Qualification Pack

Drone Data Processor

QP Code: TEL/Q6223

Version: 1.0

NSQF Level: 5

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Contents

Qualification Pack

TEL/Q6223: Drone Data Processor

Brief Job Description

The individual of this job role is responsible for data extraction and collection, encompassing images, videos, thermal, infrared, radio frequency, lidar, and radar inputs, with a focus on generating precise 3D Point Clouds in .xyz and .las formats. The individual is also responsible for Utilizing both local computer and Cloud-based software, the role involves adept data processing, followed by insightful analysis and projection for informed decision-making.

Personal Attributes

The individual must have analytical ability to work and coordination with others. They should have good verbal and written communication skills.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. TEL/N6273: Data extraction/collection
2. TEL/N6274: Processing of Collected Data
3. TEL/N6275: Analise and Project the Collected Data
4. TEL/N6276: Analise Remote Sensing Data
5. TEL/N6277: Identify Equipment and Infra Faults
6. TEL/N6278: RF Mapping and Optimization
7. DGT/VSQ/N0102: Employability Skills (60 Hours)

Qualification Pack (QP) Parameters

Sector	Telecom
Sub-Sector	Network Managed Services
Occupation	Network Operation and Maintenance
Country	India
NSQF Level	5

Qualification Pack

Credits	18
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2523.0100
Minimum Educational Qualification & Experience	Graduate (Completed 2nd Year of 3year/4year (Electronics/Telecom/CS)) with NA of experience OR Graduate ((Completed 1st Year of 3year/4year (Electronics/Telecom/CS))) with 1 Year of experience and 6 months in relevant experience OR Completed 3 year diploma after 10th with 1 Year of experience and 6 months in relevant experience OR Previous relevant Qualification of NSQF Level (NSQF Level 4.5) with 1 Year of experience and 6 months in relevant experience OR Previous relevant Qualification of NSQF Level (NSQF Level 4) with 3 Years of experience in relevant experience
Minimum Level of Education for Training in School	12th Class
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	NA
Next Review Date	30/05/2027
NSQC Approval Date	30/05/2024
Version	1.0
Reference code on NQR	QG-05-TL-02635-2024-V1-TSSC
NQR Version	1

TEL/N6273: Data extraction/collection

Description

This OS unit is about spatial data management, encompassing the generation, processing, and analysis of 3D Point Clouds, meshing 3D textures, and creating 2D orthomosaics through aerial imagery stitching.

Scope

The scope covers the following :

- Generate, process, and analyse 3D Point Cloud spatial data
- Mesh the 3D Textures
- Create 2D orthomosaics by processing and stitching aerial imagery
- Generate 2D Digital Elevation Models (DEMs) through data processing and analysis

Elements and Performance Criteria

Generating, processing, and analyzing 3D Point Cloud spatial data

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

PC1. calibrate drones and associated sensors (Accelerometers, Tilt Sensors, Current Sensors, Magnetic Sensors, etc.) to guarantee accurate data measurements

PC2. plan drone flights ensuring optimal overlap between images for accurate data extraction.

PC3. interpret and collect drone data (images, videos, thermal, infrared, RF, lidar, and radar data)

PC4. adjust sensor settings like Magnetic Sensors and Accelerometers based on environmental conditions and data collection requirements

PC5. ensure compatibility of 3D Point Cloud data formats (.xyz, .las) with downstream processing tools like ArcGIS, QGIS, MapInfo

PC6. verify that the selected formats meet project specifications and industry standards

Meshing 3D Textures

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

PC7. predict accurate GCPs to enhance the precision of the calibration, ensuring that spatial relationships in the 3D textured mesh are aligned with real-world coordinates.

PC8. navigate through the software interface like DroneDeploy, DJI Terra, Pix4D, DroneMapper and others to input necessary parameters, and execute the calibration process effectively.

PC9. process raw drone imagery efficiently, converting it into a format suitable for 3D reconstruction.

PC10. execute visual information from the original images onto the 3D mesh, ensuring realistic and detailed textures.

Creating 2D orthomosaics by processing and stitching aerial imagery

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

PC11. capture data, including the principles of photogrammetry and image acquisition.

