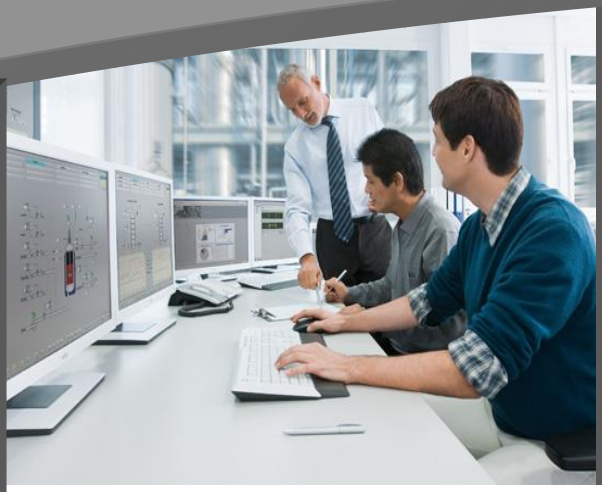
QUALIFICATION PACK - OCCUPATIONAL STANDARDS FOR INSTRUMENTATION AUTOMATION SURVEILLANCE AND COMMUNICATION INDUSTRY



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What are Occupational Standards(OS)?

- OS describe what individuals need to do, know and understand in order to carry out a particular job role or function
- OS are performance standards that individuals must achieve when carrying out functions in the workplace, together with specifications of the underpinning knowledge and understanding

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Introduction

Qualification Pack-DCS Programmer & Troubleshooter

SECTOR: INSTRUMENTATION AUTOMATION SURVEILLANCE & COMMUNICATION

SUB-SECTOR: Automation

OCCUPATION: DCS Programming, Commissioning & troubleshooting

REFERENCE ID: IAS/Q8003

ALIGNED TO: NCO-2015/ NIL

DCS Programmer & Troubleshooter provides solution to Process Industry engineering and later troubleshoots any issues in Plant operations. Industrial automation is used for handling different processes with the help of PLC programs and SCADA based operator stations.

Brief Job Description: The individual is responsible for programming logics for PLC and graphics screens for controlling various processes of Industries, finding and fixing errors or faults, if any, during the operation of the process plant.

Personal Attributes: The individual must have knowledge of process manufacturing, field instrumentation, control system installation and expertise in the following project phases like documentation, detailed design generation, implementation, system integration, testing and onsite startup. Planning & coordination of project work within deadlines.

Job Details

Qualification Pack Code	**IAS/Q8003**		
Job Role	**DCS Programmer and Troubleshooter**		
Credits (NSQF)	**TBD**	**Version number**	**1.0**
Sector	**Instrumentation Automation Surveillance & Communication**	**Drafted on**	**15/09/2017**
Sub-sector	**Automation**	**Last reviewed on**	**15/09/2017**
Occupation	**DCS Programming, Comissioning & troubleshooting**	**Next review date**	**15/09/2019**
NSQC Clearance on*	**DD/MM/YYYY**		

*** only after clearance from NSQC**

Job Role	**DCS Programmer & Troubleshooter**
Role Description	a. Programming of DCS system b. Commissioning of PLC and SCADA system onsite c. Troubleshooting of PLC and SCADA issues onsite
NSQF level	4
Minimum Educational Qualifications	Diploma in Electrical/Electronics/Instrumentation B.Sc in Electronics
Maximum Educational Qualifications	NA
Training (Suggested but not mandatory)	Training on Basics of DCS.
Minimum Job Entry Age	24 years.
Experience	Minimum 3 years Experience 2 years experience in PLC and SCADA systems Individual should assist Senior Engineer for DCS commissioning and troubleshooting for 6 months Perform DCS programming, commissioning and troubleshooting under supervision of Senior Engineer for 6 months
Applicable National Occupational Standards (NOS)	**Compulsory:** 1. IAS/N2200 Understanding the DCS Control Panel and PLC Module / Equipments 2. IAS/N2201 Developing PLC program and SCADA project using DCS Software 3. IAS/N2202 Testing and commissioning DCS Project using trial runs onsite 4. IAS/N2203 Troubleshooting of faults in Process Plant 5. IAS/N2005 Health and Safety in Workplace **Optional:** N.A.
Performance Criteria	As described in the relevant OS units

Definitions

Keywords /Terms	Description
Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/related set of functions in an industry.
Function	Function is an activity necessary for achieving the key purpose of the sector, occupation or an area of work, which can be carried out by a person or a group of persons. Functions are identified through functional analysis and form the basis of OS.
Sub-function	Sub-function are sub-activities essential to fulfil in achieving the objectives of the function.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organization.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the knowledge and understanding they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria	Performance criteria are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualification Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualification pack code.
Unit Code	Unit codeis unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of varialbles that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.
Knowledge and Understanding	Knowledge and understanding are statements which together which together specify the technical, generic, professional and organizational specific knowledge that an individual needs in order to perform to the required standard.
Organizational Context	Organizational context includes the way the organization is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Techinical Knowledge	Techinical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.

CoreSkills/Generic Skills	Core skills or generic skills are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.

Acronyms

Keywords /Terms	Description
FAT	Factory Acceptance Test
SAT	Site Acceptance Test
PLC	Programmable Logic Controller
DCS	Distributed Control System
HMI	Human Machine Interface
SCADA	Supervisory Control And Data Acquisition
PC	Personal Computer or Desktop
NOS	National Occupational Standard(s)
NVQF	National Vocational Qualifications Framework
NSQF	National Skill Qualifications Framework
NVEQF	National Vocational Education Qualifications Framework
QP	Qualification Pack
ESD	Electro Static Discharge

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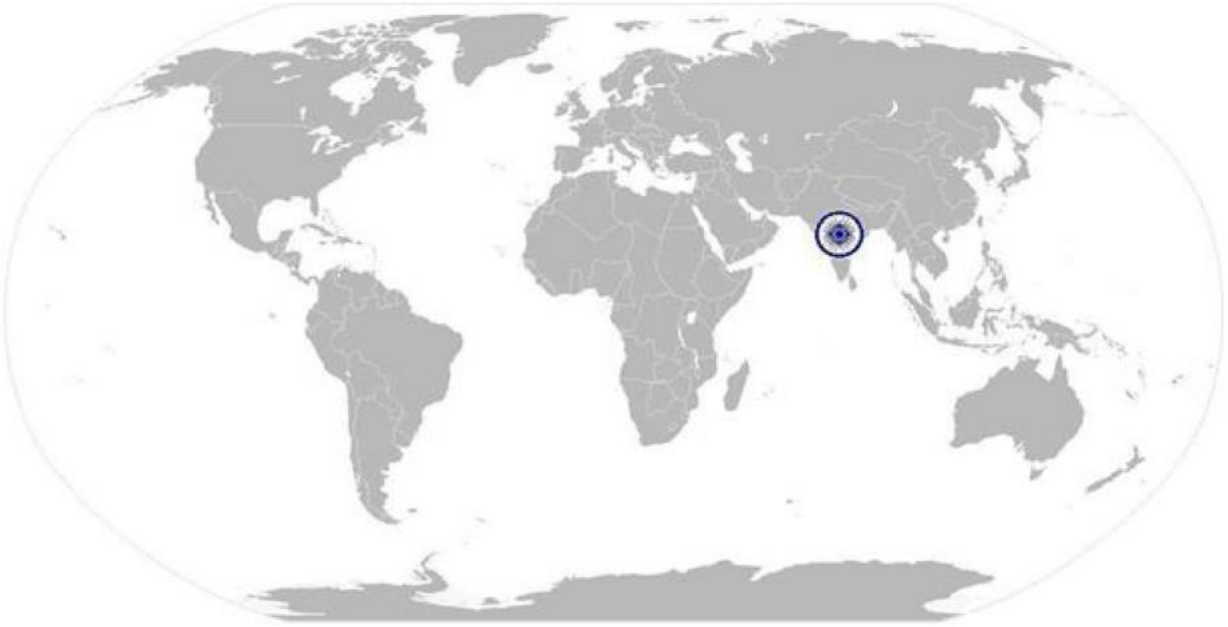
National Occupational Standard



Overview

This unit is about understanding the DCS Control Panel and the PLC Modules / Equipments used inside the control panel.

