

QUALIFICATIONS PACK - OCCUPATIONAL STANDARDS FOR INSTRUMENTATION AUTOMATION SURVEILLANCE AND COMMUNICATION

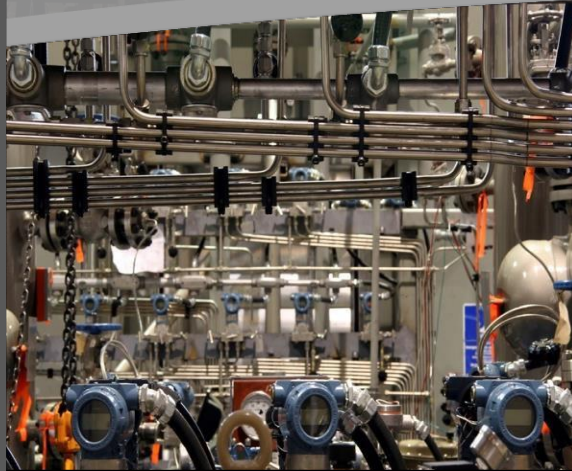
What are Occupational Standards (OS)?

- 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

Qualifications Pack- Installer and Operator- Additive Manufacturing (3D Printing)

SECTOR: Instrumentation Automation Surveillance & Communication

SUB-SECTOR: Instrumentation, Automation

OCCUPATION: Installation & Commissioning; Operation & Maintenance

REFERENCE ID: IAS/Q4500

ALIGNED TO: NCO-2015/ NIL

Installer and Operator- Additive Manufacturing (3D Printing) works in industries related to Additive Manufacturing. The Installer is normally employed by the Authorized Dealer of Printer Manufacturer. The Operator is engaged by Additive Manufacturing Design and Services companies.

Brief Job Description: Install a 3D Printer, Configure the Hardware and Software, Calibrate it and successfully demonstrate its operation to the customer. The technician is capable of operating the machine for additive manufacturing, maintaining it and seeking technical service support.

Personal Attributes: Is multi skilled, organized, team player, customer centric and able to work in unfamiliar surroundings. Pays attention to details and has an eye for the quality. Able to spot defects and trace it back to root cause. Gets resolution of tricky problems from experts.

Qualifications Pack For: Installer and Operator- Additive Manufacturing (3D Printing)

Job Details	Qualifications Pack Code	IAS/Q4500		
	Job Role	Installer and Operator- Additive Manufacturing (3D Printing)		
	Credits(NSQF)	TBD	Version number	1.0
	Sector	Instrumentation Automation Surveillance & Communication	Drafted on	01 June 2017
	Sub-sector	Automation	Last reviewed on	01 June 2017
	Occupation	Installation & Commissioning; Operation & Maintenance	Next review date	10 June 2019

Job Role	Installer and Operator- Additive Manufacturing (3D Printing)
Role Description	Install a 3D Printer, Configure, Calibrate and successfully demonstrate to the customer. Can operate the machine for additive manufacturing, maintain and seek service support.
NSQF level	4
Minimum Educational Qualifications*	10th Pass
Maximum Educational Qualifications*	NA
Training (Suggested but not mandatory)	Hands on training on installation, calibration and technical support of 3D Printer by manufacturer or dealer
Minimum Job Entry (Age)	18 Years
Experience	2 year experience in Installation and configuring of hardware and software related to computers and related peripherals.
Applicable National Occupational Standards (NOS)	<p>Compulsory:</p> <ol style="list-style-type: none"> IAS/N3001 Installation and Commissioning of 3D Printer IAS/N3002 Maintenance and Technical Support of 3D Printer IAS/N2003 Health and Safety in Workplace IAS/N2105 Work Effectively With Teams <p>Optional:</p> <ol style="list-style-type: none"> IAS/N3003 Operation and Optimization of 3D Printing for Additive Manufacturing
Performance Criteria	As described in the relevant OS units

Qualifications Pack For: Installer and Operator- Additive Manufacturing (3D Printing)

Definitions

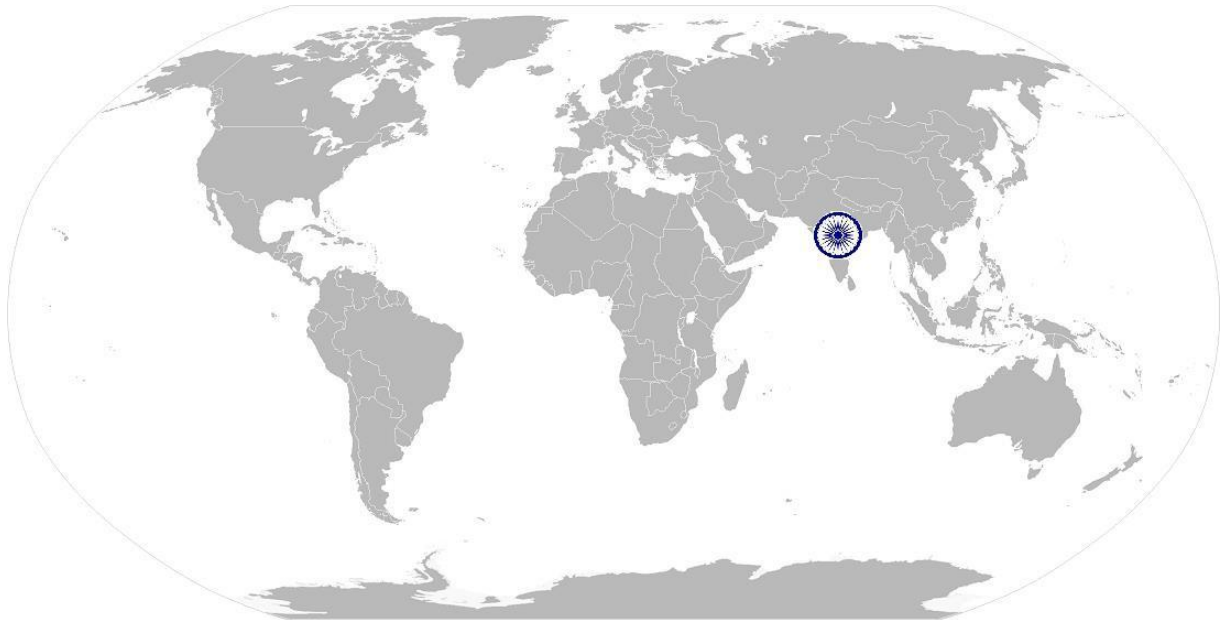
Keywords /Terms	Description
Core skills/generic skills	Core skills or generic skills are a group of skills that are key to learning and working in today’s world. These skills are typically needed in any work environment. In the context of the OS these include communication related skills that are applicable to most job roles.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a data base to verify that this is the appropriate OS they are looking for.
Function	Function is an activity necessary for achieving the key purpose of the sector, occupation, or area of work, which can be carried out by a person or group of persons.
Job Role	Job role defines a unique set of functions that together form a unique employment opportunity in an organization.
Knowledge and understanding	Knowledge and understanding statements which together specify the technical, generic, professional and organizational specific knowledge that an individual needs in order to perform to the required standards.
National occupational standards	NOS are occupational standards which apply uniquely in the Indian context.
Occupation	Occupation is a set of job roles under which role holders perform similar/related set of functions in an industry.
Organizational context	Organizational context includes the way the organization is structured and how it operates, including the operative knowledge managers have of their relevant areas of responsibility.
OS (Occupational Standards)	OS specify the standards of performance an individual must achieve when carrying out a function in the work place together with the knowledge and understanding they need to meet that standard consistently. Occupational standards are applicable both in Indian and global contexts.
Performance Criteria	Performance criteria are statements that together specify the standards of performance required when carrying out a task.
Qualification pack code	Qualification pack code is a unique reference code that identifies a qualification pack.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with, carrying out the function which has a critical impact on the quality of performance required.
Sector	Sector is a conglomeration of different business operation having similar businesses 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.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Unit Code	Unit code is a unique identifier for an ‘OS’ unit which can be denoted with either ‘O’ or ‘N’.
Unit title	Unit title gives clear overall statement about what the incumbent should be able to do.

Qualifications Pack For: Installer and Operator- Additive Manufacturing (3D Printing)

Acronyms & Keywords	Keywords /Terms	Description
	Automation	Industrial automation deals primarily with the automation of manufacturing, quality control and material handling processes.
	3D	Three Dimensional (X, Y and Z axis), i.e. Left to Right, Front to Back and Bottom to Top respectively.
	3D Printer	The physical 3D Printer.
	Packing Material	The packing material like cardboard, plastics, Styrofoam, straps or any other material that is used for shipping and not part of the physical machine.
	Printer Manual	Standard Operating Manual as sent by the Manufacturer with the 3D Printer.
	Hardware	The Physical Machine and its parts.
	Software	The installation software drivers and key operating executable file on the Computer.
	Filament or Material	The input raw material (plastics, Teflon, metal powder etc.) to be used in the Machine.
	Calibration	The installation of the build plate and setup/adjustment of the X, Y and Z axis.
	Build Plate	The area where the Printed object will be built.
	Test Print	The output of the Printer - which is the object created using the material.
	Network	The connection between the 3D Printer and the Computer and the Internet.
	BoQ	Bill of Quantities
PO	Purchase order	

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National Occupational Standard



Overview

This OS unit is about Installation and Commissioning of 3D Printer.