PC12. solve 2D orthomosaics from individual images

PC13. implement georeferencing techniques to ensure spatial accuracy in the orthomosaic.

PC14. perform accuracy assessments by comparing the generated orthomosaic with ground truth data.

PC15. categorize artifacts, outliers, or irrelevant data from the orthomosaic.

Generating 2D Digital Elevation Models (DEMs) through data processing and analysis

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

PC16. extract data from Geographic Information System (GIS) software

PC17. utilise various GIS platforms such as ArcGIS, QGIS, or other specialized software for processing elevation data.

PC18. integrate data acquired from drone sensors (such as LiDAR or photogrammetry) with existing 2D DEMs

PC19. carry out the process of aligning and merging drone-generated elevation data into the broader terrain model

PC20. examine any anomalies or discrepancies in the elevation values derived from both drone data and the existing DEM

PC21. judge filtering and smoothing techniques to enhance the quality of the 2D DEM.

PC22. extract 2D DEM data (contour lines, slope information, or drainage patterns) file from external memory

PC23. generate comprehensive reports detailing the findings and insights derived from the 2D DEM processing for effective communication with stakeholders.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. principles of survey planning, including optimal drone flight patterns to achieve sufficient image overlap for accurate data extraction.

KU2. area to be surveyed

KU3. various data types such as images, videos, thermal, infrared, LiDAR, and radar data.

KU4. downstream processing tools like ArcGIS, QGIS, MapInfo.

KU5. weather conditions and metrological forecast.

KU6. 3D Point Cloud data formats (xyz,las)

KU7. importance of calibrating sensors to minimize distortions and ensure accurate data acquisition for 3D Textured Mesh generation.

KU8. altitude, speed, and overlap, to optimize data acquisition and enhance the quality of 3D Textured Mesh.

KU9. 3D textured mesh with real-world coordinates.

KU10. drone software like DroneDeploy, DJI Terra, Pix4D, and DroneMapper to input parameters and execute effective calibration processes.

KU11. image geotagging, camera calibration, and image sharpness assessment to enhance the overall quality of the 3D Textured Mesh.

KU12. efficiently processing raw drone imagery and converting it into a format suitable for 3D reconstruction.

KU13. principles of photogrammetry and image acquisition for effective 2D orthomosaic creation

KU14. algorithms for noise reduction and data interpolation to create a more accurate representation of the terrain

Generic Skills (GS)

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

GS1. understanding of project need
GS2. communicate with client for specific need
GS3. listen and coordination with others
GS4. probe customers using appropriate open and close ended questions to understand the nature of problem, without any pre-conclusions
GS5. plan the development activities
GS6. organize all hardware/software components required for setup
GS7. manage time and work
GS8. read and comprehend/understand equipment installation manual

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Generating, processing, and analyzing 3D Point Cloud spatial data	**6**	**12**	**-**	**3**
PC1. calibrate drones and associated sensors (Accelerometers, Tilt Sensors, Current Sensors, Magnetic Sensors, etc.) to guarantee accurate data measurements	1	2	-	-
PC2. plan drone flights ensuring optimal overlap between images for accurate data extraction.	1	2	-	-
PC3. interpret and collect drone data (images, videos, thermal, infrared, RF, lidar, and radar data)	1	2	-	1
PC4. adjust sensor settings like Magnetic Sensors and Accelerometers based on environmental conditions and data collection requirements	1	2	-	1
PC5. ensure compatibility of 3D Point Cloud data formats (.xyz, .las) with downstream processing tools like ArcGIS, QGIS, MapInfo	1	2	-	-
PC6. verify that the selected formats meet project specifications and industry standards	1	2	-	1
Meshing 3D Textures	**8**	**14**	**-**	**2**
PC7. predict accurate GCPs to enhance the precision of the calibration, ensuring that spatial relationships in the 3D textured mesh are aligned with real-world coordinates.	1	4	-	1
PC8. navigate through the software interface like DroneDeploy, DJI Terra, Pix4D, DroneMapper and others to input necessary parameters, and execute the calibration process effectively.	3	2	-	-
PC9. process raw drone imagery efficiently, converting it into a format suitable for 3D reconstruction.	2	5	-	-
PC10. execute visual information from the original images onto the 3D mesh, ensuring realistic and detailed textures.	2	3	-	1