IAS/N2200 **Understanding DCS Control Panel and PLC Modules / Equipments**

National Occupational Standard

Unit Code	IAS/N2200
Unit Title (Task)	**Understanding the DCS Control Panel and PLC Module / Equipments**
Description	This unit is about to understand the DCS Control panel & PLC Modules / Equipments.
Scope	This unit/task covers the following: • Detailing the DCS Control Panel functional requirements • Understanding the PLC modules used in the Control Panel • Understanding the Equipments used in the Control Panel
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Detailing the DCS Control Panel functional requirements	To be competent, the user/individual on the job must be able to PC1. Identify the customer requirement of the DCS Control Panel PC2. Interact with customer & understand number of field equipment's and number of I/Os that needs to be connected to PLC PC3. Interact with customer for Panel switches and then guiding fabrication team for the cutouts on panel door PC4. Assisting the technician for panel manufacturing PC5. Examine the panel and perform Factory Acceptance Test (FAT)
Understanding the PLC modules used in the Control Panel	PC6. Understand the Mains power supply unit for powering PLC and remote panels PC7. Understand the signal modules used in the panels PC8. Examine the wiring of the signal modules with other components in the panel PC9. Examine the wiring of the special modules, if any
Understanding the Equipments used in the Control Panel	PC10. Understand the wiring diagrams between the PLC modules and the equipments/components used in panel PC11. Understand the ferrule numbers used for the wiring in panel PC12. Understand the equipment's like switches, push buttons, lamps, relays, contactors etc used in panel PC13. Understand the terminal base along with the numbering used in panel
Knowledge & Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. Company's code of conduct, organization culture and reporting structure KA2. Company's documentation policy KA3. Company's line of business and production policy KA4. Departments involved with installation and commissioning KA5. Quality and standards system followed in the company
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. Electrical, electronics and instrumentation KB2. Standard operating procedure (SOP) of the organization for

	control panel development process KB3. Basics of machine safety and normal safety processes KB4. Quality, standards and guidelines to be followed during panel design development KB5. PLC module and equipments used in the automation process KB6. DCS programming software KB7. General arrangement drawing KB8. Electrical load calculations KB9. Basics on industrial process involved (example: oil and gas, refinery, etc) and stages involved in the process KB10. Safety aspects to be inbuilt in the control panel system as per the process requirement KB11. Instrumentation used in the factory and its wiring concept KB12. DCS Control panel and wiring knowledge KB13. Testing process and parameters involved in the panel testing KB14. Electronics indicators, switchgear and panel accessories KB15. Sources and methods for obtaining required technical information for the control panel being developed KB16. IEC Standards KB17. Relevant regulations, standards and codes of practice and their implications on the panel KB18. Relevant documents and procedures used in the process
Skills (S)	
A. Core Skills/ Generic Skills	**Writing Skills**
	The individual on the job needs to know and understand how to: SA1. Compose E-mails, letters and other official documents clearly SA2. Write user requirements SA3. Write test reports SA4. Write technical documentation SA5. Write schedules and timelines
	Reading Skills
	The individual on the job needs to know and understand how to: SA6. Read user requirements SA7. Read technical specifications and documentation SA8. Read standards and regulatory compliance documents SA9. Read schedules and timelines SA10. Read drawings
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA11. Question customers appropriately in order to understand the application and the requirements SA12. Discuss task lists, schedules and work-loads with co-workers SA13. Keep customers informed about progress

	SA14. Use simple and clear language when communicating with a customer SA15. Report issues and problems to managers in clear terms
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. Make decisions pertaining to the scope of work SB2. Make decisions pertaining to readiness of the panel for supply SB3. Make decisions pertaining to readiness of customer site for panel installation SB4. Make decisions pertaining to changes in panel onsite
	Plan and Organise
	The user/individual on the job needs to know and understand: SB5. Plan and organize panel installation - including requirements, design and integration, testing, installation and commissioning, Customer Acceptance Test and feedback SB6. Anticipate issues and have alternate strategy
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB7. Understand real needs of the customer and suggest most appropriate solution SB8. Support customer when they need help SB9. Build customer relationships and rapport which promotes two way business
	Problem Solving
	The user/individual on the job needs to know and understand how to: SB10. Think through the problem, evaluate the possible solution(s) and suggest an optimum /best possible solution(s) SB11. Solve issues of clients lacking the technical background SB12. Identify and implement solutions to resolve delays
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB13. Use the existing information to arrive at actionable decision points SB14. Use the existing information for improving the customer satisfaction SB15. Analyze problems and identify causes and possible solutions
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB16. Apply, analyze and evaluate the information gathered from observation, experience, reasoning or communication, as a guide to think and take action SB17. Anticipate problems, risks and opportunities and utilize these for mitigation and business optimization

NOS Version Control

NOS Code	**IAS/N2200**		
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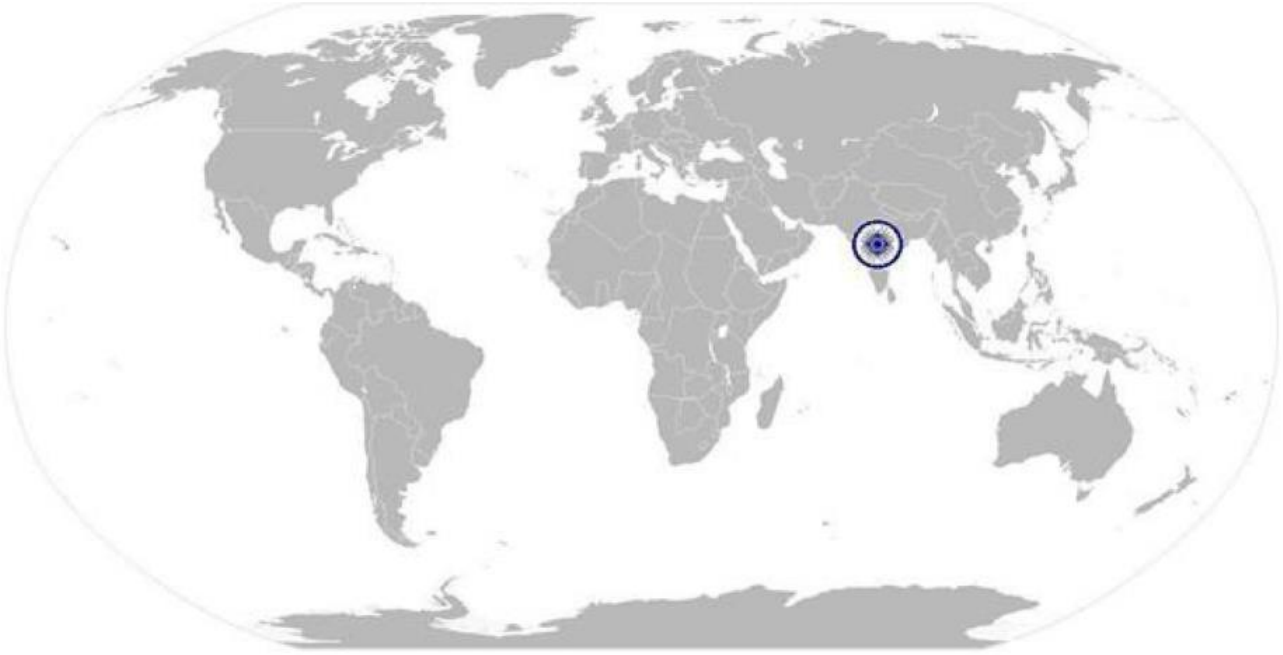
Industry	**Instrumentation Automation Surveillance & Communication**	**Drafted on**	**15/09/2017**
Industry Sub-sector	**Automation**	**Last reviewed on**	**15/09/2017**
Occupation	**DCS Programming, Comissioning & troubleshooting**	**Next review date**	**15/09/2019**



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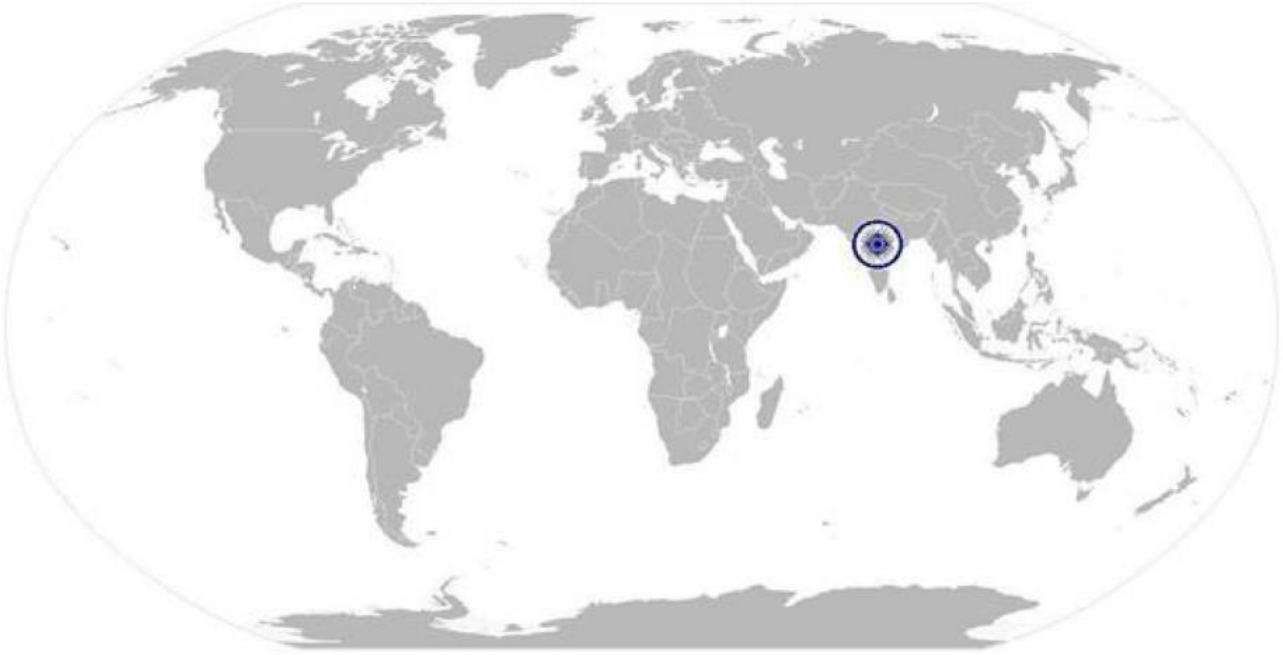


Overview

This unit is about developing PLC Program and SCADA Project using DCS software.