IAS/N3001

Installation and Commissioning-3D Printer

National Occupational Standard	Unit Code	IAS/N3001
	Unit Title (Task)	Installation and Commissioning of 3D Printer
	Description	This OS unit is about unpacking the printer, inspecting, powering on, configuring, making calibration of axes, loading material and taking test print. Mechanical adjustments and software settings are done to get the desired print quality.
	Scope	This unit/task covers the following: <ul style="list-style-type: none"> • Unpacking and Inspecting the 3D Printer • Installing and Configuring the 3D Printer • Calibrating and Test Printing • Confirming the 3D Printer Performance
	Performance Criteria(PC) w.r.t. the Scope	
	Element	Performance Criteria
	Unpacking and Inspecting the 3D Printer	To be competent, the individual on the job must be able to: <ul style="list-style-type: none"> PC1. Have specified inspection and installation checklist ready - in electronic or paper form. PC2. Make sure you are carrying required tools, accessories and consumables. PC3. Verify that there is no shipping damage PC4. Verify shipping details and printer model against order PC5. Remove Packing PC6. Inspect for any damage PC7. Note printer details (Type, Model, Serial no., Options etc.) and verify against PO PC8. Verify received BoQ, including accessories PC9. If any damage or deficiency is found, record it and communicate to the customer, manufacturer/supplier/service center per recommended procedure. Follow company practice about repacking, return shipment and remedial steps.
	Installing and Configuring the 3D Printer	To be competent, the individual on the job must be able to: <ul style="list-style-type: none"> PC10. Inspect the site and verify that it meets the recommended requirements, in terms of space, power connection, ventilation, connectivity, storage of consumables, lighting, temperature etc. PC11. Ensure availability of electrical power of the required quality. Do not connect power cable yet. PC12. Ensure availability of LAN/internet connection if needed for installation. PC13. Locate Printer Manual and Software to be installed. If downloadable, go to the link provided and download the relevant documents. PC14. Ensure availability of printing raw material in the acceptable forms (e.g. filament, powder etc.) PC15. Read and understand the instructions for installation.

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Installation and Commissioning-3D Printer

	<p>PC16. Remove any internal packing, restraining screws, and cable ties etc. which are used for safe transportation.</p> <p>PC17. Check for any loose screws, missing screws, loose parts or debris inside the printer. In case found, handle accordingly.</p> <p>PC18. Verify that all sub-assemblies are in place; and the cables and connectors are properly plugged in.</p> <p>PC19. Verify that the print tray and print head are clean.</p> <p>PC20. Recapitulate the Power-On sequence of the Printer model (i.e. you should know what the printer is expected to do on power up).</p> <p>PC21. Connect power cable of the printer to the wall socket or outlet. Switch on power first at the outlet and then on the printer.</p> <p>PC22. Verify that the expected Power-On routine is followed (such as internal self-tests, appropriate display messages, X, Y, Z axes mechanisms and the print head moving to their initial positions).</p> <p>PC23. If any error is reported, refer to manual about its meaning and what corrective action is needed. Perform the recommended steps and confirm if the error code disappears, replaced by a healthy status.</p> <p>PC24. If the error persists or is fatal, note the error for communication to the supplier/service center per recommended procedure for such cases.</p> <p>PC25. Follow all installation steps as specified in the installation manual, except sample printing, which will be performed in the next activity.</p>
<p>Calibrating and Test Printing</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC26. Perform the Calibration procedure for the printer recommended by the manufacturer. This generally requires leveling and adjustments of X and Y axis platform leveling screws to align the platform perpendicular to Z-axis in the entire print area.</p> <p>PC27. Take a test print with the recommended model. Note that it may take a long time, lasting tens of minutes to hours, depending on the size and complexity of the test model.</p> <p>PC28. Observe the result carefully and notice any deficiency, referring to the manual for guidance about assessing test print quality.</p> <p>PC29. If any adjustment is indicated, perform the operation.</p> <p>PC30. Repeat the test print and verify quality. Repeat the steps 27-29 till satisfactory print is obtained.</p> <p>PC31. If the desired print quality is not obtained following the recommended calibration procedure, contact the manufacturer's technical support team and get help.</p>
<p>Confirming the 3D Printer Performance</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC32. Ensure that the printer prints correctly the specified material(s) in the specified forms.</p> <p>PC33. Ensure that the printer prints correctly within the specified volume. Refer to manual for guidance.</p> <p>PC34. Ensure that the print quality is satisfactory - specifically that the resolution is met and there are no discontinuities, jagged edges or undesirable marks or protrusions on the surface.</p> <p>PC35. Ensure that the printing speed is within the specified limits.</p>

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Installation and Commissioning-3D Printer

	<p>PC36. Ensure that the material of the specified type and form feeds correctly.</p> <p>PC37. Prepare installation report and get it signed by the customer.</p> <p>PC38. Have the customer register the printer for warranty coverage.</p>
Knowledge and Understanding (K)	
<p>A. Organizational Context (Knowledge of the company / organization and its processes)</p>	<p>The individual on the job needs to know and understand:</p> <p>KA1. Company hierarchy and reporting structure</p> <p>KA2. Company code of conduct</p> <p>KA3. company culture</p> <p>KA4. Company documentation policy</p> <p>KA5. Quality and standards systems followed in the company</p> <p>KA6. Company business, locations, products, services and clients</p> <p>KA7. Company website, contacts</p> <p>KA8. Partners, their products and services</p> <p>KA9. Company sales and after sales policies</p>
<p>B. Technical Knowledge</p>	<p>The user/individual on the job needs to know and understand:</p> <p>KB1. Installation of common computer hardware and software and internet connection</p> <p>KB2. Operate the printer and provide operational and technical support to the end user.</p> <p>KB3. About Additive manufacturing and use of 3D printing</p> <p>KB4. About 3D printing technologies, advantages and shortcomings</p> <p>KB5. Difference between rapid prototyping machine and a 3D printer</p> <p>KB6. Capabilities of 3D printers - specifically the models supported by your company</p> <p>KB7. Established manufacturers of 3D printers</p> <p>KB8. Popular materials used to print 3D objects - specifically about the material supported by your company</p> <p>KB9. Popular 3D modeling software - specifically, suitable for beginners in 3D design</p> <p>KB10. Useful online information on 3D Printing</p> <p>KB11. How to make adjustments, calibration, performance improvement of printers supported by your company</p> <p>KB12. How material is fed into printer head</p> <p>KB13. How to handle filament breakage and feeding new filament</p> <p>KB14. Use of multi head printers</p> <p>KB15. How to clean the printer platform and the print head</p> <p>KB16. How to perform preventive maintenance</p> <p>KB17. How to get technical support from the manufacturer</p> <p>KB18. Open source software related to 3D printing, modeling, additive printing</p>
Skills (S) [Optional]	
<p>A. Core Skills/ Generic</p>	<p>Writing Skills</p>

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Installation and Commissioning-3D Printer

Skills	<p>The user/individual on the job needs to know and understand how to:</p> <p>SA1. Compose e-mails, letters and other official documents clearly SA2. Write test reports SA3. Write plans, schedules and timelines</p>
	Reading Skills
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SA4. Read user requirements and PO SA5. Read technical specifications, drawings, manuals, instructions SA6. Read standards and regulatory compliance documents SA7. Read schedules and timelines</p>
	Oral Communication
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SA8. Discuss schedules and work items with co-workers SA9. Keep customers informed about progress SA10. Avoid using jargon, slang or acronyms when communicating with a customer SA11. Report issues and problems to manufacturer's technical support team in clear terms</p>
B. Professional Skills	Decision Making
	<p>The individual on the job needs to take decision pertaining to:</p> <p>SB1. Shortcomings in received printer and action needed SB2. Acceptance of a test print as successful; to decide if the printer is installed correctly or needs reinstallation. SB3. In case of reported printing issues, to confirm if instructions in Product Manual are followed correctly by user, so as isolate the root cause to user error, material defect or product fault. SB4. When to report or escalate issues to Technical Support</p>
	Plan and Organize
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB5. Plan installation of printers at different customer locations. SB6. Organize expert support from within/outside organization for introducing new technology</p>
	Customer Centricity
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB7. Understand real needs of the customer and suggest most appropriate solution SB8. Support customer when they need help</p>
	Problem Solving

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Installation and Commissioning-3D Printer