Qualification Pack

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Creating 2D orthomosaics by processing and stitching aerial imagery	**6**	**20**	**-**	**2**
PC11. capture data, including the principles of photogrammetry and image acquisition.	2	4	-	-
PC12. solve 2D orthomosaics from individual images	1	4	-	-
PC13. implement georeferencing techniques to ensure spatial accuracy in the orthomosaic.	1	4	-	1
PC14. perform accuracy assessments by comparing the generated orthomosaic with ground truth data.	1	4	-	1
PC15. categorize artifacts, outliers, or irrelevant data from the orthomosaic.	1	3	-	-
Generating 2D Digital Elevation Models (DEMs) through data processing and analysis	**10**	**14**	**-**	**3**
PC16. extract data from Geographic Information System (GIS) software	1	2	-	-
PC17. utilise various GIS platforms such as ArcGIS, QGIS, or other specialized software for processing elevation data.	2	2	-	-
PC18. integrate data acquired from drone sensors (such as LiDAR or photogrammetry) with existing 2D DEMs	1	3	-	-
PC19. carry out the process of aligning and merging drone-generated elevation data into the broader terrain model	1	1	-	1
PC20. examine any anomalies or discrepancies in the elevation values derived from both drone data and the existing DEM	2	2	-	1
PC21. judge filtering and smoothing techniques to enhance the quality of the 2D DEM.	1	2	-	-
PC22. extract 2D DEM data (contour lines, slope information, or drainage patterns) file from external memory	1	1	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC23. generate comprehensive reports detailing the findings and insights derived from the 2D DEM processing for effective communication with stakeholders.	1	1	-	-
NOS Total	**30**	**60**	**-**	**10**

National Occupational Standards (NOS) Parameters

NOS Code	TEL/N6273
NOS Name	Data extraction/collection
Sector	Telecom
Sub-Sector	
Occupation	Network Operation and Maintenance
NSQF Level	5
Credits	3
Version	1.0
Last Reviewed Date	30/05/2024
Next Review Date	30/05/2027
NSQC Clearance Date	30/05/2024

TEL/N6274: Processing of Collected Data

Description

This OS unit is about importing and pre-processing of drone-acquired data, followed by the extraction of georeferenced information.

Scope

The scope covers the following :

- Import and Pre-process Drone Data
- Extract Georeferenced Data
- Integrate and Synthesis Fused Data

Elements and Performance Criteria

Import and Pre-process Drone Data

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

PC1. state various data sources collected by drones, such as images, videos, RF data, LiDAR point clouds, thermal data, or other relevant sensor outputs.

PC2. utilize appropriate data storage solutions, including databases or file systems, to efficiently manage and store large volumes of collected data.

PC3. employ data management tools and software like PrecisionHawk, Amazon S3, Microsoft Azure Blob Storage and others to efficiently handle and organize the incoming data, facilitating a streamlined import process.

PC4. conduct checks to verify the integrity of the collected data, identifying and addressing any issues such as missing files, corrupted data, or incomplete datasets.

PC5. integrate geospatial reference information into the dataset, enabling accurate georeferencing and spatial alignment during subsequent processing stages.

PC6. perform initial data cleaning tasks, including the removal of outliers, sensor artifacts, or noise that may affect the quality of the dataset.

PC7. handle varying data volumes efficiently, scaling the import process to accommodate large datasets without sacrificing processing speed or accuracy.

PC8. integrate metadata associated with the collected data, such as GPS information, timestamps, or sensor specifications, to enhance the overall contextual understanding of the dataset.

Extract Georeferenced Data

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

PC9. utilize Ground Control Points to anchor and align drone-collected data with real-world coordinates, ensuring spatial accuracy.

PC10. employ Global Navigation Satellite System (GNSS) technology to enhance georeferencing precision, considering factors such as GPS and RTK capabilities.

PC11. integrate georeferencing seamlessly into the overall data processing workflow, ensuring that spatial accuracy is maintained throughout the various stages.