IAS/N2201 **Developing PLC program and SCADA project using DCS Software**

National Occupational Standard

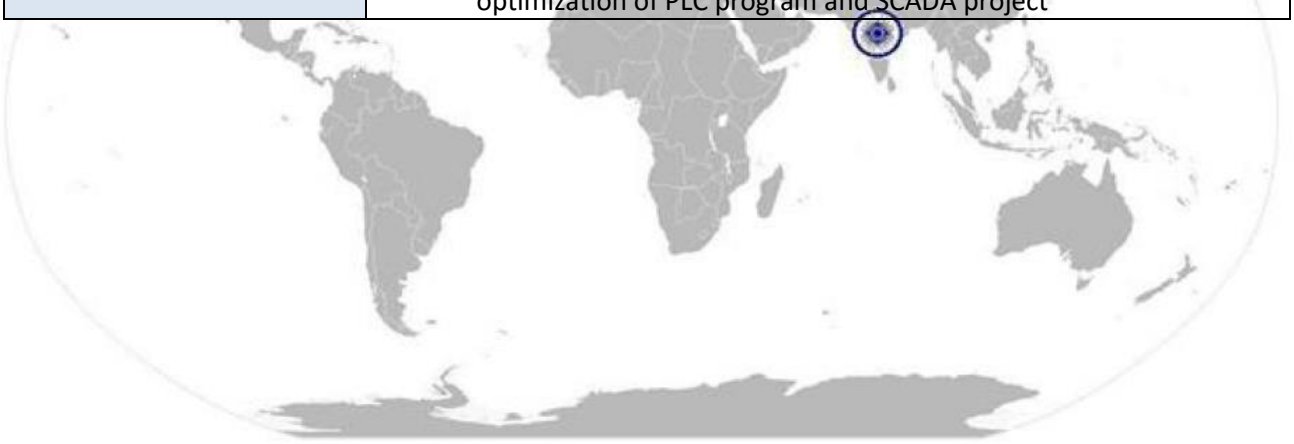
Unit Code	IAS/N2201
Unit Title (Task)	**Developing PLC Program and SCADA Project using DCS Software**
Description	This unit is about to develop PLC program and SCADA project using the DCS software.
Scope	This unit/task covers the following: • Detailing the DCS programming software & its pre-requisites • Analyzing the utilization of pre-program libraries from DCS software • Developing the program / logic / code for the DCS controller and HMI
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Detailing the DCS programming software & its pre-requisites	To be competent, the user/individual on the job must be able to PC1. Identify the Organization/Customer approved Software and use it for developing the process logics and Operator interface PC2. Collect information related to pre-requisites for software installation on PC/Laptops for programming PC3. Ensure availability of others software's like Office, Adobe reader, Windows features etc. which are required for the DCS programming software. PC4. Identify the Operating System of PC/Laptop where DCS is to be installed PC5. Ensure the communication protocol to be used for communicating between programming software, PLC and Operator station (HMI) PC6. Check the availability of the communication port on PC/Laptop PC7. Gather basic knowledge on different types of programming language available within the software
Analyzing the utilization of pre-program libraries from DCS software	PC8. Acquire & collect information of basic program blocks in the DCS software PC9. Identify and examine special programming blocks which has functionalities to create SCADA objects on the Operator station PC10. Get detail information on communication program blocks used specially for communication between different components PC11. Gather detailed information about the timely execution of program blocks in the controller PC12. Using appropriate programming language as per standards
Developing the program / logic / code for the DCS controller and HMI	PC13. Discuss & collect information from customer regarding the equipments and instruments used in the plant PC14. Prepare IO list and give necessary comments from the inputs given by customer PC15. Configure the hardware details of Controller, Remote stations and PC stations used as operator stations in DCS Software PC16. Set parameters in signal modules and other remote devices for better performance in the plant

	PC17. Discuss with customer to understand the automation required in the process plant PC18. Develop the program as per customer inputs and functional process description PC19. Create Operator station (HMI) project and establish connection with the controller PC20. Develop pictures, Graphic objects and provide animations as per customers requirement and according to P&ID PC21. Develop archive system and security levels in the HMI/SCADA project
Knowledge & Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. Company's code of conduct, organization culture and reporting structure KA2. Company's documentation policy KA3. Company's line of business and production policy KA4. Departments involved with installation and commissioning KA5. Quality and standards system followed in the company
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. Electrical, electronics and instrumentation KB2. Basics of computer and operating systems KB3. Standard operating procedure (SOP) of the organization for process automation logic development KB4. Basics of machine safety and normal safety processes KB5. Quality, standards and guidelines to be followed during program development KB6. Control system module and technologies used in the automation process KB7. DCS programming software KB8. Application software, Installation and debugging KB9. Piping and instrumentation diagram (P&ID) KB10. Basics on industrial process involved (example: oil and gas, refinery, etc) and stages involved in the process KB11. Basics on infrastructure process involved in the industry (example: water treatment plant, chilling units etc.) KB12. Safety aspects to be inbuilt in the DCS programming as per the process requirement KB13. Sources and methods for obtaining required technical information for the PLC program and SCADA project to be developed KB14. IEC Standards in DCS programming language KB15. Relevant documents to be referred for optimized DCS programming
Skills (S)	
A. Core Skills/ Generic	**Writing Skills**

Skills	The individual on the job needs to know and understand how to: SA1. Compose E-mails, letters and other official documents clearly SA2. Write user requirements SA3. Write test reports SA4. Write technical documentation SA5. Write schedules and timelines
	Reading Skills
	The individual on the job needs to know and understand how to: SA6. Read user requirements SA7. Read technical specifications SA8. Read standards and regulatory compliance documents SA9. Read schedules and timelines SA10. Read drawings
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA11. Question customers appropriately in order to understand the application and the requirements SA12. Discuss task lists, schedules, and work-loads with customers SA13. Keep customers informed about progress of logic development SA14. Use simple and clear language when communicating with a customer
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. Make decisions pertaining to the scope of work SB2. Make decisions pertaining to use of relevant PLC programming software and programming language SB3. Make decisions pertaining to optimize logic development
	Plan and Organise
	The user/individual on the job needs to know and understand: SB4. Plan and organize project - including requirements, design and integration, testing, installation and commissioning, Customer Acceptance Test and customer feedback SB5. Anticipate issues and have alternate strategy
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB6. Understand real needs of the customer and suggest most appropriate solution SB7. Make customer happy and make them want to work with the company SB8. Manage relationships and maintain good rapport with customers to get detail inputs on logic
	Problem Solving

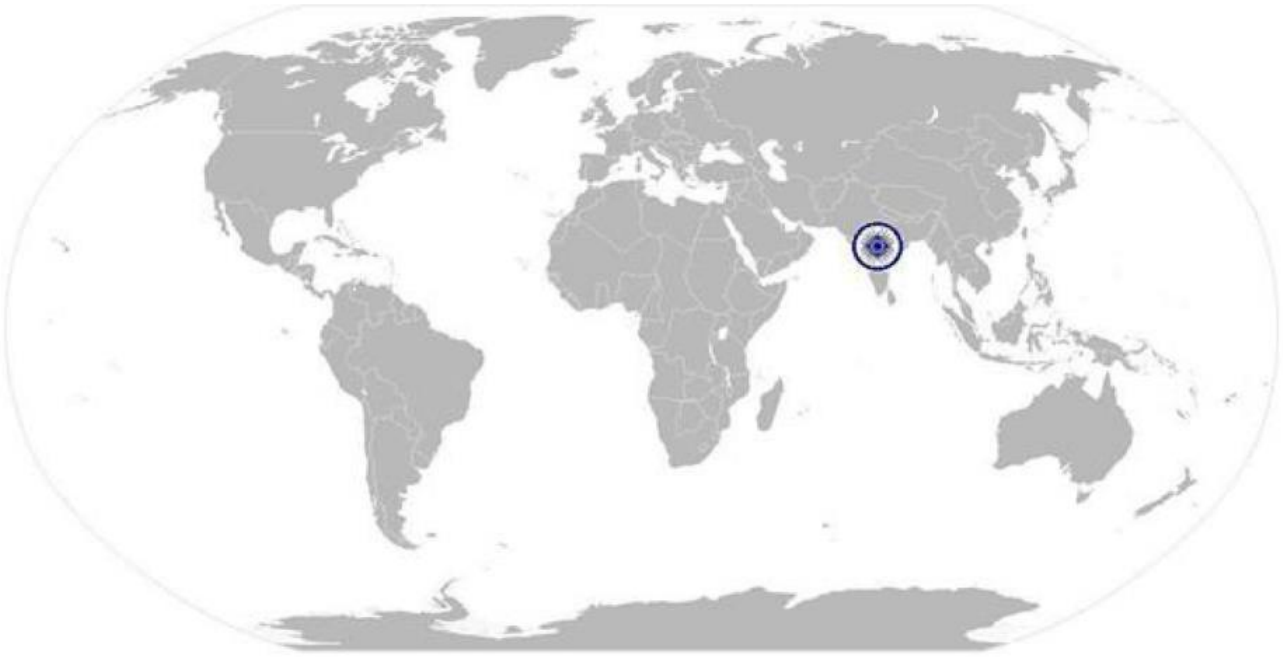
IAS/N2201 **Developing PLC program and SCADA project using DCS Software**