	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB9. Think through the problem, evaluate the possible solution(s) and suggest an optimum/best possible solution(s)</p> <p>SB10. Identify intermediate or temporary solutions to resolve delays</p>
	<p style="text-align: center;">Analytical Thinking</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB11. Use the existing information to arrive at actionable decision points</p> <p>SB12. Use the existing information for improving the customer satisfaction</p> <p>SB13. Use the existing information to optimize solution and company business</p> <p>SB14. Analyze problems and identify causes and possible solutions</p>
	<p style="text-align: center;">Critical Thinking</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB15. Analyze and apply the information gathered from observation and experience as a guide to interaction with customer and support team</p>

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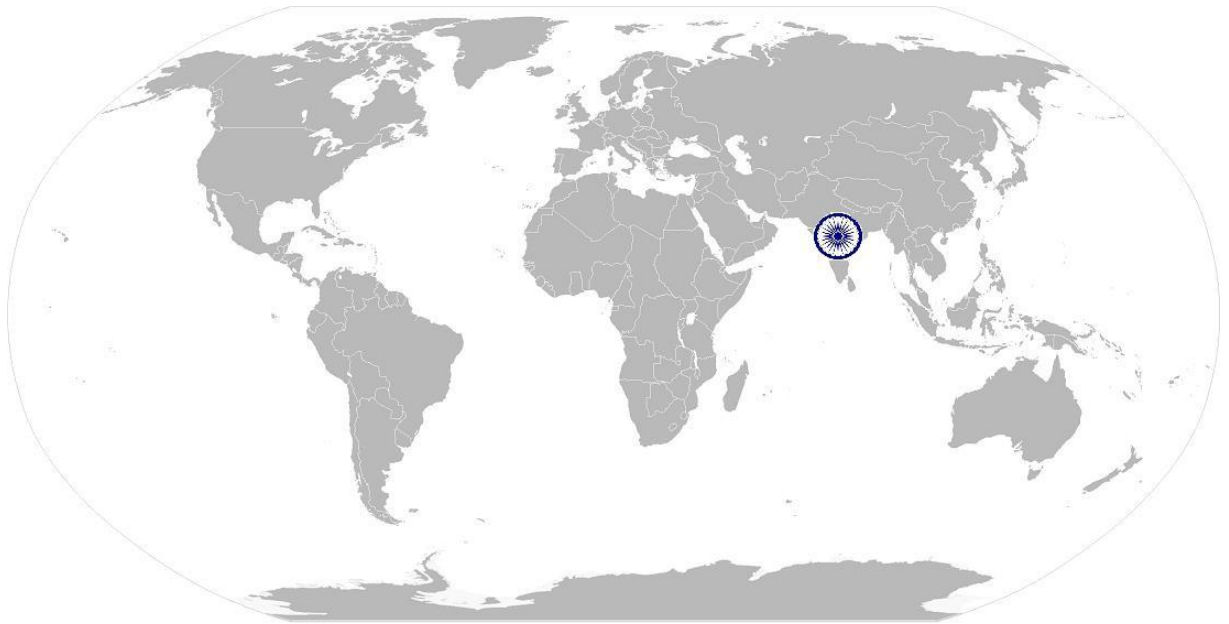
Installation and Commissioning-3D Printer

NOS Version Control

NOS Code	IAS/N3001		
Credits(NVEQF/NVQF/NSQF) [OPTIONAL]	TBD	Version number	0.1
Industry	Instrumentation Automation Surveillance & Communication	Drafted on	10/06/2017
Industry Sub-sector	Automation	Last reviewed on	10/06/2017
Occupation	Installation & Commissioning	Next review date	10/06/2019

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National Occupational Standard



Overview

This OS unit is about performing routine maintenance of 3D Printer and to provide technical support when required.

IAS/N3002

Maintenance and Technical Support of 3D Printer

National Occupational Standard

Unit Code	IAS/N3002
Unit Title (Task)	Maintenance and Technical Support of 3D Printer
Description	This OS unit is about performing routine maintenance of 3D Printer and to provide technical support when required.
Scope	This unit/task covers the following: <ul style="list-style-type: none"> Preventive Maintenance of 3D Printer Post Installation Technical Support
Performance Criteria(PC) w.r.t. the Scope	
Element	Performance Criteria
Preventive Maintenance of 3D Printer	<p>To be competent, the individual on the job must be able to:</p> <p>PC1. For any maintenance, make sure the printer is turned off and the build plate is cool so as to avoid injury.</p> <p>PC2. Use recommended tools and wear gloves.</p> <p>PC3. Follow the periodic cleaning and other maintenance procedures as recommended by the manufacturer for the make/model of printer.</p> <p>PC4. Follow safety procedures recommended by the manufacturer for the make/model of printer.</p> <p>PC5. Remove old prints/objects on the build plate.</p> <p>PC6. Clean the build plate (Hot Bed/Printing Platform) for any residue causing uneven surface. Perform manufacturer recommended procedure.</p> <p>PC7. To remove filament (material) from the machine use the method recommended by the manufacturer for the make/model of printer.</p> <p>PC8. To clean the filament feeder use the method recommended by the manufacturer for the make/model of printer. This may require printer to be unloaded (i.e. filament spool removed).</p> <p>PC9. Lubricate the axis mechanisms periodically following manufacturer's recommendations. Do not over lubricate and only use recommended oil/grease.</p>

IAS/N3002

Maintenance and Technical Support of 3D Printer

<p>Post Installation Technical Support</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC10. Get all details of the printer settings, print jobs performed, filament material used</p> <p>PC11. Understand the performance issue faced by the customer.</p> <p>PC12. Analyze the issue and find possible reasons, referring to the troubleshooting guide provided by the manufacturer.</p> <p>PC13. Try to categorize the issue and if any solution/suggestions found in the troubleshooting manual, try those:</p> <ol style="list-style-type: none"> a. Material and feed related b. Print-head related c. Alignment related d. Resolution related e. Quality of print related f. Software related g. Reliability related h. Other <p>PC14. If no solution found, or the suggested fix doesn't work contact the Technical Support team of the manufacturer, with copy to the customer.</p> <p>PC15. Log complaint and get trouble ticket number.</p> <p>PC16. Talk to the support team and make sure they understand the issue.</p> <p>PC17. Follow up to get a resolution that works.</p> <p>PC18. In case of delay, non-resolution escalate the matter per defined process.</p> <p>PC19. Close the issue and make sure the customer is satisfied.</p> <p>PC20. Perform Hardware and Software upgrades, customizations etc. per company policies and notifications</p> <p>PC21. Perform periodic configurations and calibration per company policies and notifications</p>
<p>Knowledge and Understanding (K)</p>	
<p>Organizational Context (Knowledge of the company / organization and its processes)</p>	<p>The individual on the job needs to know and understand:</p> <p>KA1. Company hierarchy and reporting structure</p> <p>KA2. Company code of conduct</p> <p>KA3. company culture</p> <p>KA4. Company documentation policy</p> <p>KA5. Quality and standards systems followed in the company</p> <p>KA6. Company business, locations, products, services and clients</p> <p>KA7. Company website, contacts</p> <p>KA8. Partners, their products and services</p> <p>KA9. Company sales and after sales policies</p> <p>KA10. Partner Technical Support website, contacts, call centers</p>
<p>Technical Knowledge</p>	<p>The user/individual on the job needs to know and understand:</p> <p>KB1. Operation, maintenance and technical support of 3D Printers supported by the company</p>

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Maintenance and Technical Support of 3D Printer

	<p>KB2. In-depth knowledge about the technologies, capabilities and working of 3D printer models supported by the company</p> <p>KB3. Materials used to print 3D objects for the model supported by the company</p> <p>KB4. How to make adjustments, calibration, performance improvement of printers supported by the company</p> <p>KB5. How material is fed into the printer head</p> <p>KB6. How to handle filament breakage and feeding new filament</p> <p>KB7. How to clean the printer platform and the print head</p> <p>KB8. How to perform preventive maintenance</p> <p>KB9. How to get technical support from the manufacturer</p> <p>KB10. How to perform Hardware and Software upgrades</p>
Skills (S) [Optional]	
Core Skills/ Generic Skills	Writing Skills
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SA1. Compose e-mails, letters and other official documents clearly</p> <p>SA2. Write test reports</p> <p>SA3. Write plans, schedules and timelines</p>
	Reading Skills
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SA4. Read technical specifications, drawings, manuals, instructions</p> <p>SA5. Read 3-D CAD design documents</p> <p>SA6. Read schedules and timelines</p>
	Oral Communication
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SA7. Discuss technical issues, designs with customer</p> <p>SA8. Keep customers informed about progress</p> <p>SA9. Report issues and problems to manufacturer's technical team</p>
Professional Skills	Decision Making
	<p>The individual on the job needs to take decision pertaining to:</p> <p>SB1. Quality and Technical issues in the printer and action needed</p> <p>SB2. Categorizing an issue and troubleshooting accordingly.</p> <p>SB3. When to report or escalate issues to manufacturer's technical team</p>
	Plan and Organize
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB4. Plan preventive maintenance of printers at one or more locations.</p> <p>SB5. Plan printer spares and consumables keeping in view the usage</p>
	Customer Centricity

