

Advanced Diploma - PLC/SCADA/DCS Engineer (Certified PLC/SCADA/DCS Engineer)

Preamble:

Stiff competition, higher quality standards and growing concerns of safety & environmental damage have pushed the Industrial sector to adapt state-of-the-art Automation Techniques for effective utilization of resources and optimized performance of the process plants. Recent trend of merging control systems associated with both factory and process automation demands knowledge from diverse fields. Automation applications span plant automation, discrete and batch process control, embedded machine control and manufacturing production line automation. The industrial automation applications include automation of time critical systems that demand precise real-time readings and control.

Objective:

This course is aimed at equipping an Engineer / Diploma holder / M.Sc holder (in specific streams) with appropriate knowledge and skills required in configuring, programming and operating Industrial automation systems with the use of Industrial Field Instruments, PLCs, SCADA/ HMI and DCS.

Expected Job Roles:

- Industrial Automation Engineer
- Control & Instrumentation Engineer
- Instrumentation Engineer

Duration:

480 Hours - (Theory: 150 Hrs + Practical: 330 Hrs)

This course shall be offered as full time intensive course.

Course Outline:

Sl. No	Module Title	Duration (Hours)			Credits	
		Theory	Lab	Total	Theory (hr/15)	Lab (hr/30)
1	Industrial Field Instrumentation, PLC and PID Controllers & NI-LabVIEW	90	210	300	6	7
2	SCADA/ HMI System Development	30	60	100	2	2
3	Distributed Control Systems	30	60	80	2	2
	Total Duration/Credits	150	330	480	21	

Prerequisites:

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Concepts of Basic Electronics, control systems and Instrumentation

Eligibility:

BE /B.Tech or Diploma in Electrical/ Electronics/ Instrumentation/ Chemical Engineering/ Applied Electronics and Instrumentation/ Instrumentation & Control/ Electronics & Communication/ Mechatronics / Computer Science. Students undergoing BTech are also eligible, however they will be issued course certificate only on production of their degree certificate.

Detailed Syllabus and Learning Outcome:

S.No	Module Title	Topics	Duration (Hours)		Learning Outcome
			Theory	Lab	
1	Industrial Field Instrumentation, PLC and PID Controllers & NI-LabVIEW	<ul style="list-style-type: none"> • Programmable Logic Controllers Basics • Hardware/Software introduction & Instruction sets • Programming of PLC using IEC 61131-3 Languages (LD, FBD etc.) • Detailed functions of Digital and Analog IO modules • Branded PLCs interface with plant Digital IOs & Analog Sensors/Actuators • AllenBradly PLCs: SLC-500 with RS-Logix 500, Emulate 500 & LogixPro Simulator • Compact Logix with RS-Logix 5000 • ABB – AC 500 controllers (PM 581-ETH) with 3S CoDeSys Software • ABB – AC 500 controllers (PM 	90	210	<p>Gain knowledge and skill through theory and practical experiments about:</p> <p>Basics of Programmable Logic Controllers Hardware/ Software and Instruction sets</p> <p>Programming of PLC using IEC 61131-3 Languages (LD, FBD etc.)</p> <p>Functions of Digital and Analog IO modules</p> <p>Branded PLCs interface with plant Digital IOs & Analog Sensors/Actuators</p> <p>AllenBradly PLCs: SLC-500 with RS-Logix 500, Emulate 500 & LogixPro Simulator</p> <p>Compact Logix with RS-Logix 5000</p> <p>ABB – AC 500 controllers (PM 581-ETH) with 3S CoDeSys Software</p> <p>ABB – AC 500 controllers (PM 581-ETH) with 3S CoDeSys Software</p> <p>Siemens CPU 300 Controllers with Simatic</p>