	The user/individual on the job needs to know and understand how to: SB9. Think through the problem, evaluate the possible solution(s) and suggest an optimum /best possible solution(s) SB10. Solve issues of co-workers, lacking the technical know how SB11. Identify immediate or temporary solutions to resolve delays
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB12. Use the existing information to arrive at actionable decision points SB13. Use the existing information for improving the PLC program and SCADA project development SB14. Use the existing information to optimize the logic SB15. Analyze problems and identify causes and possible solutions
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB16. Apply, analyze and evaluate the information gathered from observation, experience, reasoning or communication, as a guide to think and take action SB17. Anticipate problems, risks and opportunities and utilize these for optimization of PLC program and SCADA project



NOS Version Control

NOS Code	IAS/N2201		
Credits (NSQF)	TBD	Version number	1.0
Industry	Instrumentation Automation Surveillance & Communication	Drafted on	15/09/2017
Industry Sub-sector	Automation	Last reviewed on	15/09/2017
Occupation	DCS Programming, Comissioning & troubleshooting	Next review date	15/09/2019



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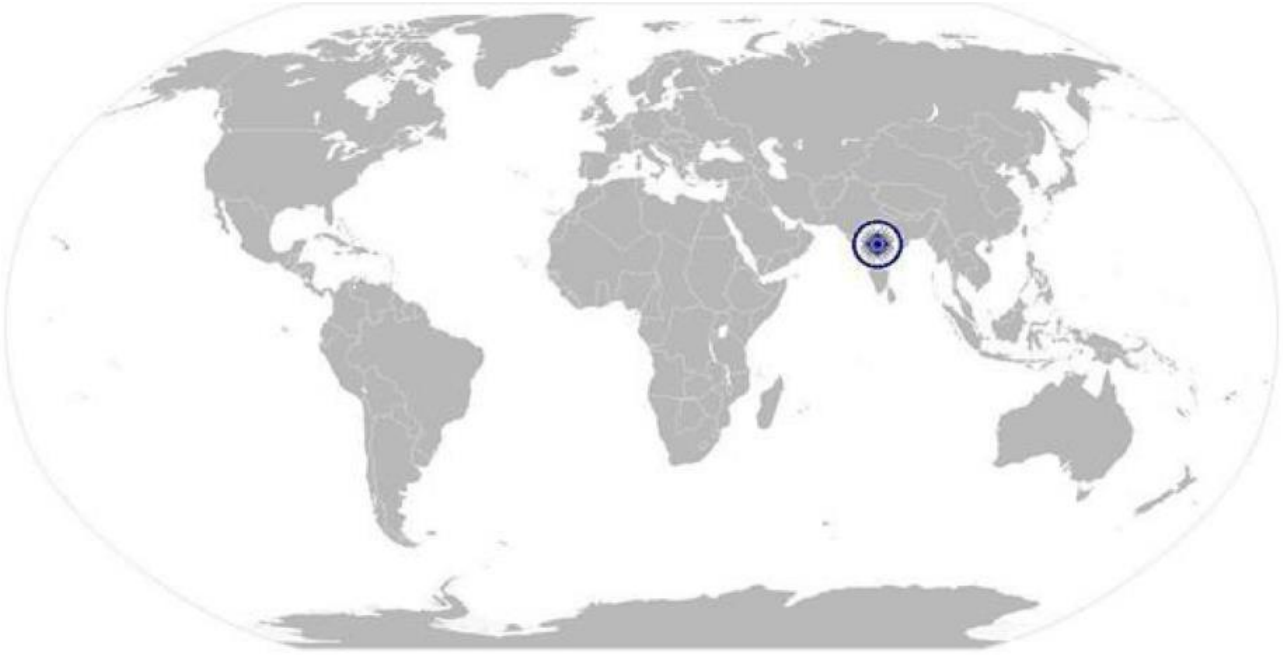
National Occupational Standard



Overview

This unit is about testing and commissioning DCS Project using trial runs onsite.

IAS/N2202 **Testing and Commissioning DCS Project using trial runs onsite**

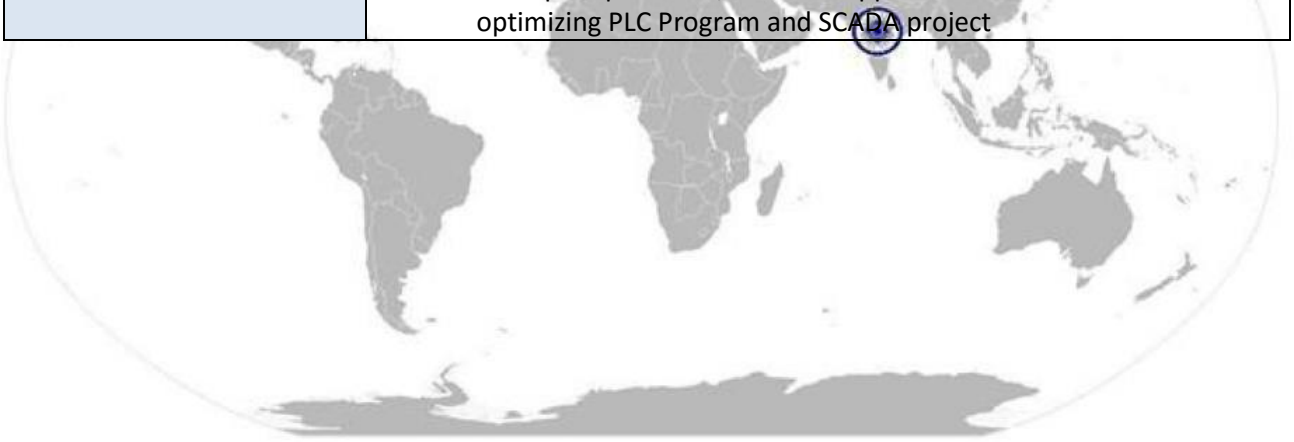
National Occupational Standard

Unit Code	IAS/N2202
Unit Title (Task)	**Testing and commissioning DCS project using trial runs onsite**
Description	This unit is about to understand the testing and commissioning of DCS Project using trial runs onsite.
Scope	This unit/task covers the following: • Checking the functionality of physical Inputs & Outputs by forcing PLC IO's • Transferring logic to PLC and SCADA project in Operator PC • Commissioning the program using trail runs for the process/application • Developing the error handling program for the PLC & testing it.
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Checking the functionality of physical Inputs & Outputs by forcing PLC IO's	To be competent, the user/individual on the job must be able to PC1. Complete the program and examine it using software checks like compilation PC2. Download the compilation error free program to controller PC3. Activate the respective Inputs and outputs in software to check the automation logic and thereby identify any error PC4. Modify and edit the logical error, data address overlap & wrong IO address access to maximize program stability PC5. Continue with further checks to eliminate the logical & address errors PC6. Activate the SCADA project in runtime and carry out the Input Output checks on SCADA systems PC7. Test the animations on the runtime screens
Transferring logic to PLC and SCADA project in Operator PC	PC8. Connect actual sensors and actuators to signal modules to check the hardware components PC9. According to customer requirement create PC Stations in the DCS projects PC10. Collect information about the architecture of the SCADA system in the plant PC11. Create Server and client projects in the DCS software PC12. Identify Server Operating System and Client Operating System for the DCS software PC13. Configure and prepare PC stations with respective software's and licenses installed PC14. Transfer the SCADA projects to respective PC stations for example, Server PC and Client PC PC15. Establish the connections between Server PC and Controller as well as Server PC and Client PC through Ethernet Switch
Commissioning the program using trail runs for the process/application	PC16. Inform customer about the preliminary check of IO's and gather information about availability of resources for trial runs PC17. Get permissions from customer for execution of process through program

	PC18. Train the operators to educate them the sequence of operation in case of emergency PC19. Prepare a standard operating procedure (SOP) for the logic and SCADA operation developed for the customer PC20. Collect the backup of the final DCS project and submit a copy to the plant head for future reference
Developing the error handling program for the PLC & testing it	PC21. Identify hardware and software related errors in the plant PC22. Ensure use of appropriate programming logics to avoid non functionality of controller due to hardware errors PC23. Generate outputs from error handling program for error monitoring on SCADA systems PC24. Examine these error handling programs by physically creating faults like supply failure, communication break, IO channel error, module failure etc. PC25. Ensure completion of Site Acceptance Test (SAT) and send report to customer
Knowledge & Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. Company's reporting structure KA2. Company's documentation policy KA3. Company's line of business and product offerings KA4. Company's departments involved with engineering KA5. Quality and standards followed in the company
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. Electrical, electronics and instrumentation KB2. Basics of computer and operating systems KB3. Standard operating procedure (SOP) of the organization for process automation logic testing KB4. Control system module and technologies used in the automation process KB5. Application software, Installation, testing and debugging KB6. General arrangement drawing KB7. Piping and instrumentation diagram (P&ID) KB8. Basics on industrial process involved (example: oil and gas, refinery, etc) and stages involved in the process KB9. Basics on infrastructure process involved in the industry (example: water treatment plant, chilling units etc.) KB10. Safety aspects to be inbuilt in the PLC program and SCADA project testing as per the process requirement KB11. Testing process and parameters involved in the testing KB12. Sources and methods for obtaining required technical information for the PLC program and SCADA project to be tested KB13. IEC Standards in DCS programming language KB14. Relevant documents to be referred for testing PLC program and SCADA project