IAS/N3002

Maintenance and Technical Support of 3D Printer

	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB6. Understand real needs of the customer and suggest most appropriate solution</p> <p>SB7. Support customer when they need help</p>
	<p>Problem Solving</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB8. Think through the problem, evaluate the possible solution(s) and suggest an optimum/best possible solution(s)</p> <p>SB9. Identify intermediate or temporary solutions to resolve delays</p>
	<p>Analytical Thinking</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB10. Use the existing information to arrive at actionable decision points</p> <p>SB11. Use the existing information for improving the customer satisfaction</p> <p>SB12. Use the existing information to optimize solution and company business</p> <p>SB13. Analyze problems and identify causes and possible solutions</p>
	<p>Critical Thinking</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB14. Analyze and apply the information gathered from observation and experience as a guide to interaction with customer and support team</p>

IAS/N3002

Maintenance and Technical Support of 3D Printer

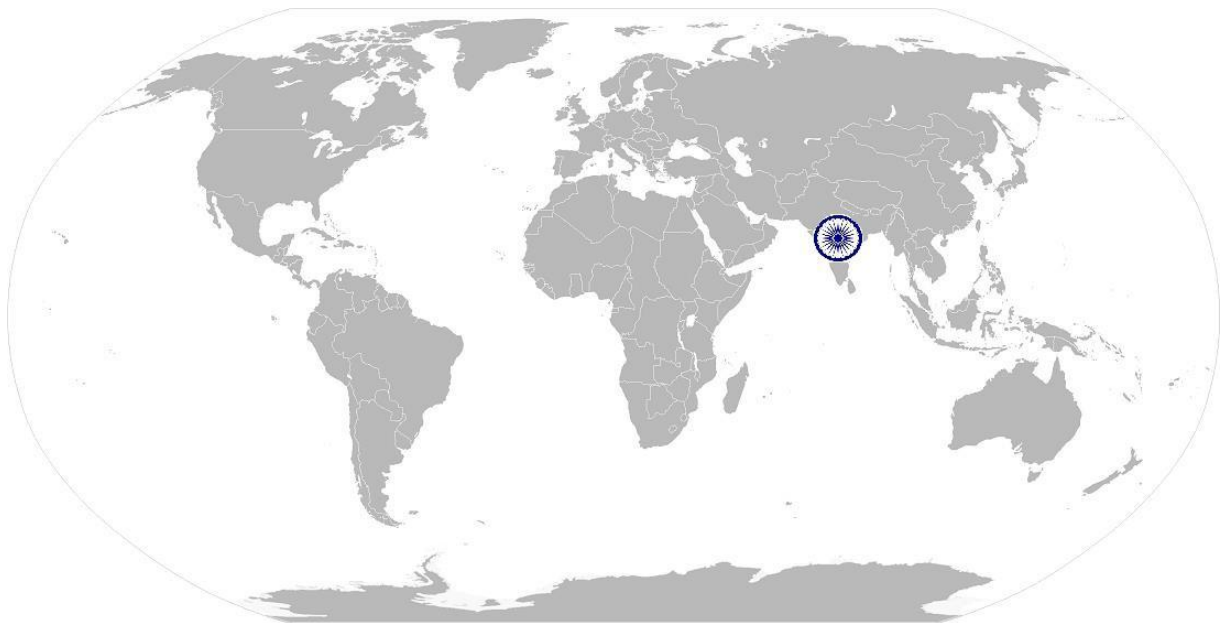
NOS Version Control

NOS Code	IAS/NXXX2		
Credits(NVEQF/NVQF/NSQF) [OPTIONAL]	TBD	Version number	0.1
Industry	Instrumentation Automation Surveillance & Communication	Drafted on	10/06/2017
Industry Sub-sector	Automation	Last reviewed on	10/06/2017
Occupation	Installation & Commissioning; Repair & Maintenance	Next review date	10/06/2019

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IAS/N3003 Operation and Optimization of 3D Printing for Additive Manufacturing

National Occupational Standard



Overview

This OS unit covers the running of the operating 3D Printer for Prototyping or Additive Manufacturing with optimization of 3D CADs. Includes post processing, maintenance, and software/hardware upgrades.

IAS/N3003 Operation and Optimization of 3D Printing for Additive Manufacturing

National Occupational Standard	Unit Code	IAS/N3003
	Unit Title (Task)	Operation and Optimization of 3D Printing for Additive Manufacturing
	Description	This OS unit covers the design and optimization of 3D CAD drawings and operation of 3D Printer for Prototyping or Additive Manufacturing. Includes post processing, maintenance and installing software/hardware upgrades.
	Scope	The scope of this task covers the following: <ul style="list-style-type: none"> • Optimization of CAD Model and drawing file for 3D Printing • 3D Printing and Post Processing • Maintenance & Upgrade of printer
	Performance Criteria(PC) w.r.t. the Scope	
	Element	Performance Criteria
	Optimization of CAD Model and drawing file for printing	To be competent, the user/individual on the job must be able to: <p>PC1. Understand the design of the part to be made.</p> <p>PC2. Understand the part resolution and the material - and verify that these are compatible with the printer.</p> <p>PC3. Import / Open the 3D model created by the user in CAD Software.</p> <p>PC4. Optimize the design for printing - Detect and avoid errors that can arise during the modeling process.</p> <p>PC5. Finalize the Polygonal Model and save it to STL, OBJ or any other format compatible with the printer</p> <p>PC6. Run 3D printing simulation, if available. Make changes if needed.</p> <p>PC7. Ensure connection of the 3D Printer to the CAD design software through LAN or other supported interface</p> <p>PC8. Export the file for 3D printing in compatible format e.g. STL or OBJ</p> <p>PC9. Convert the STL/OBJ File to G-Code</p> <p>PC10. Be able to upload the G-Code into the machine</p>
	3D Printing and Post Processing	To be competent, the user/individual on the job must be able to: <p>PC11. Ensure that the Printer is powered from UPS - as 3D printing normally take several hours to days.</p> <p>PC12. Ensure that the recommended operating environment conditions are met.</p> <p>PC13. Check if the file to be printed is already available on the machine. If not, Import / Load the model design through available interfaces in the correct format.</p> <p>PC14. Set optimum parameters for the printer</p> <p>PC15. Verify that the required input Material, i.e. resin, plastic or metal is loaded</p> <p>PC16. Print the Model using recommended best practices</p> <p>PC17. Allow the system to cool and unload the printed model using recommended device (e.g. spatula).</p> <p>PC18. Perform any post printing operation required by the design or as recommended (i.e. remove supports, polishing, painting etc.).</p>

IAS/N3003 Operation and Optimization of 3D Printing for Additive Manufacturing

	<p>PC19. Depending upon the result, optimize the printer parameters and provide feedback to the model designer for optimization of model to suit printer capabilities.</p> <p>PC20. Clean the Build tray/platform as recommended.</p> <p>PC21. At the end of the batch/day's operation, perform the recommended shut down procedure, if any.</p>
<p>Maintenance & Upgrade of printer</p>	<p>To be competent, the user/individual on the job must be able to:</p> <p>PC22. Comply with relevant Standard Operating Procedures (SOPs)</p> <p>PC23. Perform recommended periodic maintenance of the printer</p> <p>PC24. Ensure timely material ordering and replenishment according to plan</p> <p>PC25. Keep the supervisor/manager informed about progress or any delays</p> <p>PC26. Refer any unresolved problem to a 'Technical Specialist'</p> <p>PC27. Visit printer website to check for any software/hardware/security upgrades and install. Verify that these work - else roll back the upgrade and consult the 'Technical Specialist'</p>
<p>Knowledge and Understanding (K)</p>	
<p>A. Organizational Context (Knowledge of the company / organization and its processes)</p>	<p>The user/individual on the job needs to know and understand:</p> <p>KA1. Company hierarchy and reporting structure</p> <p>KA2. Company code of conduct, company culture</p> <p>KA3. Company documentation policy, Quality and standards systems followed in the company</p> <p>KA4. Company business, locations, products, services and clients</p> <p>KA5. Company website, contact</p> <p>KA6. How Additive Manufacturing affects the company</p>
<p>B. Technical Knowledge</p>	<p>The user/individual on the job needs to know and understand:</p> <p>KB1. Working knowledge of popular CAD software (AutoDesk, Solidworks etc.)</p> <p>KB2. Load, view, edit 3D Design on the CAD Software that the user has created</p> <p>KB3. File formats for 3D printing</p> <p>KB4. Import, export and convert file in different formats for 3D printing</p> <p>KB5. Knowledge of installed Printers - How to load and configure software, loading the material, printing, cleaning</p> <p>KB6. Materials supported on the installed printers, their characteristics and design criteria for modeling using these</p> <p>KB7. How to assess printed object for quality and trouble shoot</p> <p>KB8. The user/ individual on the job needs to know and understand how to:</p> <p>KB9. Working with 3D Printers and Filament / Materials</p> <p>KB10. Load the Filament or Material into the 3D Printer</p> <p>KB11. Calibration of the X, Y and Z axis</p> <p>KB12. About G-Code for the 3D Printer</p> <p>KB13. Post Processing techniques</p>
<p>Skills (S) [Optional]</p>	
<p>Writing Skills</p>	

