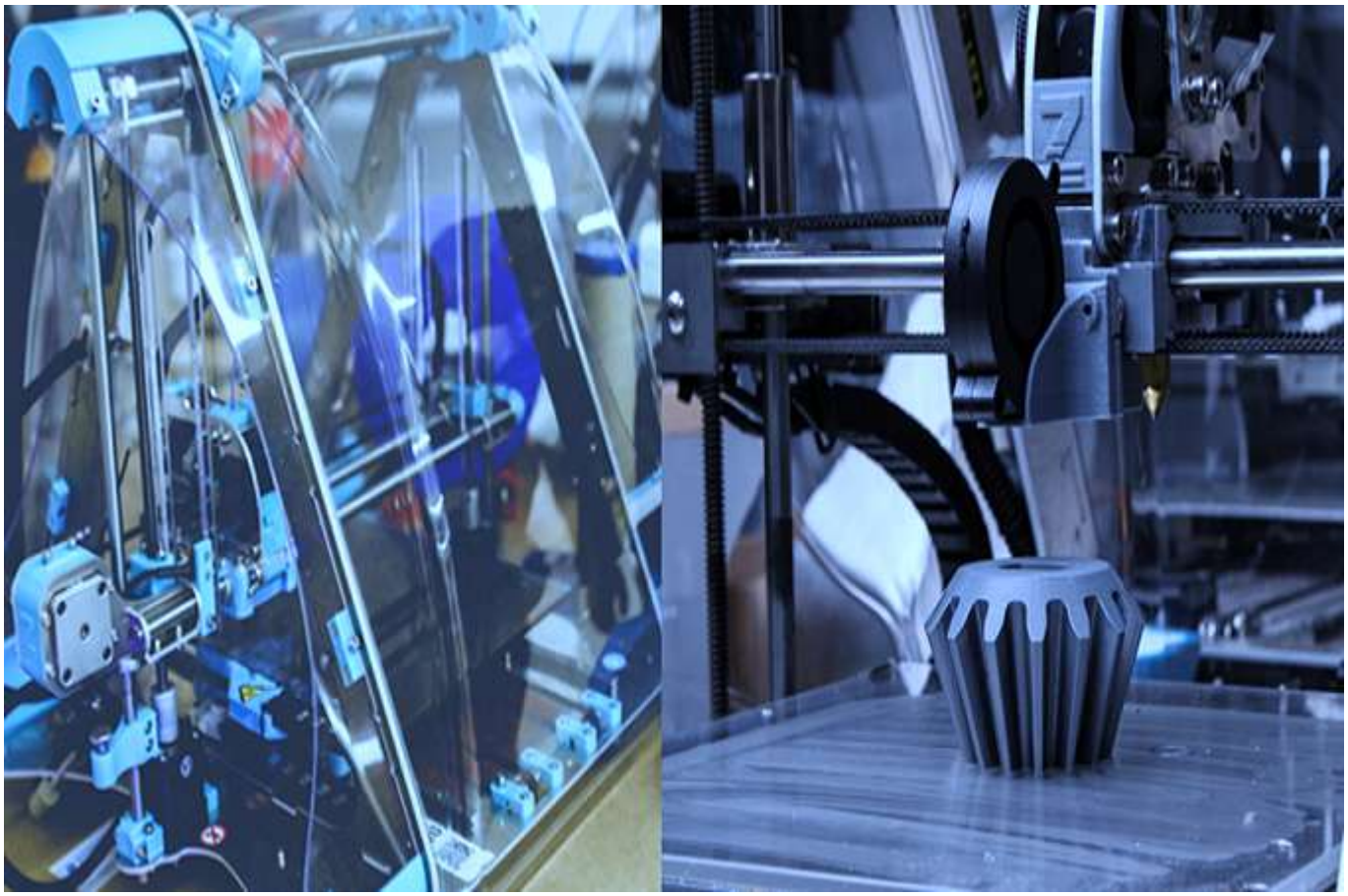

Installer - Additive Manufacturing (3D Printing)

QP Code: IAS/Q5602

Version: 1.0

NSQF Level: 4

Instrumentation, Automation, Surveillance & Communication Sector Skill Council || IASC SSC, 201-202, STBP NSIC Complex, Okhla Industrial Estate, New Delhi
110020

Contents

IAS/Q5602: Installer - Additive Manufacturing (3D Printing)

Brief Job Description

The technician is responsible for installing a 3D Printer, configuring the hardware and software, calibrating it and successfully demonstrating its operation to the customer.