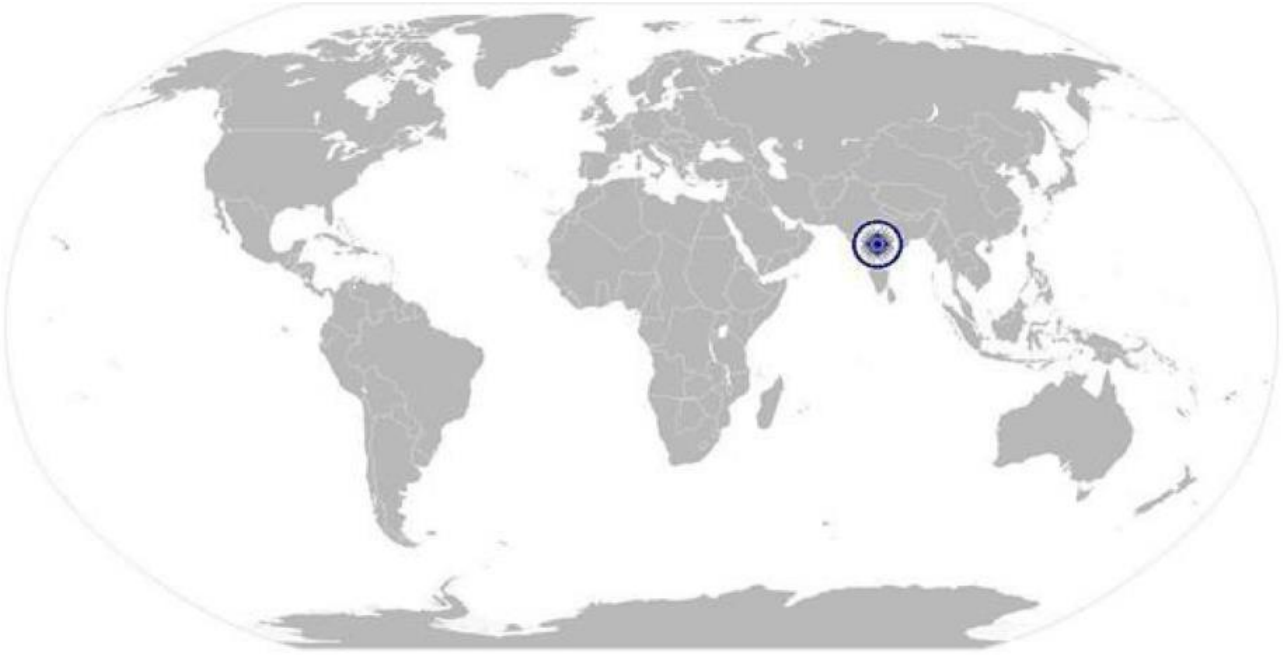
Skills (S)	
A. Core Skills/ Generic Skills	**Writing Skills**
	The individual on the job needs to know and understand how to: SA1. Compose E-mails, letters and other official documents clearly SA2. Write technical documentation SA3. Write test reports SA4. Write schedules and timelines
	Reading Skills
	The individual on the job needs to know and understand how to: SA5. Read user requirements SA6. Read technical specifications SA7. Read standards and regulatory compliance documents SA8. Read schedules and timelines SA9. Read drawings
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA10. Discuss task lists, schedules and work-loads with colleagues SA11. Keep colleagues informed about progress of logic testing SA12. Discuss with colleagues appropriately in order to understand the nature of the problem and make a diagnosis SA13. Report issues and problems to managers in clear terms
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. Make decisions pertaining to the scope of work SB2. Make decisions pertaining to the appropriate solution to faults in programming SB3. Make decisions pertaining to readiness of DCS project for installation SB4. Make decisions pertaining to installation of program onsite
	Plan and Organise
	The user/individual on the job needs to know and understand: SB5. Plan and organize project - including requirements, design and integration, testing, installation and commissioning, Customer Acceptance Test and customer feedback SB6. Anticipate issues and have alternate strategy
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB7. Understand real needs of the customer and deliver most appropriate solution SB8. Build good relationships and rapport with customers which will help in inputs related to program testing

	Problem Solving
	The user/individual on the job needs to know and understand how to: SB9. Think through the problem, evaluate the possible solution(s) and suggest an optimum /best possible solution(s) SB10. Solve problems of colleagues lacking the technical background SB11. Identify immediate or temporary solutions to resolve faults and implement the proper solution immediately
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB12. Use the existing information to arrive at actionable decision points SB13. Use the existing information to optimize PLC program SB14. Analyze problems and identify causes and possible solutions
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB15. Apply, analyze and evaluate the information gathered from observation, experience, reasoning or communication, as a guide to think and take action SB16. Anticipate problems, risks and opportunities and utilize these for optimizing PLC Program and SCADA project



NOS Version Control

NOS Code	**IAS/N2202**		
Credits (NSQF)	**TBD**	**Version number**	**1.0**
Industry	**Instrumentation Automation Surveillance & Communication**	**Drafted on**	**15/09/2017**
Industry Sub-sector	**Automation**	**Last reviewed on**	**15/09/2017**
Occupation	**DCS Programming, Comissioning & troubleshooting**	**Next review date**	**15/09/2019**



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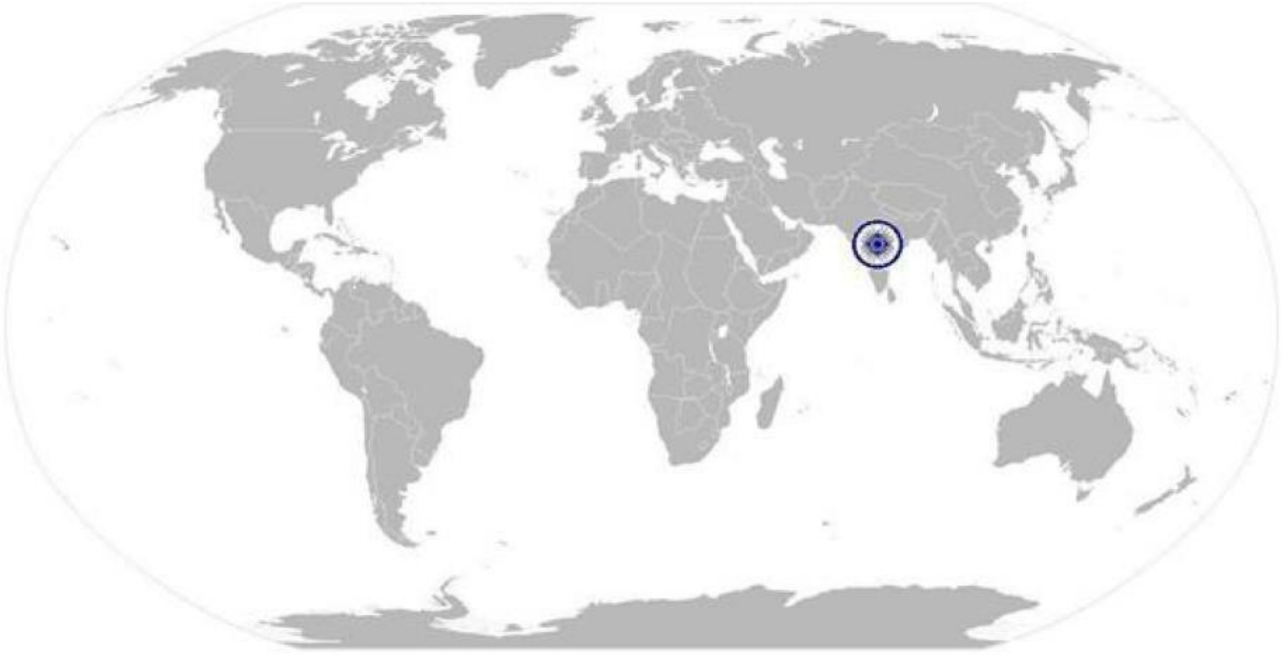
National Occupational Standard



Overview

This unit is about understanding the events of troubleshooting a fault in process plant.

IAS/N2203 **Troubleshooting of faults in Process Plant**

National Occupational Standard

Unit Code	**IAS/N2203**
Unit Title (Task)	**Troubleshooting of faults in Process Plant**
Description	This unit is about to understand the process of troubleshooting a fault in a process plant.
Scope	This unit/task covers the following: • Gathering information of Products, Hardware and Software Support • Testing hardware components and logic in PLC • Installation of replaced products & schedule tasks
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Gathering Information of Products, Hardware and Software Support	To be competent, the user/individual on the job must be able to PC1. Ask the problem in the plant to the Supervisor/Engineer PC2. Prepare document and flow chart before rectifying the problem PC3. Check the control drawing of the plant connected with the different modules PC4. Check the availability of additional modules, equipment and electrical components on site PC5. Refer the settings of Instruments and installation guidelines PC6. Check the availability and healthiness of the PC stations used for operating the plant PC7. Check the availability of software & program backup in plant
Testing hardware component and logic in PLC	PC8. Test the panel and signal modules which are used in the plant PC9. Check earthing and power supply properly before troubleshooting PC10. Cross check whether the controller and its module are in operating state PC11. Communication cables are supporting the protocol and are healthy PC12. Make changes in running project program if it is required to rectify the faults PC13. Perform necessary checks on PC stations for smooth performance
Installation of replaced products & schedule tasks	PC14. Match the product according to the catalog number with the drawing PC15. Replace and install the module/equipment if it is found faulty PC16. Parameter of the connected load must be entered accurately in controller PC17. Take a program backup before and after troubleshooting PC18. Get the parameter reading according to schedule PC19. Install, test and start-up plant on-site PC20. Prepare a site report after troubleshooting and mention the remedy
Knowledge & Understanding (K)	