IAS/N3003 Operation and Optimization of 3D Printing for Additive Manufacturing

A. Core Skills/ Generic Skills	The user/individual on the job needs to know and understand how to: SA1. Compose e-mails, letters and other official documents clearly SA2. Write test reports SA3. Write plans, schedules and timelines
	Reading Skills
	The user/individual on the job needs to know and understand how to: SA4. Read technical specifications, drawings, manuals, instructions SA5. Read 3-D CAD design documents SA6. Read schedules and timelines
	Oral Communication
	The user/individual on the job needs to know and understand how to: SA7. Discuss technical issues, designs with customer SA8. Keep customers informed about progress SA9. Report issues and problems to manufacturer's technical team
B. Professional Skills	Decision Making
	The individual on the job needs to take decision pertaining to: SB1. Quality and Technical issues in the printer and action needed SB2. Categorizing an issue and troubleshooting accordingly. SB3. When to report or escalate issues to manufacturer's technical team
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB4. Plan preventive maintenance of printers at one or more locations. SB5. Plan printer spares and consumables keeping in view the usage
	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. Support customer when they need help
	Problem Solving
The user/individual on the job needs to know and understand how to: SB8. Think through the problem, evaluate the possible solution(s) and suggest an optimum/best possible solution(s) SB9. Identify intermediate or temporary solutions to resolve delays	
	Analytical Thinking

IAS/N3003 Operation and Optimization of 3D Printing for Additive Manufacturing

	<p>The user/individual on the job needs to know and understand how to:</p> <ul style="list-style-type: none"> SB10. Use the existing information to arrive at actionable decision points SB11. Use the existing information for improving the customer satisfaction SB12. Use the existing information to optimize solution and company business SB13. Analyze problems and identify causes and possible solutions
	<p>Critical Thinking</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <ul style="list-style-type: none"> SB14. Analyze and apply the information gathered from observation and experience as a guide to interaction with customer and support team

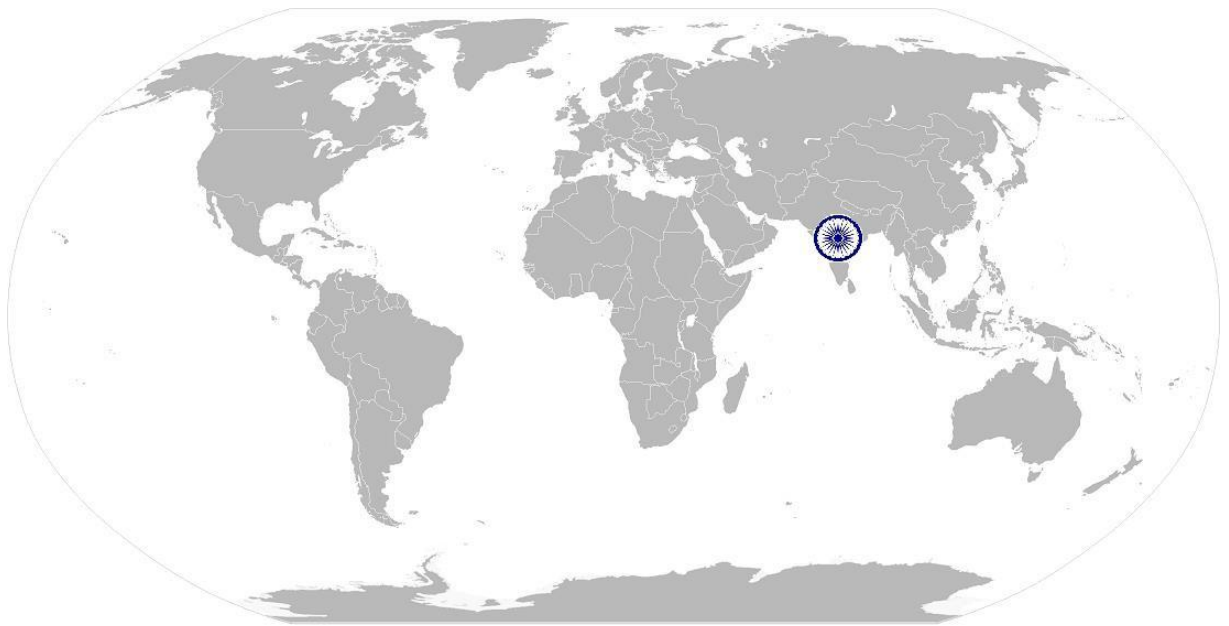
IAS/N3003 Operation and Optimization of 3D Printing for Additive Manufacturing

NOS Version Control

NOS Code	IAS/N3003		
Credits(NVEQF/NVQF/NSQF) [OPTIONAL]	TBD	Version number	0.1
Industry	Instrumentation Automation Surveillance & Communication	Drafted on	10/06/2017
Industry Sub-sector	Automation	Last reviewed on	10/06/2017
Occupation	Installation & Commissioning; Operation & Maintenance	Next review date	10/06/2019

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National Occupational Standard



Overview

This NOS unit is about building relationships and working with people and groups inside and outside the organization, using skills and habits, to achieve the team goals and objectives.

IAS/N2105

Work Effectively With Teams

National Occupational Standard	Unit Code	IAS/N2105
	Unit Title (Task)	Work Effectively With Teams
	Description	This NOS unit is about building relationships and working with people and groups inside and outside the organization, using skills and habits, to achieve the team goals and objectives.
	Scope	<p>This unit/task covers the following:</p> <ul style="list-style-type: none"> • Creating team environment • Communicating - giving and receiving • Working cooperatively • Participating in team decision making • Demonstrating Sense of Responsibility • Showing respect for opinions, customs and preferences
	Performance Criteria(PC) w.r.t. the Scope	
	Element	Performance Criteria
	Create Team Environment	<p>To be competent, the individual on the job must be able to:</p> <p>PC1. Know and understand the team objectives and goals</p> <p>PC2. Know team members by name. Greet them appropriately and respond to their greetings.</p> <p>PC3. Know the roles and responsibilities of team members. Ensure others know about you and your role in the team</p> <p>PC4. Learn about the culture and preferences of team members – especially if they belong to other organizations or nationalities</p> <p>PC5. Follow organization’s policies and procedures for working with team members within and outside the organization – especially relating to privacy, confidentiality and security.</p> <p>PC6. Create an environment of trust and mutual respect</p>
	Communicate – Give and Receive	<p>To be competent, the individual on the job must be able to:</p> <p>PC7. Use appropriate mode of communication – verbal, written, mail, phone or text and clearly articulate your message to ensure that the recipient understands the message.</p> <p>PC8. Listen to team members and try to understand what they are wanting to say. Seek or provide clarifications if you see any gap in understanding</p> <p>PC9. Communicate professionally and follow organization protocols. Do not overload the team members with unnecessary and unsolicited information</p> <p>PC10. Share important information with the team timely.</p> <p>PC11. Respond to communications promptly.</p>

IAS/N2105

Work Effectively With Teams

<p>Work Cooperatively</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC12. Perform own role and produce output in time for other team members to consume</p> <p>PC13. Receive inputs from others and work upon it per role requirement</p> <p>PC14. Make adjustments within the permissible rules so that work flows smoothly.</p> <p>PC15. Help team members to perform their role effectively and provide any clarifications and support they need</p> <p>PC16. Share tools and common resources fairly, taking cognizance of others' needs and schedules</p> <p>PC17. Resolve any contentious issues amicably, involving the team lead or the supervisor if needed</p> <p>PC18. Let team members know in good time if you cannot carry out your commitments, explaining the reasons and alternate solutions, if any. Let the team lead know about this.</p>
<p>Participate in Team Decision making</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC19. Think positively and make constructive suggestions to meet the goals</p> <p>PC20. Accept and give suggestions with open mind</p> <p>PC21. Take initiatives and volunteer to contribute</p> <p>PC22. Help team members with facts and figures to arrive at workable decisions</p> <p>PC23. Accept decisions professionally and support these, even if these do not match your suggestions and personal views</p>
<p>Demonstrate Sense of Responsibility</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC24. Act in the interest of the team and the organization to ensure that things do not 'fall through the gap' and team goals are achieved.</p> <p>PC25. Take initiative to correct the situation if something seems to be going wrong.</p> <p>PC26. Seek help or escalate if the situation demands</p>
<p>Show Respect for Opinions, Customs and Preferences</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC27. Follow organization's and statutory guidelines about making references or comments to social customs or preferences</p> <p>PC28. Refrain from making any comments to hurt sentiments</p> <p>PC29. Accommodate team members' preferences to the extent feasible. If these come in the way of fulfilling team goals, discuss with the supervisor/ team leader.</p> <p>PC30. Seek information and clarifications from others if you do not understand any customs.</p>
<p>Knowledge and Understanding (K)</p>	