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		<p>581-ETH) with 3S CoDeSys Software</p> <ul style="list-style-type: none"> • Siemens CPU 300 Controllers with Simatic STEP 7 Software • Fundamental process control techniques • Implementing PID algorithm using above mentioned Controllers • Using smart module and control stepper motor • Comparison of different brands of PLCs • Introduction to Enclosure & Safety details • Comparison of different brands of PLCs • Transducer • Measuring Temperature with Thermocouple & RTD • Flow, Pressure, Force & Strain measurement using Strain gage • Control Valve • Introduction to Measurement and Automation Software LabVIEW • Graphical programming for data acquisition & Control • Signal processing, analysis & presentation using LabVIEW 			<p>STEP 7 Software Fundamental process control techniques</p> <p>Implementing PID algorithm using above mentioned Controllers</p> <p>Using smart module and control stepper motor</p> <p>Comparison of different brands of PLCs</p> <p>Enclosure & Safety details</p> <p>Gain knowledge and skill through theory and practical experiments about:</p> <p>Industrial field instruments like temperature/ flow/ pressure sensors and transmitters, control valves, pumps, I/P converters, etc.,</p> <p>Data acquisition, analysis and control software NI LabVIEW.</p> <p>Graphical programming, analysis & presentation using LabVIEW</p>
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2.	SCADA/ HMI System Development	<ul style="list-style-type: none"> • Introduction to Industrial Networking and RS 232-422-423-485 standards • Industrial field buses • MODBUS – Serial, • PROFIBUS-DP, • HART • Introduction to SCADA and SCADA / HMI Components • Intellution's iFIX SCADA Software • HMI Development, Data Processing, Control Algorithm Programming • Data Acquisition PLCs/RTUs, Database Connectivity and Report generating. • OPC (OLE for Process Control) Configuration with RTUs (PLC) • Cyber Security for Industrial Control Systems (ICS) • NI LabVIEW DSC (Data logging and Supervisory Control module) Software 	30	60	<p>Gain knowledge and skill through theory and practical experiments about:</p> <p>Industrial Networking, RS 232-422-423-485 standards Industrial field buses MODBUS – Serial, PROFIBUS-DP, HART SCADA / HMI System Components Intellution's iFIX SCADA Software HMI Development, Data Processing, Control Algorithm Programming Data Acquisition PLCs/RTUs, Database Connectivity and Report generating. OPC (OLE for Process Control) Configuration with RTUs (PLC) Cyber Security for Industrial Control Systems (ICS) NI LabVIEW DSC (Data logging and Supervisory Control module) Software</p>
3.	Distributed Control Systems	<ul style="list-style-type: none"> • Introduction to DCS and Compare with SCADA system • Introduction to ABB 800F DCS with Control Builder IT software • Hardware Configuration of ABB 800F (PM 802F) (process station – PS) • Developing a project and 	30	60	<p>Gain knowledge and skill through theory and practical experiments about:</p> <p>Distributed Control Systems (DCS) architecture Comparison with SCADA system Details of ABB 800F DCS with Control Builder IT software</p>

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		control the plant through field bus (Profibus) <ul style="list-style-type: none"> Monitoring & controlling the plant using DigiVI-visualization software (operator station- OS) 			Hardware Configuration of ABB 800F (PM 802F) (process station – PS) Developing a project and control the plant through field bus (Profibus) Monitoring & controlling the plant using DigiVI-visualization software (operator station- OS)
Total Hours = 480			150	330	

Examination & Certification:

NIELIT's NSQF Examination pattern will be followed for Examination & Certification.

Sl No	Examination Pattern	Modules Covered	Duration in Minutes	Maximum Marks
1	Theory Paper – 1	1	90	100
2	Theory Paper – 2	2,3	90	100
4	Practical -1	1,2,3	180	90
5	Internal Assessment	1,2,3	-	50
6	Project/Presentation /Assignment	1,2,3	-	60
7	Major Project/Dissertation	1,2,3	-	100
	Total			500

Note:

- Pass percentage would be 50% marks in each component, with aggregate pass percentage of 50% and above.
- Grading will be as under:

Grade	S	A	B	C	D
Marks Range (in %)	$\geq 85\%$	$\geq 75\% - < 85\%$	$\geq 65\% - < 75\%$	$\geq 55\% - < 65\%$	$\geq 50\% - < 55\%$

- Theory examination would be conducted online and the paper comprise of MCQ and each question will carry 1 marks.
- Practical examination/Internal Assessment/ Project/Presentation/Assignment would be evaluated internally.

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5. Major Project/Dissertation would be evaluated preferably by External / Subject Expert including NIELIT Officials.
6. Candidate may apply for re-examination within the validity of registration.
7. The examinations would be conducted in English Language only.