PC12. develop the capability to verify the accuracy of georeferencing by comparing the processed data against established reference datasets or surveyed ground truth points.

PC13. adapt georeferencing techniques to different terrains and environmental conditions, considering challenges such as elevation variations and complex topography.

PC14. validate the accuracy of processed data through statistical analysis, cross-referencing with ground truth information, and employing error-checking methods.

PC15. detect anomalies and inconsistencies in the collected data, including outliers, sensor errors, or artifacts that may impact data quality.

PC16. conduct quality checks of the gathered data, using software tools to identify issues and rectify it.

Integrate and Synthesis Fused Data

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

PC17. assess the compatibility of different data types, considering their formats, resolutions, and coordinate systems to ensure seamless integration.

PC18. choose appropriate data fusion techniques based on the nature of the collected data. This may involve image fusion, feature-level fusion, or decision-level fusion methods.

PC19. manage differences in sensor calibration parameters between datasets, ensuring consistency in the interpretation of measurements across fused data.

PC20. integrate LiDAR point clouds with imagery data to enhance the richness of information, allowing for detailed analysis of both surface characteristics and visual features.

PC21. combine spectral information from optical sensors with thermal data, enabling a more comprehensive analysis of land cover, temperature variations, RF level variations and environmental conditions.

PC22. conduct quality control checks post-fusion to identify and rectify any artifacts, misalignments, or inconsistencies in the fused dataset.

PC23. optimize fusion parameters such as weighting factors, fusion algorithms, or resolution adjustments to achieve the best balance between data sources and enhance overall data quality.

PC24. document the entire data fusion process, including the methods used, parameters adjusted, and decisions made, for transparency and reproducibility.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. LiDAR point clouds, thermal data, and other sensor outputs, to comprehend the diverse nature of incoming datasets.

KU2. Precision Hawk, Amazon S3, Microsoft Azure Blob Storage and others data management software.

KU3. different data storage solutions, including databases and file systems, and know how to efficiently manage and store large volumes of collected data while ensuring accessibility and data integrity.

KU4. geospatial reference information into the dataset, enabling accurate georeferencing and spatial alignment during subsequent processing stages.

KU5. sensor calibration techniques.

KU6. Ground Control Points (GCPs) to anchor and align drone-collected data with real-world coordinates, ensuring spatial accuracy during georeferencing.

KU7. Global Navigation Satellite System (GNSS) technology.

KU8. methods to verify the accuracy of georeferencing by comparing processed data against established reference datasets or surveyed ground truth points.

KU9. integration of LiDAR point clouds with imagery data to enhance the richness of information, allowing for detailed analysis of both surface characteristics and visual features.

KU10. optical sensors with thermal data, enabling a more comprehensive analysis of land cover, temperature variations, and environmental conditions.

Generic Skills (GS)

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

GS1. understanding of project need

GS2. assignment of band width

GS3. in the text, voice and video

GS4. communicate with client for specific need

GS5. either need of intranet or internet

GS6. sound knowledge of LAN and wireless devices

GS7. liaising and coordination skills

GS8. probe customers using appropriate open and close ended questions to understand the nature of problem, without any pre-conclusions