IAS/N2203 **Troubleshooting of faults in Process Plant**

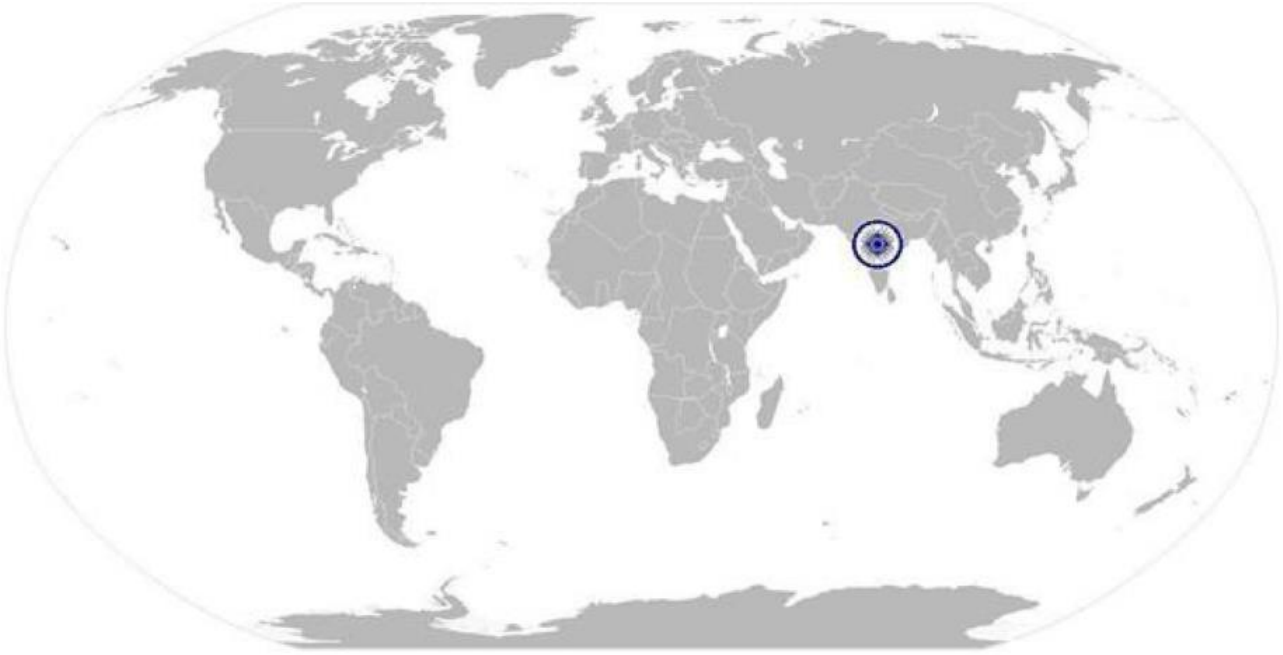
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. Company's code of conduct, organization culture and reporting structure KA2. Company's documentation policy KA3. Departments involved with maintenance KA4. Quality and standards system followed in the company
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. Electrical, electronics and instrumentation KB2. Basics of computer and operating systems KB3. Standard operating procedure (SOP) of the organization for control panel development process KB4. Basics of machine safety and normal safety processes KB5. Quality, standards and guidelines to be followed during design development KB6. PLC module and equipments used in the automation process KB7. DCS programming software KB8. Application software, Installation and debugging KB9. General arrangement drawing KB10. Piping and instrumentation diagram (P&ID) KB11. Basics on industrial process involved (example: oil and gas, refinery, etc) and stages involved in the process KB12. Basics on infrastructure process involved in the industry (example: water treatment plant, chilling units etc.) KB13. Safety aspects to be inbuilt in the control panel system as per the process requirement KB14. Instrumentation used in the factory and its wiring concept KB15. Electrical panel and wiring knowledge KB16. Testing process and parameters involved in the testing KB17. Electronics indicators, switchgear and panel accessories KB18. IEC Standards KB19. Relevant regulations, standards and codes of practice and their implications on the troubleshooting KB20. How to communicate with shop floor technicians in order to resolve any discrepancies during troubleshooting KB21. Basic power systems, motor fundamentals, drive systems fundamentals
Skills (S)	
A. Core Skills/ Generic Skills	**Writing Skills**
	The individual on the job needs to know and understand how to: SA1. Compose e mails, letters and other official documents clearly SA2. Write user requirements SA3. Write technical documentation SA4. Write test reports SA5. Write schedules and timelines

	Reading Skills
	The individual on the job needs to know and understand how to: SA6. Read user requirements SA7. Read technical specifications SA8. Read standards and regulatory compliance documents SA9. Read schedules and timelines SA10. Read drawings
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA11. Question customers appropriately in order to understand the faults and to analyse the solution SA12. Discuss task lists, schedules and work-loads with co-workers SA13. Give clear directions to customers SA14. Keep customers informed about progress SA15. Use simple and clear language when communicating with a customer SA16. Report issues and problems to managers in clear terms
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. Make decisions pertaining to the scope of work SB2. Make decisions pertaining to the appropriate solution to customer problem SB3. Make decisions pertaining to readiness of the system after solving the issues SB4. Make decisions pertaining to start the process plant
	Plan and Organise
	The user/individual on the job needs to know and understand: SB5. Plan and organize project - including requirements, design and integration, testing, installation and commissioning, Customer Acceptance Test and customer feedback SB6. Anticipate issues and have alternate strategy
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB7. Understand real needs of the customer and suggest most appropriate solution SB8. Support customer when they need help SB9. Make customer happy and teach them to handle issues and troubleshoot the plant if necessary SB10. Manage relationships with customers who may be stressed, frustrated, confused or angry SB11. Build and maintain good relationships with customer for self troubleshooting the plant by assisting online

	Problem Solving
	The user/individual on the job needs to know and understand how to: SB12. Think through the problem, evaluate the possible solution(s) and suggest an optimum /best possible solution(s) SB13. Deal with clients lacking the technical background to solve the problem on their behalf SB14. Identify immediate or temporary solutions to resolve delays - and implement the proper solution when possible
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB15. Use the existing information to arrive at actionable decision points SB16. Use the existing information for improving the customer satisfaction SB17. Use the existing information to optimize solution and bring machine/plant in running state SB18. Analyze problems and identify causes and possible solutions
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB19. Apply, analyze, and evaluate the information gathered from observation, experience, reasoning, or communication, as a guide to thought and action SB20. Anticipate problems, risks and opportunities and utilize these for further troubleshooting of the process

NOS Version Control

NOS Code	IAS/N2203		
Credits (NSQF)	TBD	Version number	1.0
Industry	Instrumentation Automation Surveillance & Communication	Drafted on	15/09/2017
Industry Sub-sector	Automation	Last reviewed on	15/09/2017
Occupation	DCS Programming, Comissioning & troubleshooting	Next review date	15/09/2019



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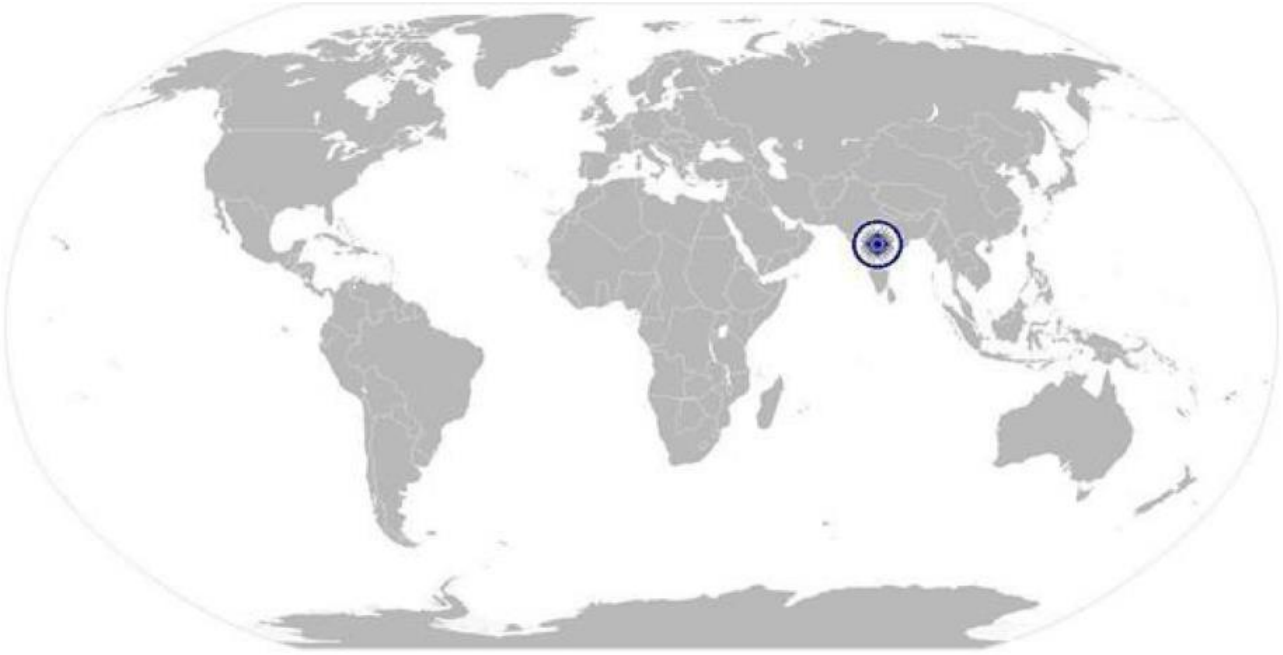


Overview

This unit is about the individual's responsibility to maintain a safe, healthy and secure working environment.