Personal Attributes

The individual should be multi-skilled, organized, team-oriented, customer-centric and should have the ability to work in unfamiliar surroundings. He/she must pay attention to details, have an eye for quality, have the ability to identify defects and their root cause/s. He/she should be able to resolve problems with the help of experts.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. IAS/N5606: Install a 3D printer
2. IAS/N5607: Maintain and provide technical support for 3D printer
3. IAS/N5608: Operate and optimise 3D printing for additive manufacturing
4. IAS/N9001: Work effectively with teams
5. IAS/N9002: Health and safety in workplace

Qualification Pack (QP) Parameters

Sector	Instrumentation
Sub-Sector	Instrumentation & Automation
Occupation	Installation and Commissioning(Instrumentation and Automation)
Country	India
NSQF Level	4
Aligned to NCO/ISCO/ISIC Code	NCO-2015/NIL
Minimum Educational Qualification & Experience	10th Class with NA of experience OR I.T.I (2 Years after 8th class in the relevant sector / trade / stream) with NA of experience

Minimum Level of Education for Training in School	Not Applicable
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	22/04/2020
Next Review Date	22/04/2025
Deactivation Date	22/04/2025
NSQC Approval Date	
Version	1.0

IAS/N5606: Install a 3D printer

Description

This OS unit is about installing and commissioning 3D printer, which includes unpacking the printer, inspecting it, switching it on, configuring, calibrating the axes, loading material and taking test print. It also includes adjustment of mechanical and software settings to get the desired print quality.

Scope

The scope covers the following :

- Prepare for installation
- Install and configure the 3D Printer
- Calibrate and run test prints

Elements and Performance Criteria

Prepare for installation

To be competent, the user/individual on the job must be able to:

PC1. verify the shipping details, along with the printer model, BOQ, etc. against the order. In case of damage or deficiency, record and communicate the same to the customer or manufacturer/supplier/ service centre as per recommended procedure

PC2. identify the printer manual and software to be installed

PC3. ensure availability of printing raw material, tools, accessories and consumables in the acceptable forms, for e.g., filament and powder

Install and configure the 3D printer

To be competent, the user/individual on the job must be able to:

PC4. verify if the expected power-on routing is followed. Expected routing: such as internal self-tests, appropriate display messages, X, Y, Z axes mechanisms and the printer head moving to their initial positions, etc.

PC5. install and set all the parameters required for configuration

PC6. execute corrective action for any errors reported during installation/configuration based on the installation manual

Calibrate and run test prints

To be competent, the user/individual on the job must be able to:

PC7. observe the test print result carefully to make note of deficiency, if any

PC8. verify that the printer prints the specified material(s) in the format as per acceptable standards including resolution, and there are no discontinuities, jagged edges or undesirable marks or protrusions on the surface

PC9. make necessary adjustments to address print quality issues, repeat the test print and verify quality again

PC10. ensure that the printing speed is within the specified limits

PC11. prepare installation report and get it signed by the customer

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. organisation's policies on customer care
KU2. organisation's code of conduct
KU3. organisation's culture and typical customer profile
KU4. organisation's reporting structure
KU5. organisation's documentation policy
KU6. organisation's sales and after-sales policy
KU7. organisation's website, contact personnel and related details
KU8. installation of commonly used computer hardware and software
KU9. how to communicate with customers in order to put them at ease
KU10. operation of the printer and technical support that can be provided to the end user
KU11. 3D printing technologies, advantages and shortcomings
KU12. commonly recognised 3D printer manufacturers
KU13. popular materials used to print 3D objects
KU14. popular 3D modelling software
KU15. how to make adjustments, calibration and performance improvement of printers
KU16. process to feed material into the printer head
KU17. process of working with multi head printers
KU18. process to clean the printer platform and the print head
KU19. preventive maintenance of 3d printers
KU20. process to get technical support from the manufacturer
KU21. open source software related to 3d printing, modelling and additive printing

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. complete forms such as work orders, invoices, maintenance records, etc
GS2. note problems and details of work done on job sheet
GS3. write emails and messages about site related issue
GS4. read warnings, instructions and other text material on product labels, components as well as the manuals
GS5. read and correctly interpret organisational information about working practices at the site
GS6. read product / module serial numbers and interpret details such as make, date and availability
GS7. receive and ask for clarifications from supervisor about the job requirement
GS8. describe site conditions and issues to co-workers and supervisor
GS9. communicate in local language
GS10. communicate to the management in meetings about site issues