IAS/N2105

Work Effectively With Teams

<p>A. Organizational Context (Knowledge of the company / organization and its processes)</p>	<p>The user/individual on the job needs to know and understand:</p> <p>KA1. The organization’s policies and procedures for working with colleagues, roles and responsibilities in relation to this</p> <p>KA2. The importance of effective communication and establishing good working relationships with colleagues</p> <p>KA3. Different methods of communication and the circumstances in which it is appropriate to use these</p> <p>KA4. The importance of creating an environment of trust and mutual respect</p> <p>KA5. The implications of own work on the work and schedule of others</p>
<p>B. Technical Knowledge</p>	<p>The user/individual on the job needs to know and understand:</p> <p>KB1. Different types of information that colleagues might need and the importance of providing this information when it is required</p> <p>KB2. The importance of helping colleagues with problems, in order to meet quality and time standards as a team</p>
<p>Skills (S) [Optional]</p>	
<p>A. Core Skills/ Generic Skills</p>	<p>Writing Skills</p>
	<p>The user/ individual on the job need to know and understand how to:</p> <p>SA1. Complete written work with attention to details</p>
	<p>Reading Skills</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SA2. Read instructions, guidelines/procedures</p>
	<p>Oral Communication (Listening and Speaking skills)</p> <p>The user/individual on the job needs to know and understand how to:</p> <p>SA3. Listen attentively</p> <p>SA4. Speak clearly in simple language, without using jargons</p> <p>SA5. Ask for clarification and from the speaker if you cannot hear clearly what was said</p>
<p>B. Professional Skills</p>	<p>Decision Making</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB1. Make decisions on a suitable course of action or response keeping in view resource utilization while meeting commitments</p>
	<p>Plan and Organize</p>
	<p>The user/individual on the job needs to know and understand:</p> <p>SB2. Plan and organize work to achieve targets and deadlines</p>
	<p>Customer Centricity</p> <p>The user/individual on the job needs to know and understand how to:</p> <p>SB3. Understand real needs of the customer and suggest most appropriate solution</p> <p>SB4. Support customer when they need help</p>
<p>Problem Solving</p>	

IAS/N2105

Work Effectively With Teams

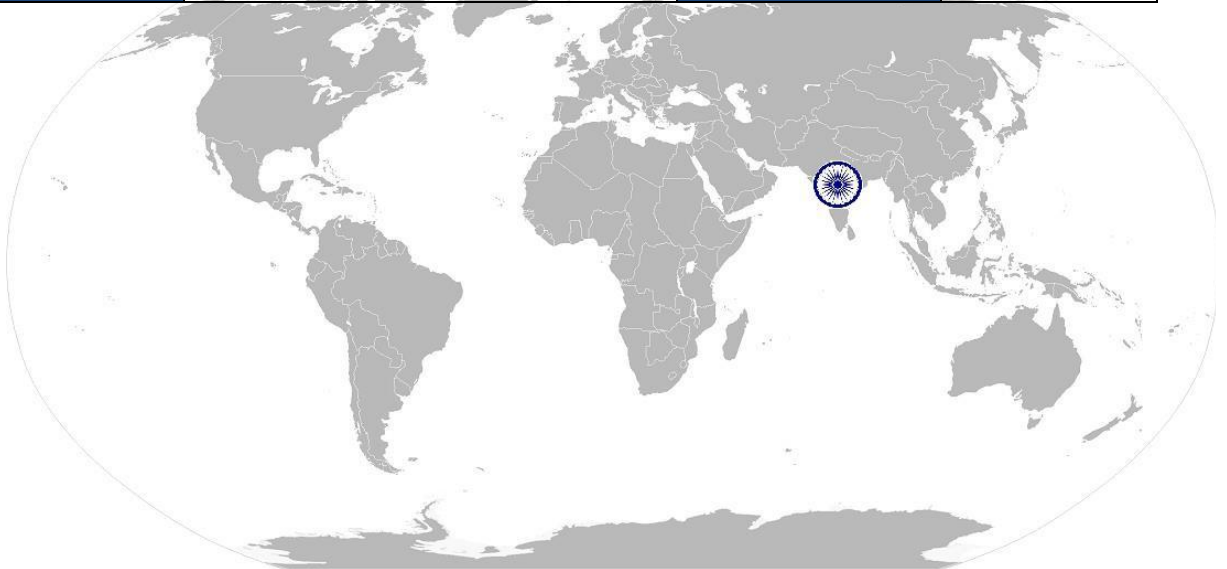
	The user/individual on the job needs to know and understand how to: SB5. Apply problem solving approaches in different situations
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB6. Use the existing information to arrive at actionable decision points SB7. Use the existing information for improving the customer satisfaction SB8. Use the existing information to optimize solution and company business SB9. Analyze problems and identify causes and possible solutions
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB10. Apply balanced judgments to different situations

IAS/N2105

Work Effectively With Teams

NOS Version Control

NOS Code	IAS/N2105		
Credits(NSQF)	TBD	Version number	1.0
Industry	Instrumentation Automation Surveillance & Communication	Drafted on	01/06/2017
Industry Sub-sector	Automation	Last reviewed on	01/06/2017
Occupation	Installation & Commissioning, Operation & Maintenance	Next review date	01/06/2018



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National Occupational Standard



Overview

This unit is about maintaining a safe, healthy and secure working environment.

Unit Code	IAS/N2003
Unit Title (Task)	Health and Safety in Workplace
Description	This OS unit is about following adequate safety procedures to make work environment safe
Scope	<p>This unit/ task covers the following:</p> <ul style="list-style-type: none"> Follow standard safety procedures of the company Maintain good health and posture
Performance Criteria(PC) w.r.t. the Scope	
Element	Performance Criteria
Follow standard safety procedures of the company	<p>To be competent, the user/ individual must be able to:</p> <p>PC1. Comply with general safety procedures followed in the company</p> <p>PC2. Follow standard safety procedures while handling an equipment, hazardous material or tool</p> <p>PC3. Remove finger rings or any other metal objects which may interfere with the work before working on the unit</p> <p>PC4. Use safety materials such as goggles, gloves, ear plugs, caps, ESD pins, covers, shoes, etc.</p> <p>PC5. Escalate about any hazardous materials or things found in the premises</p> <p>PC6. Report about any breach of safety procedure in the company</p> <p>PC7. Ensure zero accidents at work</p> <p>PC8. Avoid damage of components due to negligence in ESD procedures</p> <p>PC9. Participate regularly in fire drills or other safety related workshops organized by the company</p> <p>PC10. Ensure no loss for company due to safety negligence</p>
Maintain good health and posture	<p>To be competent, the user/ individual must be able to:</p> <p>PC11. Maintain appropriate posture, especially in long hours of sitting or standing position and in handling heavy materials</p> <p>PC12. Participate in company organized health sessions such as yoga, physiotherapy or games</p> <p>PC13. Handle heavy and hazardous materials with care and using appropriate tools and handling equipment such as trolleys, jacks and ladders</p>
Knowledge and Understanding (K)	

<p>A. Organizational Context (Knowledge of the company / organization and its processes)</p>	<p>The individual on the job needs to know and understand:</p> <p>KA1. Company's policies on: incentives, delivery standards, and personnel management</p> <p>KA2. Company occupational safety and health policy followed</p> <p>KA3. Company emergency evacuation procedure</p> <p>KA4. Company's medical policy</p>
<p>B. Technical Knowledge</p>	<p>The individual on the job needs to know and understand:</p> <p>KB1. How to maintain the work area safe and secure</p> <p>KB2. How to handle hazardous materials, tools and equipment</p> <p>KB3. Emergency procedures to be followed such as fire accidents, electrocution etc.</p> <p>KB4. Long term value of good posture and use of appropriate handling equipment</p> <p>KB5. Safety regulations and standards and how to apply these</p>
<p>Skills (S) [Optional]</p>	
<p>A. Core Skills/ Generic Skills (Knowledge of the company / organization and its processes)</p>	<p>Writing Skills</p>
	<p>The individual on the job needs to know and understand:</p> <p>SA1. Compose e mails, letters, memos, reminders, and other documents clearly</p> <p>SA2. Share knowledge, issues, problems and resolutions relating to safety and health</p>
	<p>Reading Skills</p>
	<p>The individual on the job needs to know and understand:</p> <p>SA3. Read mails, messages, alerts</p> <p>SA4. Read pictures, drawings, notes relating to safety and health</p>
<p>B. Professional Skills</p>	<p>Decision Making</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB1. Make decisions pertaining to safety and health issues at workplace</p> <p>SB2. Make decisions about escalating safety and health issues at workplace to managers</p>
	<p>Plan and Organize</p>