GS9. plan the development activities

GS10. organize all hardware/software components required for setup

GS11. plan testing and deployment activities

GS12. time and work management

GS13. read and comprehend/understand equipment installation manual

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Import and Pre-process Drone Data	**10**	**20**	**-**	**3**
PC1. state various data sources collected by drones, such as images, videos, RF data, LiDAR point clouds, thermal data, or other relevant sensor outputs.	1	3	-	-
PC2. utilize appropriate data storage solutions, including databases or file systems, to efficiently manage and store large volumes of collected data.	1	1	-	-
PC3. employ data management tools and software like PrecisionHawk, Amazon S3, Microsoft Azure Blob Storage and others to efficiently handle and organize the incoming data, facilitating a streamlined import process.	2	2	-	1
PC4. conduct checks to verify the integrity of the collected data, identifying and addressing any issues such as missing files, corrupted data, or incomplete datasets.	1	3	-	1
PC5. integrate geospatial reference information into the dataset, enabling accurate georeferencing and spatial alignment during subsequent processing stages.	1	1	-	-
PC6. perform initial data cleaning tasks, including the removal of outliers, sensor artifacts, or noise that may affect the quality of the dataset.	1	4	-	-
PC7. handle varying data volumes efficiently, scaling the import process to accommodate large datasets without sacrificing processing speed or accuracy.	1	2	-	-
PC8. integrate metadata associated with the collected data, such as GPS information, timestamps, or sensor specifications, to enhance the overall contextual understanding of the dataset.	2	4	-	1
Extract Georeferenced Data	**10**	**20**	**-**	**3**
PC9. utilize Ground Control Points to anchor and align drone-collected data with real-world coordinates, ensuring spatial accuracy.	1	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. employ Global Navigation Satellite System (GNSS) technology to enhance georeferencing precision, considering factors such as GPS and RTK capabilities.	1	1	-	-
PC11. integrate georeferencing seamlessly into the overall data processing workflow, ensuring that spatial accuracy is maintained throughout the various stages.	1	3	-	-
PC12. develop the capability to verify the accuracy of georeferencing by comparing the processed data against established reference datasets or surveyed ground truth points.	2	4	-	1
PC13. adapt georeferencing techniques to different terrains and environmental conditions, considering challenges such as elevation variations and complex topography.	1	3	-	-
PC14. validate the accuracy of processed data through statistical analysis, cross-referencing with ground truth information, and employing error-checking methods.	1	2	-	1
PC15. detect anomalies and inconsistencies in the collected data, including outliers, sensor errors, or artifacts that may impact data quality.	1	3	-	-
PC16. conduct quality checks of the gathered data, using software tools to identify issues and rectify it.	2	2	-	1
Integrate and Synthesis Fused Data	**10**	**20**	**-**	**4**
PC17. assess the compatibility of different data types, considering their formats, resolutions, and coordinate systems to ensure seamless integration.	1	2	-	1
PC18. choose appropriate data fusion techniques based on the nature of the collected data. This may involve image fusion, feature-level fusion, or decision-level fusion methods.	1	2	-	-
PC19. manage differences in sensor calibration parameters between datasets, ensuring consistency in the interpretation of measurements across fused data.	2	3	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC20. integrate LiDAR point clouds with imagery data to enhance the richness of information, allowing for detailed analysis of both surface characteristics and visual features.	1	3	-	1
PC21. combine spectral information from optical sensors with thermal data, enabling a more comprehensive analysis of land cover, temperature variations, RF level variations and environmental conditions.	1	2	-	1
PC22. conduct quality control checks post-fusion to identify and rectify any artifacts, misalignments, or inconsistencies in the fused dataset.	1	4	-	-
PC23. optimize fusion parameters such as weighting factors, fusion algorithms, or resolution adjustments to achieve the best balance between data sources and enhance overall data quality.	2	2	-	-
PC24. document the entire data fusion process, including the methods used, parameters adjusted, and decisions made, for transparency and reproducibility.	1	2	-	1
NOS Total	**30**	**60**	**-**	**10**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	TEL/N6274
NOS Name	Processing of Collected Data
Sector	Telecom
Sub-Sector	
Occupation	Network Operation and Maintenance
NSQF Level	5
Credits	3
Version	1.0
Last Reviewed Date	30/05/2024
Next Review Date	30/05/2027
NSQC Clearance Date	30/05/2024

TEL/N6275: Analise and Project the Collected Data

Description

This OS unit is about the analysis of GIS data, identification, and extraction of featured data, as well as the generation of 3D models and orthomosaics.

Scope

The scope covers the following :

- Perform Analysis of GIS Data
- Identify and Extract Featured Data
- Generate 3D Models
- Create Orthomosaics

Elements and Performance Criteria

Perform Analysis of GIS Data

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

PC1. extract spatial data from drone sensors, ensuring that the collected information is georeferenced and aligns with the desired coordinate system.

PC2. integrate diverse datasets into the GIS environment, combining drone-collected data with existing spatial datasets for a comprehensive analysis.