GS11. interact with co-workers and gather information related to process and site conditions
GS12. educate on precautions to be taken in order to avoid recurrence of problem
GS13. follow standard operating procedures while making decisions
GS14. work with supervisor and co-workers to achieve smooth workflow
GS15. work with superiors and co-workers to share knowledge and learning
GS16. maintain personal grooming
GS17. be polite, patient and courteous under all circumstances, with all types of customers
GS18. decide on the spot on whether interaction of customer with superior is necessary or not
GS19. maintain proper etiquette such as keeping appropriate physical distance from the customer during conversation, not entering bedroom without permission, etc.
GS20. put customer at ease and gain customer's confidence
GS21. seek inputs to assess the problems
GS22. evaluate the possible solution(s) to a problem and suggest an optimum solution
GS23. use the existing information to arrive at the course of actions
GS24. undertake and express new ideas and initiatives to others
GS25. improve work processes
GS26. anticipate problems, risks and opportunities and utilise these for mitigation and business optimisation

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare for installation	**12**	**12**	**-**	**3**
PC1. verify the shipping details, along with the printer model, BOQ, etc. against the order. In case of damage or deficiency, record and communicate the same to the customer or manufacturer/supplier/ service centre as per recommended procedure	4	4	-	1
PC2. identify the printer manual and software to be installed	4	4	-	1
PC3. ensure availability of printing raw material, tools, accessories and consumables in the acceptable forms, for e.g., filament and powder	4	4	-	1
Install and configure the 3D printer	**12**	**13**	**-**	**3**
PC4. verify if the expected power-on routing is followed. Expected routing: such as internal self-tests, appropriate display messages, X, Y, Z axes mechanisms and the printer head moving to their initial positions, etc.	4	4	-	1
PC5. install and set all the parameters required for configuration	4	5	-	1
PC6. execute corrective action for any errors reported during installation/configuration based on the installation manual	4	4	-	1
Calibrate and run test prints	**16**	**25**	**-**	**4**
PC7. observe the test print result carefully to make note of deficiency, if any	4	4	-	1
PC8. verify that the printer prints the specified material(s) in the format as per acceptable standards including resolution, and there are no discontinuities, jagged edges or undesirable marks or protrusions on the surface	4	4	-	1
PC9. make necessary adjustments to address print quality issues, repeat the test print and verify quality again	4	4	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. ensure that the printing speed is within the specified limits	2	7	-	-
PC11. prepare installation report and get it signed by the customer	2	6	-	1
NOS Total	**40**	**50**	**-**	**10**

National Occupational Standards (NOS) Parameters

NOS Code	IAS/N5606
NOS Name	Install a 3D printer
Sector	Instrumentation
Sub-Sector	Instrumentation & Automation
Occupation	Installation and Commissioning(Instrumentation and Automation)
NSQF Level	4
Credits	TBD
Version	1.0
Last Reviewed Date	NA
Next Review Date	NA
NSQC Clearance Date	

IAS/N5607: Maintain and provide technical support for 3D printer

Description

This unit is about performing routine maintenance of 3D printer and providing technical support when required.

Scope

The scope covers the following :

- Perform preventive maintenance of 3D Printer
- Provide post installation technical support

Elements and Performance Criteria

Perform preventive maintenance of 3D printer

To be competent, the user/individual on the job must be able to:

PC1. perform periodic maintenance as recommended by the manufacturer

PC2. clean the build plate (hot bed/printing platform) for any residue causing uneven surface

PC3. remove filament (material) from the machine using the method as specified in the instruction manual

PC4. clean the filament feeder using the method as specified

PC5. lubricate the axis mechanisms periodically without over lubricating and using recommended oil or grease

PC6. follow the precautions necessary for maintenance of printer

Provide post installation technical support

To be competent, the user/individual on the job must be able to:

PC7. verify that all details of the printer settings, print jobs performed and filament material used are as per standards and record any deviations

PC8. identify actual and potential causes by analysing the issue as well as the related systems, referring to the troubleshooting guide provided by the manufacturer under categories such as material and feed related, print-head related, quality of print related, software related, etc.