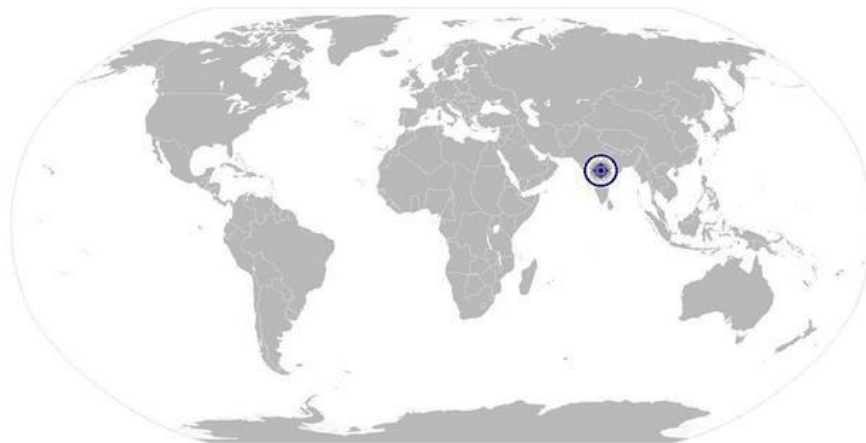
	<p>The user/individual on the job needs to know and understand:</p> <p>SB3. Plan and organize work conforming to the safety and health norms of the company</p>
<p>Customer Centricity</p>	
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB4. Understand real needs of the customer and suggest most appropriate solution</p> <p>SB5. Support customers when they need help</p>
<p>Problem Solving</p>	
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB6. 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</p>
<p>Analytical Thinking</p>	
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB7. Use the existing information to arrive at actionable decision points</p> <p>SB8. Use the existing information for improving the customer satisfaction</p> <p>SB9. Use the existing information to optimize solution and company business</p> <p>SB10. Analyze problems and identify causes and possible solutions</p>
<p>Critical Thinking</p>	
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB11. Apply, analyze, and evaluate the information gathered from observation, experience, reasoning, or communication, as a guide to thought and action</p> <p>SB12. Anticipate problems, risks and opportunities and utilize these for mitigation and business optimization</p>

IAS/N2003

Health and Safety in Workplace

NOS Version Control

NOS Code	IAS/N2003		
Credits(NSQF)	TBD	Version number	1.0
Industry	Instrumentation Automation Surveillance & Communication	Drafted on	30/07/2016
Industry Sub-sector	Automation	Last reviewed on	30/07/2016
Occupation	Product Engineering / System Design	Next review date	30/07/2019



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Qualifications Pack For Installer and Operator- Additive Manufacturing (3D Printing)

Annexure

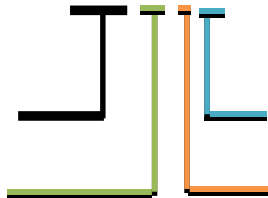
Nomenclature for QP and NOS

Qualifications Pack

9 characters

[IAS]/Q 0101

[Insert 3 letter code for SSC]



QP number (2 numbers)

Q denoting Qualifications Pack

Occupation (2 numbers)

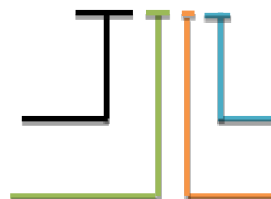
Occupational Standard

An example of NOS with 'N'

9 characters

[IAS] /N0001

[Insert 3 letter code for SSC]



OS number (2 numbers)

N denoting National Occupational Standard

Occupation (2 numbers)

Qualifications Pack For Installer and Operator- Additive Manufacturing (3D Printing)

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

Sub-sector	Range of Occupation numbers
Installation and Commissioning	00-29
Operation and 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	IAS
Slash	/	/
Next letter	Whether QP or NOS	Q
Next two numbers	Occupation code	01
Next two numbers	OS number	01

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CRITERIA FOR ASSESSMENT OF TRAINEES

Job Role Installer and Operator- Additive Manufacturing (3D Printing)

Qualification Pack IAS/Q4500

Sector Skill Council Instrumentation Automation Surveillance & Communication

Guidelines for Assessment

1. Criteria for assessment for each Qualification Pack will be approved 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 approved 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 evaluations 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 minimum 70 % marks for each NOS as prescribed by the SSC
6. 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

Relative weightage of NOSs in assessment		
NOS	Marks	% Weight
1. IAS/N3001 Installation and Commissioning of 3D Printer	150	25
2. IAS/N3002 Maintenance and Technical Support of 3D Printer	130	25
3. IAS/N3003 Operation and Optimization of 3D Printing for Additive Manufacturing	140	30
4. IAS/N2003 Health and Safety in Workplace	50	10
5. IAS/N2105 Work Effectively With Teams	75	10
		100

Assessment Outcomes	Assessment Criteria for Outcomes	Marks Allocation			
		Total Marks (150+130 +140+50+ 75)	Out of	Theory	Skills Practical
1. IAS/N3001 Installation and Commissioning of 3D Printer	PC1. Preparation of inspection and installation checklist.		2	1	1
	PC2. Preparing list of required tools, accessories and consumables.		2	1	1
	PC3. Checking for shipping damage		2	1	1
	PC4. Verification of shipping details and printer model against order		2	1	1

	PC5. Unpacking of Printer safely	150	2	1	1
	PC6. Inspection for any damage		2	1	1
	PC7. Verify printer details (Type, Model, Serial no., Options etc.) against PO		2	1	1
	PC8. Verify received BoQ		2	1	1
	PC9. Assess, record and report any damage or deficiency to the customer, manufacturer/supplier. Follow company practice about repacking, return shipment and remedial steps.		5	2	3
	PC10. Inspect the site and verify that it meets the recommended requirements, in terms of space, power connection, ventilation, connectivity, storage of consumables, lighting, temperature etc.		2	1	1
	PC11. Ensure availability of electrical power of the required quality.		2	1	1
	PC12. Ensure availability of LAN/internet connection if needed for installation.		2	1	1
	PC13. Locate Printer Manual and Software to be installed. If downloadable, go to the link provided and download the relevant documents.		3	1	2
	PC14. Ensure availability of printing raw material in the acceptable forms (e.g. filament, powder etc.)		2	1	1
	PC15. Read and understand the instructions for installation.		4	2	2
	PC16. Remove any internal packing, restraining screws, and cable ties etc. which are used for safe transportation.		3	1	2
	PC17. Check for any loose screws, missing screws, loose parts or debris inside the printer. In case found, handle accordingly.		2	1	1
	PC18. Verify that all sub-assemblies are in place; and the cables and connectors are properly plugged in.		3	1	2
	PC19. Verify that the build tray and print head are clean.		2	1	1
	PC20. Recapitulate the Power-On sequence of the Printer model (i.e. you should know what the printer is expected to do on power up).		2	1	1
	PC21. Connect power cable of the printer to the wall socket or outlet. Switch on power first at the outlet and then on the printer.		2	1	1
	PC22. Verify that the expected Power-On routine is followed (such as internal self-tests, appropriate display messages, X, Y, Z axes mechanisms and the print head moving to their initial positions).		2	1	1
	PC23. If any error is reported, refer to manual about its meaning and what corrective action is needed. Perform the recommended steps and confirm if the error code disappears, replaced by a healthy status.		5	2	3
	PC24. If the error persists or is fatal, note the error for communication to the supplier/service center per recommended procedure for such cases.		3	1	2
	PC25. Follow all installation steps as specified in the installation manual, except sample printing, which will be performed in the next activity.		3	1	2
	PC26. Perform the Calibration procedure for the printer recommended by the manufacturer.		8	3	5
	PC27. Take a test print with the recommended model. Note that it may take a long time, lasting tens of minutes to hours, depending on the size and complexity of the test model.		3	1	2
	PC28. Observe the result carefully and notice any deficiency, referring to the manual for assessing test print quality.		8	3	5