National Occupational Standard

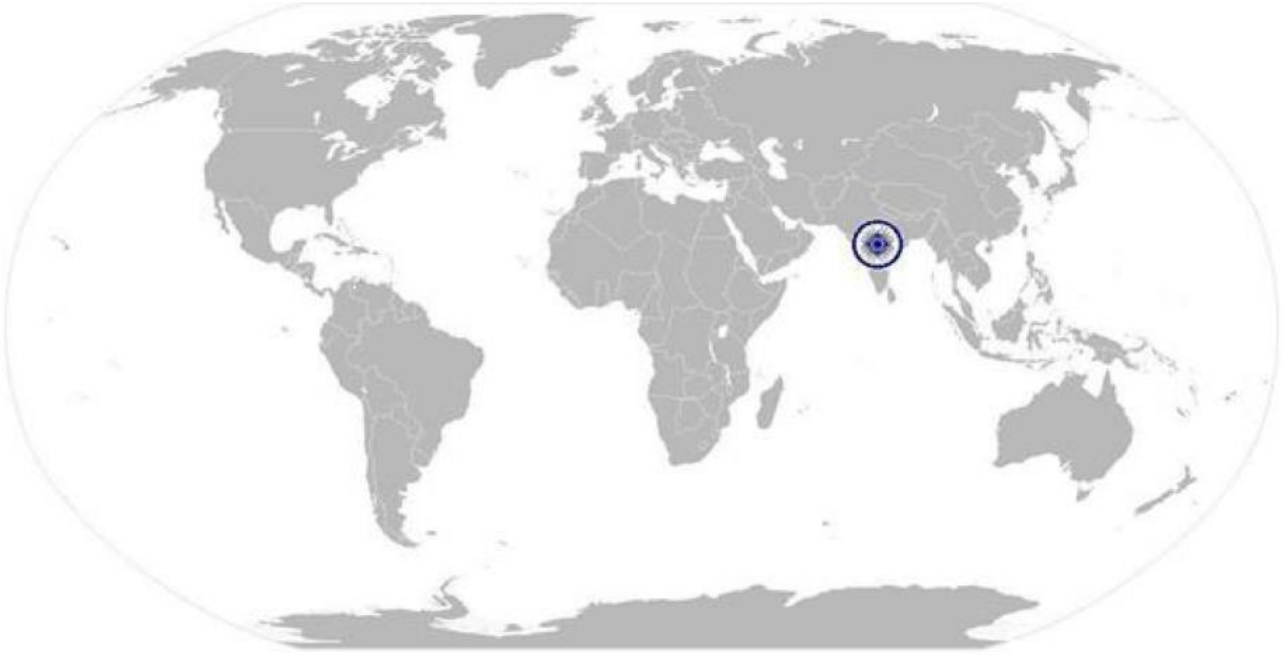
Unit Code	IAS/N2005
Unit Title (Task)	**Health and Safety in Workplace**
Description	This unit is about following adequate safety procedures to make work environment safe and healthy.
Scope	This unit/task covers the following: • Following safety measures and standards • Maintaining good health and posture
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Following safety measures and standards	To be competent, the individual must be able to: PC1. Comply with general and special safety procedures followed in the Company PC2. Follow specified safety procedures while handling an equipment, hazardous material or tool PC3. Remove ties, finger rings, or any other metal objects which may interfere with the work PC4. Use safety materials such as goggles, gloves, ear plugs, caps, ESD pins, covers, shoes, etc. PC5. Escalate about any hazardous materials or things found in the premises PC6. Report about any breach of safety procedure in the company PC7. Ensure zero accidents at work PC8. Avoid damage of components due to negligence in ESD procedures PC9. Regularly participate in fire drills or other safety related workshops organized by the company PC10. Ensure no loss for company due to safety negligence
Maintaining good health and posture	PC11. Maintain appropriate posture, especially in long hours of sitting or standing position and in handling heavy materials PC12. Participate in company organized health sessions such as yoga, physiotherapy or games PC13. Handle heavy and hazardous materials with care and using appropriate tools and handling equipment such as trolleys, jacks and ladders
Knowledge & Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The individual on the job needs to know and understand: KA1. Company's policies on: incentives, delivery standards, and personnel management KA2. Company occupational safety and health policies KA3. Company emergency evacuation procedure KA4. Company's medical policy

B. Technical Knowledge	The individual on the job needs to know and understand: KB1. How to maintain the work area safe and secure KB2. How to handle hazardous materials, tools and equipment KB3. Emergency procedures to be followed such as fire accidents, electrocution etc. KB4. Long term value of good posture and use of appropriate handling equipment KB5. Safety regulations and standards and how to apply these KB6. Electrical grounding practices
Skills (S)	
A. Core Skills/ Generic Skills	**Writing Skills**
	The individual on the job needs to know and understand: SA1. Compose E-mails, letters, memos, reminders, and other documents clearly SA2. Share knowledge, issues, problems and resolutions relating to safety and health
	Reading Skills
	The individual on the job needs to know and understand: SA3. Read mails, messages, alerts SA4. Read pictures, drawings, notes relating to safety and health
	Oral Communication (Listening and Speaking skills)
	The individual on the job needs to know and understand: SA5. Question co-workers in order to understand the safety and health issues SA6. Inform co-workers about safety and health issues SA7. Report issues and problems relating to safety and health to managers in clear terms
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. Make decisions pertaining to safety and health issues at workplace SB2. Make decisions about escalating safety and health issues at workplace to managers
	Plan and Organise
	The user/individual on the job needs to know and understand: SB3. Plan and organize work conforming to the safety and health norms of the company
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB4. Discuss customer needs with co-workers and identify most appropriate solution make customer happy and make them want

	to work with the company
	Problem Solving
	The user/individual on the job needs to know and understand how to: SB5. Discuss problems relating to the safety and health, evaluate the possible solution(s) and arrive at optimum /best possible solution(s)in consultation with concerned people
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB6. Discuss use the available information with co-workers to arrive at actionable decision points SB7. Analyze problems in team and identify causes and possible solutions
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB8. Collaborate with co-workers to analyze, and evaluate the information gathered from collective observation, experience, reasoning, or communication, as a guide to teamwork

NOS Version Control

NOS Code	IAS/N2005		
Credits (NSQF)	TBD	Version number	1.0
Industry	Instrumentation Automation Surveillance & Communication	Drafted on	15/09/2017
Industry Sub-sector	Automation	Last reviewed on	15/09/2017
Occupation	DCS Programming, Comissioning & troubleshooting	Next review date	15/09/2019



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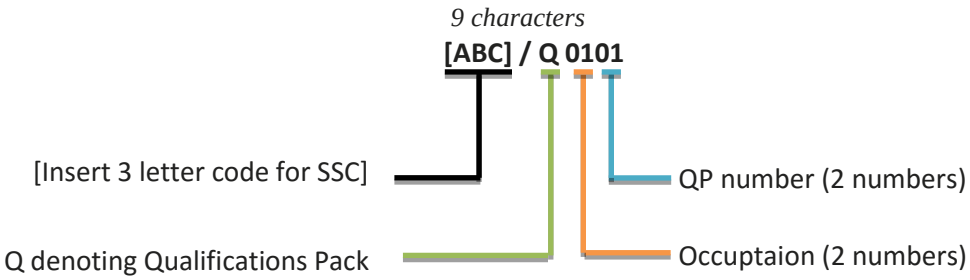
Annexure

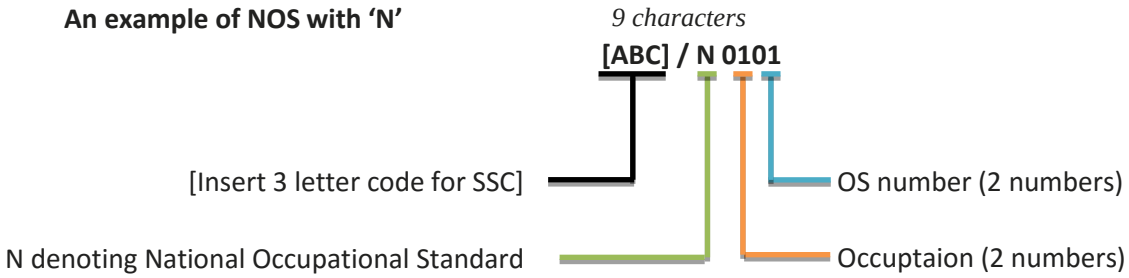
Nomenclature for QP and NOS

Qualification Pack



Occupational Standard

An example of NOS with 'N'



The following acronyms/codes have been used in the nomenclature above:

Sub-sector	Range of Occupation numbers
Installation & Commissioning	00-29
Operation & Maintenance	30-49
Calibration	50-55
Design, Fabrication / Manufacturing	56-79
Design, Fabrication, Installation & commissioning	80-89
General	90-99

Sequence	Description	Example
Three letters	Industry name	[ABC, Font: Calibri (Body), size 11]
Slash	/	/
Next letter	Whether **Q**P or **N**OS	N
Next two numbers	Occupation code	01
Next two numbers	OS number	01

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CRITERIA FOR ASSESSMENT OF TRAINEES

Job Role DCS Programmer and Troubleshooter
Qualification Pack IAS/Q8003
Sector Skill Council Instrumentation Automation Surveillance & Communication

Guidelines for Assessment

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC
3. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below).
4. Individual assessment agencies will create unique evaulations for skill practical for every student at each examination/training center based on this criteria.
5. To pass the Qualification Pack , every trainee should score a minimum of 70% in every NOS. In case of successfully passing only certain number of NOS's, the trainee is eligible to take subsequent assessment on the balance NOS's to pass the Qualification Pack.