PC9. implement the suggested solution or contact the technical support team of the manufacturer to resolve the issue

PC10. order material and parts to ensure their replenishment according to plan

PC11. keep the customer informed of actions and expected time frame for finding a solution

PC12. resolve the matter as per customer satisfaction and complete closure process or escalate the matter as per the defined process if no resolution is found

PC13. perform hardware and software upgrades, customisations etc. as per company policies and notifications

PC14. perform periodic configurations and calibration

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. organisation's policies on customer care
KU2. organisation's code of conduct
KU3. organisation's culture and typical customer profile
KU4. organisation's reporting structure
KU5. organisation's documentation policy
KU6. escalation matrix and procedures for reporting work and employment related issues
KU7. operation, maintenance and technical support of 3D printers
KU8. technologies, capabilities and working of 3D printer models
KU9. materials used to print 3d objects for the model
KU10. reason and process for making adjustments, calibration, performance and improvement of printers
KU11. details of material fed into the printer head and its process
KU12. process to clean the printer platform and the print head
KU13. preventive maintenance of 3D printers
KU14. steps to get technical support from the manufacturer
KU15. process to perform hardware and software upgrades

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. complete forms such as work orders, invoices and maintenance records
GS2. note problems and details of work done on job sheet
GS3. write emails and messages about site related issue
GS4. read warnings, instructions and other text material on product labels, components as well as the manuals
GS5. read and correctly interpret organisation's information about working practices at the site
GS6. read product and module serial numbers and interpret details such as make, date and availability
GS7. receive and ask for clarifications from supervisor on the job requirement
GS8. describe site conditions and issues to co-workers and supervisor
GS9. communicate in local language
GS10. communicate to the management in meetings about site issues
GS11. interact with co-workers and gather information related to process and site conditions
GS12. educate on precautions to be taken in order to avoid recurrence of problem
GS13. prioritise daily activities for the upkeep of calibration operation by ensuring availability of the calibration setup and its components
GS14. maintain personal grooming
GS15. be polite, patient and courteous under all circumstances, with all types of customers
GS16. decide on the spot on whether interaction of customer with superior is necessary or not

GS17. maintain proper etiquette such as keeping appropriate physical distance from customer during conversation, not entering bedroom without permission, etc.

GS18. put customer at ease and generate the customer's confidence

GS19. identify real needs of the customer and suggest most appropriate solution

GS20. seek inputs to assess the problems

GS21. evaluate the possible solution(s) to a problem and suggest an optimum solution

GS22. identify immediate or temporary solutions to resolve delays

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Perform preventive maintenance of 3D printer	**16**	**17**	**-**	**5**
PC1. perform periodic maintenance as recommended by the manufacturer	3	3	-	1
PC2. clean the build plate (hot bed/printing platform) for any residue causing uneven surface	2	2	-	1
PC3. remove filament (material) from the machine using the method as specified in the instruction manual	3	3	-	1
PC4. clean the filament feeder using the method as specified	2	2	-	1
PC5. lubricate the axis mechanisms periodically without over lubricating and using recommended oil or grease	3	3	-	1
PC6. follow the precautions necessary for maintenance of printer	3	4	-	-
Provide post installation technical support	**24**	**33**	**-**	**5**
PC7. verify that all details of the printer settings, print jobs performed and filament material used are as per standards and record any deviations	3	4	-	-
PC8. identify actual and potential causes by analysing the issue as well as the related systems, referring to the troubleshooting guide provided by the manufacturer under categories such as material and feed related, print-head related, quality of print related, software related, etc.	3	3	-	1
PC9. implement the suggested solution or contact the technical support team of the manufacturer to resolve the issue	3	4	-	-
PC10. order material and parts to ensure their replenishment according to plan	3	3	-	1
PC11. keep the customer informed of actions and expected time frame for finding a solution	3	5	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. resolve the matter as per customer satisfaction and complete closure process or escalate the matter as per the defined process if no resolution is found	3	5	-	1
PC13. perform hardware and software upgrades, customisations etc. as per company policies and notifications	3	5	-	1
PC14. perform periodic configurations and calibration	3	4	-	1
NOS Total	**40**	**50**	**-**	**10**

National Occupational Standards (NOS) Parameters

NOS Code	IAS/N5607
NOS Name	Maintain and provide technical support for 3D printer
Sector	Instrumentation
Sub-Sector	Instrumentation & Automation
Occupation	Installation and Commissioning(Instrumentation and Automation)
NSQF Level	4
Credits	TBD
Version	1.0
Last Reviewed Date	NA
Next Review Date	NA
NSQC Clearance Date	

IAS/N5608: Operate and optimise 3D printing for additive manufacturing

Description

This unit covers the design and optimisation of 3D CAD drawings and operation of 3D printer for prototyping or additive manufacturing, including post processing, maintaining and installing software/hardware upgrades.

