**

Make an effort to improve, learn ways to better yourself. Time management; utilize time and resources to get the most out of both. Takes an appropriate approach to social interactions at work. Maintains focus on work responsibilities.

8. **Communication:**

Written communication, being able to correctly write reports and memos. **Verbal communications,** being able to communicate one on one or to a group.

9. **Cooperation:**

Follow institute rules and regulations, learn and follow expectations. Get along with fellows, cooperation is the key to productivity. Able to welcome and adapt to changing workplace situations and the application of new or different skills.

10. **Respect:**

Work hard, work to the best of your ability. Carry out orders, do what's asked the first time. Show respect, accept and acknowledge an individual's talents and knowledge. Respects diversity in the workplace, including showing due respect for different perspectives, opinions and suggestions.

Annexure-IV

SUGGESTIVE FORMAT AND SEQUENCE ORDER OF SUCCESS STORY

S. No	Key Information	Detail/Description

1.	Self & Family background	- Self-introduction - Family background and socio economic status, - Education level and activities involved in - Financial hardships etc
2.	How he came on board NAVTTC Training/ or got trained through any other source	- Information about course, apply and selection - Course duration, trade selection - Attendance, active participation, monthly tests, interest in lab work
3.	Post training activities	- How job / business (self-employment) was set up - How capital was managed (loan (if any) etc). - Detail of work to share i.e. where is job or business being done; how many people employed (in case of self-employment/ business) - Monthly income or earnings and support to family - Earning a happy life than before
4.	Message to others (under training)	- Take the training opportunity seriously - Impose self-discipline and ensure regularity - Make Hard work pays in the end so be always ready for the same.

Note: Success story is a source of motivation for the trainees and can be presented in a number of ways/forms in a NAVTTC skill development course as under: -

1. **To call a passed out successful trainee of institute. He will narrate his success story to the trainees in his own words and meet trainees as well.**
2. **To see and listen to a recorded video/clip (5 to 7 minutes) showing a successful trainee Audio video recording that has to cover the above mentioned points.**
3. **The teacher displays the picture of a successful trainee (name, trade, institute, organization, job, earning etc) and narrates his/her story in teacher's own motivational words.**