Recommended hardware/software tools:

1. Allen Bradley SLC500 series, CompactLogix Series PLC (1769 L23 or better) Systems with Digital and Analog I/O modules (isolated)
2. SIEMENS SIMATIC S7 series PLC Systems (1200/300/400 latest CPUs) with Digital and Analog I/O modules (Isolated)
3. ABB AC500 PLC (PM 581-ETH CPU or better) Systems) with Digital and Analog I/O modules (Isolated)
4. HART Modem and Smart Temperature Transmitter with HART interface
5. Smart Transmitter with Profibus interface
6. Analog Isolators -Siemens/ Pepperl make
7. Smart Instruments with HART/ Foundation Fieldbus interfaces
8. Distributed Control Systems (DCS) - ABB Freelance 800F with S800 I/O modules and interfaces, Foundation fieldbus and Profibus interfaces
9. Temperature control loop process rig
10. Pressure control loop process rig
11. Level & flow control loop process rig
12. The above process rigs must be set up with real sized industrial grade instruments (Level, flow, temperature and pressure sensors and Transmitters, pumps, control valves, positioners and I/P converters) and controlled through PLC/ PAC/ LabVIEW/ SCADA/ DCS
13. DCS freelance 800F with Analog input and Output, Digital Input and Output
14. RS Logix 500 & 5000 Software – academic license
15. Emulate 500 and Logix Pro Simulator – Academic License
16. SIMATIC STEP 7 Professional programming Software – academic license
17. S7-PLCSIM – multiuser academic license
18. CODESYS Software – Academic License
19. GE Fanuc iFIX SCADA Software - Academic license
20. National Instruments LabVIEW Professional Development System – Academic site license
21. National Instrument’s LabVIEW DSC (Data logging & Supervisory Control) Software – Academic license
22. Distributed Control Systems (DCS) - ABB Freelance 800F - with Control Builder F and DigiVis – Academic License

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Faculty & Support / Lab Instructor:

1. Two Faculties with
BE/B.Tech. in Electronics & Instrumentation/Applied Electronics and Instrumentation/
Instrumentation & Control/ Electrical/Electrical & Electronics/ Electronics & Communication
(minimum 60% marks in qualifying examination)
and
Minimum 1 year of appropriate experience in Industrial Automation (in areas such as PLC,
LabVIEW, SCADA, DCS, Industrial Field Instruments and Data Acquisition Systems) in carrying
out industrial automation related projects, instrumentation & control system research, design&
engineering activities/ quality teaching in related areas
/
PG Diploma in Industrial Automation of minimum 6 months duration (passed) with minimum 70%
Marks (in areas such as PLC, LabVIEW, SCADA, DCS, Industrial Field Instruments and Data
Acquisition Systems)
2. One Support / Lab Instructor with at least Diploma in Electronics & Instrumentation/Applied
Electronics and Instrumentation/ Instrumentation & Control/ Electrical/Electrical & Electronics/
Electronics & Communication
And experience in Industrial Automation (in areas such as PLC, LabVIEW, SCADA, DCS,
Industrial Field Instruments and Data Acquisition Systems) in carrying out industrial automation
related projects, instrumentation & control system research, design& engineering activities/ quality
teaching in related areas
/
Diploma in Industrial Automation

References:

1. Process Dynamics and Control by Dale E. Seborg, Duncan A. Mellichamp, Thomas F. Edgar, John Wiley & Sons
2. Programmable Controllers - Selected Applications, L. A. Bryan, E. A. Bryan
3. SCADA: Supervisory Control and Data Acquisition, Stuart A. Boyer, ISA
4. Control systems engineer technical reference handbook By Chuck Cornell, ISA
5. Process Control Instrumentation Technology, Curtis D. Johnson
6. Industrial Ethernet, By Perry S. Marshall and John S. Rinaldi, ISA
7. Product/ User/ Maintenance manuals of AB, ABB, Siemens PLCs. ABB 800F DCS, NI LabVIEW, GE Fanuc iFIX SCADA, Smart Transmitters, Control Valves, Process Rigs, etc.,
8. Measurement and Instrumentation Principles, Alan S. Morris, Butterworth-Heinemann
9. Fundamentals of Process Control Theory, By P. W. Murrill
10. Programmable Controllers, Thomas A. Hughes
11. Industrial Instrumentation: Principles and Design by Tattamangalam R. Padmanabhan
12. Learning with LabVIEW by Robert H. Bishop, Pearson
13. Calibration: A Technician's Guide, Mike Cable, ISA
14. Practical Distributed Control Systems (DCS), IDC Technology, IDC Technologies

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15. Programmable Logic Controllers and Industrial Automation book, Madhuchhanda Mitra, Samarjit Sen Gupta, Penram International Publishing (India) Pvt. Ltd.
16. Control Valves: Practical Guides for Measurement and Control Guy Borden Jr., Editor, and Paul G. Friedmann

Course Name	Advanced Diploma - PLC/SCADA/DCS Engineer (Certified PLC/SCADA/DCS Engineer)	Vertical	Industrial Automation
Course Code		Rev No	R4
Prepared By	Arumugam J	Aligned NSQF Level	5
NIELIT Centre	Calicut	Last Revised on	03.06.2019



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