Scope

The scope covers the following :

- The individual will be responsible for the following:
- Optimize CAD model and drawing file for 3D printing
- Perform 3D printing and post-processing

Elements and Performance Criteria

Optimise CAD model and drawing file for 3D printing

To be competent, the user/individual on the job must be able to:

PC1. verify the material, design for the part to be printed and part resolution so that these are compatible with the printer

PC2. check the 3D model created by the user in CAD software

PC3. implement 3D printing simulation, if available, and make changes if needed

PC4. connect the 3D printer to the CAD design software through LAN or other supported interface

PC5. import file for 3D printing in a format compatible with the printer e.g. STL or OBJ

Perform 3D printing and post- processing

To be competent, the user/individual on the job must be able to:

PC6. confirm that the printer is powered from UPS and operating environment conditions are met

PC7. import the model design through available interfaces in the correct format on the machine

PC8. load the required input material i.e., resin, plastic or metal

PC9. unload the printed model using recommended tool (e.g., spatula) after checking that the system is adequately cooled

PC10. perform any post printing operation required, i.e., removing supports, polishing, painting, etc.

PC11. provide suggestions to optimise the printer parameters to the model designer for optimisation of model

PC12. clean the build tray/platform as recommended

PC13. perform the recommended shut down procedure at the end of the batch/day's operation

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. organisation’s policies on customer care

KU2. organisation's policies on code of conduct
KU3. organisation's culture and typical customer profile
KU4. organisation's reporting structure
KU5. organisation's documentation policy
KU6. effect of additive manufacturing on the company
KU7. popular CAD software (Autodesk, Solid works, etc.)
KU8. how to load, view and edit 3D design on the CAD software that the user has created
KU9. import, export and convert file in different formats for 3D printing
KU10. how to configure software, load material and do printing, cleaning for all installed printers
KU11. materials supported on the installed printers, their characteristics and the design criteria for using these materials in modelling
KU12. how to assess printed object for quality and trouble shoot
KU13. working with 3D printers and filament / materials
KU14. load the filament or material into the 3D printer
KU15. calibration of the X, Y and Z axis
KU16. post processing techniques

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. complete forms such as work orders, invoices and maintenance records
GS2. note problems and details of work done on job sheet
GS3. write emails and messages about site related issue
GS4. read warnings, instructions and other text material on product labels, components as well as the manuals
GS5. read and correctly interpret organisation's information about working practices at the site
GS6. read product and module serial numbers and interpret details such as make, date and availability
GS7. receive and ask for clarifications from supervisor on the job requirement
GS8. describe site conditions and issues to co-workers and supervisor
GS9. communicate in local language
GS10. communicate to the management in meetings about site issues
GS11. interact with co-workers and gather information related to process and site conditions
GS12. educate on precautions to be taken in order to avoid recurrence of problem
GS13. plan, prioritise and sequence work operations as per requirement
GS14. organise and analyse information relevant to work
GS15. focus on customer's requirement
GS16. respond to customer's queries in a timely and appropriate manner
GS17. seek inputs to assess the problems
GS18. evaluate the possible solution(s) to a problem and suggest an optimum solution
GS19. identify immediate or temporary solutions to resolve delays

GS20. undertake and express new ideas and initiatives to others

GS21. analyse and evaluate the information gathered from observation, experience, reasoning or communication, as a guide for thought and action

GS22. anticipate problems, risks and opportunities and utilise these for mitigation and business optimisation