PC3. incorporate data accurately and apply appropriate coordinate projections to ensure spatial consistency and alignment with standard mapping systems.

PC4. manage attribute data associated with spatial features, organizing and maintaining relevant information for effective GIS analysis.

PC5. perform spatial queries and analyses to extract specific information from the data, identifying spatial patterns, relationships, or trends.

PC6. conduct overlay analysis by superimposing different layers of spatial data to identify areas of intersection, union, or other spatial relationships.

PC7. utilize buffer analysis to assess the proximity of features, creating buffer zones around specific geographic elements for further investigation.

PC8. conduct network analysis to evaluate connectivity and accessibility, especially relevant for applications such as transportation planning or utility network management.

PC9. analyze terrain data to derive information about elevation, slope, aspect, and other terrain characteristics that influence the landscape.

PC10. integrate remote sensing data (e.g., satellite imagery) into the GIS for a more comprehensive understanding of the geographic area.

PC11. generate comprehensive metadata for spatial datasets, documenting key information such as data source, date of collection, and any preprocessing steps applied.

Identify and Extract Featured Data

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

PC12. clarify the specific features or objects of interest within the collected drone data, such as buildings, roads, vegetation, or other relevant elements.

PC13. use remote sensing techniques to extract information from drone-collected data, leveraging technologies such as LiDAR, photogrammetry, or multispectral sensors.

PC14. implement image processing algorithms to enhance and manipulate raw drone imagery for improved feature extraction results.

PC15. perform image segmentation to separate the collected data into meaningful segments, aiding in the isolation and extraction of individual features.

PC16. adjust parameters such as resolution, contrast, and colour settings to optimize feature extraction performance based on the characteristics of the target features.

PC17. align geospatial accuracy in feature extraction by aligning extracted features with real-world coordinates using georeferencing techniques.

PC18. work with specific characteristics of the extracted features, such as size, shape, or spectral attributes, providing detailed information for analysis.

Generate 3D Models

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

PC19. organize the data in a structured manner to facilitate the 3D modelling process.

PC20. conduct quality control checks to identify and rectify any errors or inconsistencies in the collected data.

PC21. implement preprocessing steps to clean and prepare the data for 3D modelling.

PC22. verify that the data is in the appropriate coordinate system for consistent and accurate 3D modelling.

PC23. generate a high-quality point cloud from the collected data, using techniques such as photogrammetry or LiDAR processing.

PC24. reconstruct surfaces from the point cloud to create a 3D representation of the terrain or structures in the surveyed area.

PC25. convert the point cloud or surface data into a mesh model, representing the surveyed area with a network of interconnected polygons.

PC26. apply visual information from the original images onto the 3D mesh to enhance realism and detail in the generated model.

PC27. perform a thorough quality assessment of the generated 3D model, checking for completeness, accuracy, and overall fidelity to the real-world environment.

PC28. document the entire 3D modeling process, including parameters used, methodologies applied, and any adjustments made during the generation process.

Create Orthomosaics

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

PC29. import raw drone data, ensuring proper organization and categorization of the images or datasets to be used in orthomosaic creation.

PC30. register or align individual images, compensating for variations in perspective and orientation, to ensure seamless integration into the orthomosaic.

PC31. adjust the level of overlap between images to optimize the blending of adjacent images, reducing artifacts and enhancing overall quality.

PC32. balance colour across the orthomosaic to ensure uniformity and accurate representation of the surveyed area.

PC33. utilize image stitching algorithms to seamlessly merge individual images into a coherent orthomosaic, considering features like seamless transitions and minimal distortions.

PC34. remove any artifacts or distortions that may have occurred during the orthomosaic creation process, ensuring a clean and accurate final product.

PC35. apply orthorectification techniques to correct for terrain variations and camera tilt, producing an orthomosaic with consistent scale and minimal geometric distortions.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the fundamental principles of spatial data, GIS concepts, and coordinate systems to ensure proper acquisition, integration, and analysis of drone-collected data.

KU2. remote sensing technologies, including LiDAR, photogrammetry, and multispectral sensors, and their applications in feature extraction, GIS analysis, and 3D modeling.