	PC29. Perform the indicated adjustment.		10	5	5
	PC30. Repeat adjustments logically to satisfactory print quality.		6	2	4
	PC31. If the desired print quality is not obtained following the recommended calibration procedure, contact the manufacturer's technical support team and get help.		10	5	5
	PC32. Ensure that the printer prints correctly the specified material(s) in the specified forms.		7	2	5
	PC33. Ensure that the printer prints correctly within the specified volume.		7	2	5
	PC34. Ensure that the print quality is satisfactory- the resolution is met and there are no discontinuities, jagged edges or undesirable marks or protrusions on the surface.		7	2	5
	PC35. Ensure that the printing speed is within the specified limits.		7	2	5
	PC36. Ensure that the material of the specified type and form feeds correctly.		7	2	5
	PC37. Prepare installation report and get it signed by the customer.		5	2	3
	PC38. Have the customer register the printer for warranty coverage.		2	1	1
		Total	150	60	90
2. IAS/N3002 Maintenance and Technical Support of 3D Printer	PC1. Knowledge of precautions for maintenance of printer.	130	3	1	2
	PC2. Use of recommended tools and wear gloves.		3	1	2
	PC3. Knowledge of periodic cleaning and other maintenance procedures as recommended by the manufacturer for the make/model of printer.		10	5	5
	PC4. Knowledge of safety procedures recommended by the manufacturer for the make/model of printer.		10	5	5
	PC5. Removing old prints/objects on the build plate.		5	2	3
	PC6. Cleaning the build plate (Hot Bed/Printing Platform) for any residue causing uneven surface. Perform manufacturer recommended procedure.		5	2	3
	PC7. Removing filament (material) from the machine use the method recommended by the manufacturer for the make/model of printer.		5	2	3
	PC8. Unloading Filament and Cleaning the filament feeder using the method recommended by the manufacturer for the make/model of printer.		10	5	5
	PC9. Lubricating the axis mechanisms periodically following manufacturer's recommendations.		10	5	5
	PC10. Collecting details of the printer settings, print jobs performed, filament material used		3	1	2
	PC11. Understanding the performance issue faced by the customer.		8	3	5
	PC12. Analyzing the issue and find possible reasons, referring to the troubleshooting guide provided by the manufacturer.		10	5	5
	PC13. Categorizing the issue and locating solution/suggestions from the troubleshooting manual and trying these.		10	5	5
	PC14. Contacting the Technical Support team of the manufacturer, with copy to the customer, If no solution found, or the suggested fix doesn't work		5	2	3
	PC15. Log complaint and get trouble ticket number.		3	1	2

	PC16. Talk to the support team and make sure they understand the issue.		5	2	3
	PC17. Follow up to get a resolution that works.		5	2	3
	PC18. Escalating the matter per defined process, in case of delay, non-resolution		5	2	3
	PC19. Close the issue and make sure the customer is satisfied.		5	2	3
	PC20. Perform Hardware and Software upgrades, customizations etc. per company policies and notifications		8	3	5
	PC21. Perform periodic configurations and calibration per company policies and notifications		8	3	5
		Total	130	57	73
3. IAS/N3003 Operation and Optimization of 3D Printing for Additive Manufacturing	PC1. Understand the design of the part to be made.		8	3	5
	PC2. Understand the part resolution and the material - and verify that these are compatible with the printer.		5	2	3
	PC3. Able to Import / Open the 3D model created by the user in CAD Software.		5	2	3
	PC4. Optimizing the design for printing - Detect and avoid errors that can arise during the modeling process.		10	5	5
	PC5. Finalize the Polygonal Model and save it to STL, OBJ or any other format compatible with the printer		8	3	5
	PC6. Running 3D printing simulation, if available. Make changes if needed.		8	3	5
	PC7. Connecting 3D Printer to the CAD design software through LAN or other supported interface		2	1	1
	PC8. Exporting the file for 3D printing in compatible format e.g. STL or OBJ		3	1	2
	PC9. Converting the STL/OBJ File to G-Code		3	1	2
	PC10. Be able to upload the G-Code into the machine		3	1	2
	PC11. Powering the Printer from UPS		3	1	2
	PC12. Ensuring recommended operating environment conditions are met.		3	1	2
	PC13. Importing / Loading the model design through available interfaces in the correct format.		3	1	2
	PC14. Setting optimum parameters for the printer		8	3	5
	PC15. Ensuring that the required input material is loaded		5	2	3
	PC16. Printing the Model using recommended best practices		5	2	3
	PC17. Cool and unloading the printed model using recommended device.		5	2	3
	PC18. Perform any post printing operation required		5	2	3
	PC19. Optimizing the printer parameters and provide feedback to the model designer		5	2	3
	PC20. Cleaning the Build tray/platform		5	2	3
	PC21. Perform the recommended shut down procedure at end of the batch/day's operation		3	1	2
	PC22. Complying with relevant Standard Operating Procedures (SOPs)		5	2	3
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	PC23. Performing recommended periodic maintenance of the printer		10	5	5
	PC24. Ensure timely material ordering and replenishment according to plan		5	2	3
	PC25. Keeping the supervisor/manager informed about progress or any delays		3	1	2
	PC26. Referring any unresolved problem to a 'Technical Specialist'		8	3	5
	PC27. Visit printer website to check for any software/hardware/security upgrades and install. Verify that these work - else roll back the upgrade and consult the 'Technical Specialist'		4	2	2
		Total	140	56	84
4. IAS/N2003 Health and Safety in Workplace	PC1. Comply with general safety procedures followed in the company	50	3	2	1
	PC2. Follow standard safety procedures while handling an equipment, hazardous material or tool		2	1	1
	PC3. Remove rings or any other metal objects before working on the unit		4	2	2
	PC4. Use safety materials such as goggles, gloves, ear plugs, caps, ESD pins, covers, shoes, etc.		4	1	3
	PC5. Escalate about any hazardous materials or things found in the premises		4	1	3
	PC6. Report about any breach of safety procedure in the company		3	1	2
	PC7. Ensure zero accidents at work		5	2	3
	PC8. Avoid damage of components due to negligence in ESD procedures		4	1	3
	PC9. Regularly participate in fire drills or other safety related workshops organized by the company		5	2	3
	PC10. Ensure no loss for company due to safety negligence		4	1	3
	PC11. Maintain appropriate posture, especially in long hours of sitting or standing position and in handling heavy materials		4	2	2
	PC12. Participate in company organized health sessions such as yoga, physiotherapy or games		4	2	2
	PC13. Handle heavy and hazardous materials with care and using appropriate tools and handling equipment such as trolleys, jacks and ladders		4	2	2
		Total	50	20	30
5. IAS/N2105 Work Effectively With Teams	PC1. Know and understand the team objectives and goals		3	1	2
	PC2. Know team members by name. Greet them appropriately and respond to their greetings.		2	1	1
	PC3. Know the roles and responsibilities of team members. Ensure others know about you and your role in the team		2	1	1

PC4. Learn about the culture and preferences of team members – especially if they belong to other organizations or nationalities	7 ;	5	1	4
PC5. Follow organization’s policies and procedures for working with team members within and outside the organization – especially relating to privacy, confidentiality and security.		2	1	1
PC6. Create an environment of trust and mutual respect		3	1	2
PC7. Use appropriate mode of communication – verbal, written, mail, phone or text and clearly articulate your message to ensure that the recipient understands the message.		2	1	1
PC8. Listen to team members and try to understand what they are wanting to say. Seek or provide clarifications if you see any gap in understanding		3	1	2
PC9. Communicate professionally and follow organization protocols. Do not overload the team members with unnecessary and unsolicited information		4	1	3
PC10. Share important information with the team timely.		3	1	2
PC11. Respond to communications promptly.		3	1	2
PC12. Perform own role and produce output in time for other team members to consume		3	1	2
PC13. Receive inputs from others and work upon it per role requirement		2	1	1
PC14. Make adjustments within the permissible rules so that work flows smoothly.		2	1	1
PC15. Help team members to perform their role effectively and provide any clarifications and support they need		2	1	1
PC16. Share tools and common resources fairly, taking cognizance of others’ needs and schedules		2	1	1
PC17. Resolve any contentious issues amicably, involving the team lead or the supervisor if needed		2	1	1
PC18. Let team members know in good time if you cannot carry out your commitments, explaining the reasons and alternate solutions, if any. Let the team lead know about this.		2	1	1
PC19. Think positively and make constructive suggestions to meet the goals		2	1	1
PC20. Accept and give suggestions with open mind		2	1	1
PC21. Take initiatives and volunteer to contribute		2	1	1
PC22. Help team members with facts and figures to arrive at workable decisions		2	1	1
PC23. Accept decisions professionally and support these, even if these do not match your suggestions and personal views		4	1	3
PC24. Act in the interest of the team and the organization to ensure that things do not ‘fall through the gap’ and team goals are achieved.		4	1	3

	PC25. Take initiative to correct the situation if something seems to be going wrong.		2	1	1
	PC26. Seek help or escalate if the situation demands		2	1	1
	PC27. Follow organization's and statutory guidelines about making references or comments to social customs or preferences		2	1	1
	PC28. Refrain from making any comments to hurt sentiments		2	1	1
	PC29. Accommodate team members' preferences to the extent feasible. If these come in the way of fulfilling team goals, discuss with the supervisor/ team leader.		2	1	1
	PC30. Seek information and clarifications from others if you do not understand any customs.		2	1	1
		Total	75	30	45

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