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Optimise CAD model and drawing file for 3D printing	**15**	**22**	**-**	**3**
PC1. verify the material, design for the part to be printed and part resolution so that these are compatible with the printer	3	5	-	-
PC2. check the 3D model created by the user in CAD software	3	5	-	-
PC3. implement 3D printing simulation, if available, and make changes if needed	3	4	-	1
PC4. connect the 3D printer to the CAD design software through LAN or other supported interface	3	4	-	1
PC5. import file for 3D printing in a format compatible with the printer e.g. STL or OBJ	3	4	-	1
Perform 3D printing and post- processing	**25**	**28**	**-**	**7**
PC6. confirm that the printer is powered from UPS and operating environment conditions are met	3	3	-	1
PC7. import the model design through available interfaces in the correct format on the machine	3	4	-	1
PC8. load the required input material i.e., resin, plastic or metal	3	4	-	1
PC9. unload the printed model using recommended tool (e.g., spatula) after checking that the system is adequately cooled	3	4	-	1
PC10. perform any post printing operation required, i.e., removing supports, polishing, painting, etc.	4	5	-	1
PC11. provide suggestions to optimise the printer parameters to the model designer for optimisation of model	3	2	-	-
PC12. clean the build tray/platform as recommended	3	3	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC13. perform the recommended shut down procedure at the end of the batch/day's operation	3	3	-	1
NOS Total	**40**	**50**	**-**	**10**

National Occupational Standards (NOS) Parameters

NOS Code	IAS/N5608
NOS Name	Operate and optimise 3D printing for additive manufacturing
Sector	Instrumentation
Sub-Sector	Instrumentation & Automation
Occupation	Installation and Commissioning(Instrumentation and Automation)
NSQF Level	4
Credits	TBD
Version	1.0
Last Reviewed Date	NA
Next Review Date	NA
NSQC Clearance Date	

IAS/N9001: 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

This unit/task covers the following:

- 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

Elements and Performance Criteria

Create Team Environment

To be competent, the user/individual on the job must be able to:

PC1. know and understand the team objectives and goals

PC2. know team members by name. Greet them appropriately and respond to their greetings.

PC3. know the roles and responsibilities of team members. Ensure others know about you and your role in the team

PC4. learn about the culture and preferences of team members especially if they belong to other organizations or nationalities

PC5. follow organizations policies and procedures for working with team members within and outside the organization especially relating to privacy, confidentiality and security.

PC6. create an environment of trust and mutual respect

Communicate Give and Receive

To be competent, the user/individual on the job must be able to:

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

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

PC9. communicate professionally and follow organization protocols. Do not overload the team members with unnecessary and unsolicited information

PC10. share important information with the team timely.

PC11. respond to communications promptly.

Work Cooperatively

To be competent, the user/individual on the job must be able to:

PC12. perform own role and produce output in time for other team members to consume

PC13. receive inputs from others and work upon it per role requirement

PC14. make adjustments within the permissible rules so that work flows smoothly

PC15. help team members to perform their role effectively and provide any clarifications and support they need

PC16. share tools and common resources fairly, taking cognizance of others needs and schedules

PC17. resolve any contentious issues amicably, involving the team lead or the supervisor if needed

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.

Participate in Team Decision making

To be competent, the user/individual on the job must be able to:

PC19. think positively and make constructive suggestions to meet the goals

PC20. accept and give suggestions with open mind

PC21. take initiatives and volunteer to contribute

PC22. help team members with facts and figures to arrive at workable decisions

PC23. accept decisions professionally and support these, even if these do not match your suggestions and personal views

Demonstrate Sense of Responsibility

To be competent, the user/individual on the job must be able to:

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.

PC25. take initiative to correct the situation if something seems to be going wrong

PC26. seek help or escalate if the situation demands

Show Respect for Opinions, Customs and Preferences

To be competent, the user/individual on the job must be able to:

PC27. follow organizations and statutory guidelines about making references or comments to social customs or preferences

PC28. refrain from making any comments to hurt sentiments

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

PC30. seek information and clarifications from others if you do not understand any customs

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the organizations policies and procedures for working with colleagues, roles and responsibilities in relation to this

KU2. the importance of effective communication and establishing good working relationships with colleagues

KU3. different methods of communication and the circumstances in which it is appropriate to use these

KU4. the importance of creating an environment of trust and mutual respect

KU5. the implications of own work on the work and schedule of others

KU6. different types of information that colleagues might need and the importance of providing this information when it is required

KU7. the importance of helping colleagues with problems, in order to meet quality and time standards as a team

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. complete written work with attention to detail

GS2. read instructions, guidelines/procedures

GS3. listen effectively and orally communicate information

GS4. ask for clarification and advice from the concerned person

GS5. make decisions on a suitable course of action or response keeping in view resource utilization while meeting commitments