		Marks Allocation			
Assessment outcomes	Assessment Criteria for outcomes	**Total Mark (610)**	**Out Of**	**Theory**	**Skills Practical**
1.IAS/N2200 Understanding the DCS Control Panel & PLC Module / Equipments	PC1. Identify the customer requirement of the DCS Control Panel	**115**	10	10	0
	PC2. Interact with customer & understand number of field equipment's and number of I/Os that needs to be connected to PLC		10	5	5
	PC3. Interact with customer for Panel switches and then guiding fabrication team for the cutouts on panel door		10	5	5
	PC4. Assisting the technician for panel manufacturing		10	5	5
	PC5. Examine the panel and perform Factory Acceptance Test (FAT)		10	0	10
	PC6. Understand the Mains power supply unit for powering PLC and remote panels		10	5	5
	PC7. Understand the signal modules used in the panels		10	10	0
	PC8. Examine the wiring of the signal modules with other components in the panel		10	0	10
	PC9. Examine the wiring of the special modules, if any		5	0	5

	PC10. Understand the wiring diagrams between the PLC modules and the equipments/ components used in panel		5	5	0
	PC11. Understand the ferrule numbers used for the wiring in panel		10	10	0
	PC12. Understand the equipment's like switches, push buttons, lamps, relays, contactors etc used in panel		10	10	0
	PC13. Understand the terminal base along with the numbering used in panel		5	5	0
		Total	115	70	45
2. IAS/N2201 Developing PLC Program and SCADA project using DCS Software	PC1. Identify the Organization/Customer approved Software and use it for developing the process logics and Operator interface	**150**	10	10	0
	PC2. Collect information related to pre-requisites for software installation on PC/Laptops for programming		5	5	0
	PC3. Ensure availability of others software's like Office, Adobe reader, Windows features etc. which are required for the DCS programming software.		5	5	0
	PC4. Identify the Operating System of PC/Laptop where DCS is to be Installed		5	5	0
	PC5. Ensure the communication protocol to be used for communicating between programming software, PLC and Operator station (HMI)		5	5	0
	PC6. Check the availability of the communication port on PC/Laptop		5	0	5
	PC7. Gather basic knowledge on different types of programming language available within the software		5	5	0
	PC8. Acquire & collect information of basic program blocks in the DCS software		5	5	0
	PC9. Identify and examine special programming blocks which has functionalities to create SCADA objects on the Operator station		10	0	10
	PC10. Get detail information on communication program blocks used specially for communication between different components		10	0	10
	PC11. Gather detailed information about the timely execution of program blocks in the controller		10	0	10
	PC12. Using appropriate programming language as per standards		10	0	10

	PC13. Discuss & collect information from customer regarding the equipments and instruments used in the plant		5	0	5
	PC14. Prepare IO list and give necessary comments from the inputs given by customer		10	0	10
	PC15. Configure the hardware details of Controller, Remote stations and PC stations used as operator stations in DCS Software		10	0	10
	PC16. Set parameters in signal modules and other remote devices for better performance in the plant		5	0	5
	PC17. Discuss with customer to understand the automation required in the process plant		5	5	0
	PC18. Develop the program as per customer inputs and functional process description		10	0	10
	PC19. Create Operator station (HMI) project and establish connection with the controller		5	0	5
	PC20. Develop pictures, Graphic objects and provide animations as per customers requirement and according to P&ID		10	0	10
	PC21. Develop archive system and security levels in the HMI/SCADA project		5	0	5
		Total	150	45	105
3. IAS/N2202 Testing and commissioning DCS project using trial runs onsite	PC1. Complete the program and examine it using software checks like compilation	**170**	10	0	10
	PC2. Download the compilation error free program to controller		5	0	5
	PC3. Activate the respective Inputs and outputs in software to check the automation logic and thereby identify any error		10	0	10
	PC4. Modify and edit the logical error, data address overlap & wrong IO address access to maximize program stability		10	0	10
	PC5. Continue with further checks to eliminate the logical & address errors		5	0	5
	PC6. Activate the SCADA project in runtime and carry out the Input Output checks on SCADA systems		5	0	5
	PC7. Test the animations on the runtime screens		5	0	5
	PC8. Connect actual sensors and actuators to signal modules to check the hardware components		5	0	5
	PC9. According to customer requirement create PC Stations in the DCS projects		10	0	10
	PC10. Collect information about the architecture of the SCADA system in the plant		5	5	0

	PC11. Create Server and client projects in the DCS software		10	0	10
	PC12. Identify Server Operating System and Client Operating System for the DCS Software		5	5	0
	PC13. Configure and prepare PC stations with respective software's and licenses installed		10	0	10
	PC14. Transfer the SCADA projects to respective PC stations for example, Server PC and Client PC		10	0	10
	PC15. Establish the connections between Server PC and Controller as well as Server PC and Client PC through Ethernet Switch		10	0	10
	PC16. Inform customer about the preliminary check of IO's and gather information about availability of resources for trial runs		5	5	0
	PC17. Get permissions from customer for execution of process through program		5	5	0
	PC18. Train the operators to educate them the sequence of operation in case of emergency		10	10	0
	PC19. Prepare a standard operating procedure (SOP) for the logic and SCADA operation developed for the customer		5	5	0
	PC20. Collect the backup of the final DCS project and submit a copy to the plant head for future reference		5	5	0
	PC21. Identify hardware and software related errors in the plant		5	5	0
	PC22. Ensure use of appropriate programming logics to avoid non functionality of controller due to hardware errors		5	5	0
	PC23. Generate outputs from error handling program for error monitoring on SCADA systems		5	0	5
	PC24. Examine these error handling programs by physically creating faults like supply failure, communication break, IO channel error, module failure etc.		5	0	5
	PC25. Ensure completion of Site Acceptance Test (SAT) and send report to customer		5	5	0
		Total	170	55	115
4. IAS/N2203 Troubleshooting of faults in Process Plant	PC1. Ask the problem in the plant to the Supervisor/Engineer	**105**	5	5	0
	PC2. Prepare document and flow chart before rectifying the problem		5	5	0
	PC3. Check the control drawing of the plant connected with the different modules		5	5	0
	PC4. Check the availability of additional modules, equipment and electrical components on site		5	5	0
	PC5. Refer the settings of Instruments and		5	5	0

	installation guidelines				
	PC6. Check the availability and healthiness of the PC stations used for operating the plant		5	0	5
	PC7. Check the availability of software & program backup in plant		5	5	0
	PC8. Test the panel and signal modules which are used in the plant		5	0	5
	PC9. Check earthing and power supply properly before troubleshooting		5	0	5
	PC10. Cross check whether the controller and its module are in operating state		5	0	5
	PC11. Communication cables are supporting the protocol and are healthy		5	0	5
	PC12. Make changes in running project program if it is required to rectify the faults		5	0	5
	PC13. Perform necessary checks on PC stations for smooth performance		5	0	5
	PC14. Match the product according to the catalog number with the drawing		5	5	0
	PC15. Replace and install the module/equipment if it is found faulty		5	5	0
	PC16. Parameter of the connected load must be entered accurately in controller		5	0	5
	PC17. Take a program backup before and after troubleshooting		5	0	5
	PC18. Get the parameter reading according to schedule		5	0	5
	PC19. Install, test and start-up plant on-site		10	0	10
	PC20. Prepare a site report after troubleshooting and mention the remedy		5	5	0
		Total	105	45	60
5. IAS/N2005 Health and Safety in Workplace	PC1. Comply with general and special safety procedures followed in the Company	**70**	10	10	0
	PC2. Follow specified safety procedures while handling an equipment, hazardous material or tool		5	0	5
	PC3. Remove ties, finger rings, or any other metal objects which may interfere with the work		5	0	5
	PC4. Use safety materials such as goggles, gloves, ear plugs, caps, ESD pins, covers, shoes, etc.		5	5	5
	PC5. Escalate about any hazardous materials or things found in the premises		5	5	0
	PC6. Report about any breach of safety procedure in the company		5	5	0
	PC7. Ensure zero accidents at work		5	5	0
	PC8. Avoid damage of components due to negligence in ESD procedures		5	0	5
	PC9. Regularly participate in fire drills or other		5	0	5

	safety related workshops organized by the company				
	PC10. Ensure no loss for company due to safety negligence		5	5	0
	PC11. Maintain appropriate posture, especially in long hours of sitting or standing position and in handling heavy materials		5	0	5
	PC12. Participate in company organized health sessions such as yoga, physiotherapy or games		5	0	5
	PC13. Handle heavy and hazardous materials with care and using appropriate tools and handling equipment such as trolleys, jacks and ladders		5	0	5
		Total	70	30	40

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