GS6. plan and organize work to achieve targets and deadlines

GS7. understand real needs of the customer and suggest most appropriate solution

GS8. support customer when they need help

GS9. apply problem solving approaches in different situations

GS10. use the existing information to arrive at actionable decision points

GS11. use the existing information for improving the customer satisfaction

GS12. use the existing information to optimize solution and company business

GS13. analyze problems and identify causes and possible solutions

GS14. apply balanced judgments to different situations

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Create Team Environment	**6**	**11**	**-**	**-**
PC1. know and understand the team objectives and goals	1	2	-	-
PC2. know team members by name. Greet them appropriately and respond to their greetings.	1	1	-	-
PC3. know the roles and responsibilities of team members. Ensure others know about you and your role in the team	1	1	-	-
PC4. learn about the culture and preferences of team members especially if they belong to other organizations or nationalities	1	4	-	-
PC5. follow organizations policies and procedures for working with team members within and outside the organization especially relating to privacy, confidentiality and security.	1	1	-	-
PC6. create an environment of trust and mutual respect	1	2	-	-
Communicate Give and Receive	**5**	**10**	**-**	**-**
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	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	1	2	-	-
PC9. communicate professionally and follow organization protocols. Do not overload the team members with unnecessary and unsolicited information	1	3	-	-
PC10. share important information with the team timely.	1	2	-	-
PC11. respond to communications promptly.	1	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Work Cooperatively	**7**	**8**	**-**	**-**
PC12. perform own role and produce output in time for other team members to consume	1	2	-	-
PC13. receive inputs from others and work upon it per role requirement	1	1	-	-
PC14. make adjustments within the permissible rules so that work flows smoothly	1	1	-	-
PC15. help team members to perform their role effectively and provide any clarifications and support they need	1	1	-	-
PC16. share tools and common resources fairly, taking cognizance of others needs and schedules	1	1	-	-
PC17. resolve any contentious issues amicably, involving the team lead or the supervisor if needed	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.	1	1	-	-
Participate in Team Decision making	**5**	**7**	**-**	**-**
PC19. think positively and make constructive suggestions to meet the goals	1	1	-	-
PC20. accept and give suggestions with open mind	1	1	-	-
PC21. take initiatives and volunteer to contribute	1	1	-	-
PC22. help team members with facts and figures to arrive at workable decisions	1	1	-	-
PC23. accept decisions professionally and support these, even if these do not match your suggestions and personal views	1	3	-	-
Demonstrate Sense of Responsibility	**3**	**5**	**-**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
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.	1	3	-	-
PC25. take initiative to correct the situation if something seems to be going wrong	1	1	-	-
PC26. seek help or escalate if the situation demands	1	1	-	-
Show Respect for Opinions, Customs and Preferences	**4**	**4**	**-**	**-**
PC27. follow organizations and statutory guidelines about making references or comments to social customs or preferences	1	1	-	-
PC28. refrain from making any comments to hurt sentiments	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	1	1	-	-
PC30. seek information and clarifications from others if you do not understand any customs	1	1	-	-
NOS Total	**30**	**45**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	IAS/N9001
NOS Name	Work effectively with teams
Sector	Instrumentation
Sub-Sector	Instrumentation & Automation
Occupation	Generic
NSQF Level	4
Credits	TBD
Version	1.0
Last Reviewed Date	02/05/2019
Next Review Date	01/05/2023
NSQC Clearance Date	

IAS/N9002: Health and safety in workplace

Description

This OS unit is about following adequate safety procedures to make work environment safe

Scope

This unit/ task cover the following:

- Follow standard safety procedures of the company
- Maintain good health and posture

Elements and Performance Criteria

Follow standard safety procedures of the company and safety

To be competent, the user/individual on the job must be able to:

PC1. comply with general safety procedures followed in the company

PC2. Follow standard safety procedures while handling an equipment, hazardous material or tool

PC3. remove finger rings or any other metal objects which may interfere with the work before working on the unit

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. participate regularly in fire drills or other safety related workshops organized by the company

PC10. ensure no loss for company due to safety negligence

Maintain good health and posture

To be competent, the user/individual on the job must be able to:

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 and Understanding (KU)

The individual on the job needs to know and understand:

KU1. companys policies on: incentives, delivery standards, and personnel management

KU2. company occupational safety and health policy followed

KU3. company emergency evacuation procedure

KU4. companys medical policy
KU5. how to maintain the work area safe and secure
KU6. how to handle hazardous materials, tools and equipment
KU7. emergency procedures to be followed such as fire accidents, electrocution etc.
KU8. long term value of good posture and use of appropriate handling equipment
KU9. safety regulations and standards and how to apply these
KU10. electrical grounding practices

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. compose e mails, letters, memos, reminders, and other documents clearly
GS2. share knowledge, issues, problems and resolutions relating to safety and health
GS3. read mails, messages, alerts
GS4. read pictures, drawings, notes relating to safety and health
GS5. question co-workers in order to understand the safety and health issues
GS6. inform co-workers about safety and health issues
GS7. report issues and problems relating to safety and health to managers in clear terms
GS8. make decisions pertaining to safety and health issues at workplace
GS9. make decisions about escalating safety and health issues at workplace to managers
GS10. plan and organize work conforming to the safety and health norms of the company
GS11. understand real needs of the customer and suggest most appropriate solution
GS12. support customers when they need help
GS13. 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
GS14. use the existing information to arrive at actionable decision points
GS15. use the existing information for improving the customer satisfaction
GS16. use the existing information to optimize solution and company business
GS17. analyze problems and identify causes and possible solutions
GS18. apply, analyze, and evaluate the information gathered from observation, experience, reasoning, or communication, as a guide to thought and action
GS19. anticipate problems, risks and opportunities and utilize these for mitigation and business optimization

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Follow standard safety procedures of the company and safety	**14**	**24**	**-**	**-**
PC1. comply with general safety procedures followed in the company	2	1	-	-
PC2. Follow standard safety procedures while handling an equipment, hazardous material or tool	1	1	-	-
PC3. remove finger rings or any other metal objects which may interfere with the work before working on the unit	2	2	-	-
PC4. use safety materials such as goggles, gloves, ear plugs, caps, ESD pins, covers, shoes, etc	1	3	-	-
PC5. escalate about any hazardous materials or things found in the premises	1	3	-	-
PC6. report about any breach of safety procedure in the company	1	2	-	-
PC7. ensure zero accidents at work	2	3	-	-
PC8. avoid damage of components due to negligence in ESD procedures	1	3	-	-
PC9. participate regularly in fire drills or other safety related workshops organized by the company	2	3	-	-
PC10. ensure no loss for company due to safety negligence	1	3	-	-
Maintain good health and posture	**6**	**6**	**-**	**-**
PC11. maintain appropriate posture, especially in long hours of sitting or standing position and in handling heavy materials	2	2	-	-
PC12. participate in company organized health sessions such as yoga, physiotherapy or games	2	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC13. handle heavy and hazardous materials with care and using appropriate tools and handling equipment such as trolleys, jacks and ladders	2	2	-	-
NOS Total	**20**	**30**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	IAS/N9002
NOS Name	Health and safety in workplace
Sector	Instrumentation
Sub-Sector	Instrumentation & Automation
Occupation	Generic
NSQF Level	4
Credits	TBD
Version	1.0
Last Reviewed Date	02/05/2019
Next Review Date	01/05/2023
NSQC Clearance Date	

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

1. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down a proportion of marks for Theory and Skills Practical for each PC.

2. The assessment for the theory part will be based on the knowledge bank of questions created by the SSC.

3. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.

4. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre (as per assessment criteria below).

5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training centre based on this criterion.

6. To pass the Qualification Pack, every trainee should score a minimum of 70% of aggregate marks to successfully clear the assessment.

7. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Recommended Pass % : 70

Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
IAS/N5606.Install a 3D printer	40	50	-	10	100	25
IAS/N5607.Maintain and provide technical support for 3D printer	40	50	-	10	100	25
IAS/N5608.Operate and optimise 3D printing for additive manufacturing	40	50	-	10	100	25

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
IAS/N9001.Work effectively with teams	30	45	-	-	75	15
IAS/N9002.Health and safety in workplace	20	30	-	-	50	10
Total	**170**	**225**	**-**	**30**	**425**	**100**

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
Automation	Industrial automation deals primarily with the automation of manufacturing, quality control and material handling processes.
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, computer and internet.
BOQ	Bill of Quantities
PO	Purchase order

Glossary

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.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
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 (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria (PC)	Performance Criteria (PC) 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.
Qualifications 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 qualifications pack code.
Unit Code	Unit code is a 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 variables 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 (KU)	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.

Organisational Context	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills (GS)	Core skills or Generic Skills (GS) 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 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.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.