KU3. image processing algorithms like Contrast Enhancement, Dithering and Half-Toning, Elser Difference-Map, Blind Deconvolution, Seam Carving, Seam Carving.

KU4. various GIS analysis methods, including spatial queries, overlay analysis, buffer analysis, network analysis, and terrain analysis.

KU5. quality control checks, preprocessing steps, and data organization techniques to ensure the accuracy and reliability of processed spatial data for 3D modeling, orthomosaic creation, and feature extraction.

KU6. 3D modeling techniques, including point cloud generation, surface reconstruction, mesh creation, and quality assessment, to accurately represent terrain or structures in a 3D environment.

KU7. steps involved in creating orthomosaics, including image registration, adjustment of image overlap, colour balancing, image stitching algorithms, and orthorectification techniques.

KU8. TIR sensors, applying temperature calibration techniques, analyzing thermal and infrared data, and integrating such data with GIS platforms for spatial analysis and mapping.

Generic Skills (GS)

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

GS1. understanding of project need

GS2. assignment of band width

GS3. in the text, voice and video

GS4. communicate with client for specific need

GS5. either need of intranet or internet

GS6. sound knowledge of LAN and wireless devices

GS7. liaising and coordination skills

GS8. probe customers using appropriate open and close ended questions to understand the nature of problem, without any pre-conclusions

GS9. plan the development activities

GS10. organize all hardware/software components required for setup

GS11. plan testing and deployment activities
GS12. time and work management
GS13. read and comprehend/understand equipment installation manual

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Perform Analysis of GIS Data	**10**	**15**	**-**	**4**
PC1. extract spatial data from drone sensors, ensuring that the collected information is georeferenced and aligns with the desired coordinate system.	1	2	-	-
PC2. integrate diverse datasets into the GIS environment, combining drone-collected data with existing spatial datasets for a comprehensive analysis.	1	-	-	1
PC3. incorporate data accurately and apply appropriate coordinate projections to ensure spatial consistency and alignment with standard mapping systems.	1	1	-	-
PC4. manage attribute data associated with spatial features, organizing and maintaining relevant information for effective GIS analysis.	2	2	-	1
PC5. perform spatial queries and analyses to extract specific information from the data, identifying spatial patterns, relationships, or trends.	-	1	-	-
PC6. conduct overlay analysis by superimposing different layers of spatial data to identify areas of intersection, union, or other spatial relationships.	1	2	-	-
PC7. utilize buffer analysis to assess the proximity of features, creating buffer zones around specific geographic elements for further investigation.	1	2	-	-
PC8. conduct network analysis to evaluate connectivity and accessibility, especially relevant for applications such as transportation planning or utility network management.	1	2	-	1
PC9. analyze terrain data to derive information about elevation, slope, aspect, and other terrain characteristics that influence the landscape.	-	1	-	-
PC10. integrate remote sensing data (e.g., satellite imagery) into the GIS for a more comprehensive understanding of the geographic area.	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. generate comprehensive metadata for spatial datasets, documenting key information such as data source, date of collection, and any preprocessing steps applied.	1	1	-	1
Identify and Extract Featured Data	**7**	**15**	**-**	**3**
PC12. clarify the specific features or objects of interest within the collected drone data, such as buildings, roads, vegetation, or other relevant elements.	-	3	-	-
PC13. use remote sensing techniques to extract information from drone-collected data, leveraging technologies such as LiDAR, photogrammetry, or multispectral sensors.	1	2	-	1
PC14. implement image processing algorithms to enhance and manipulate raw drone imagery for improved feature extraction results.	1	2	-	-
PC15. perform image segmentation to separate the collected data into meaningful segments, aiding in the isolation and extraction of individual features.	1	1	-	1
PC16. adjust parameters such as resolution, contrast, and colour settings to optimize feature extraction performance based on the characteristics of the target features.	2	3	-	-
PC17. align geospatial accuracy in feature extraction by aligning extracted features with real-world coordinates using georeferencing techniques.	1	2	-	-
PC18. work with specific characteristics of the extracted features, such as size, shape, or spectral attributes, providing detailed information for analysis.	1	2	-	1
Generate 3D Models	**7**	**15**	**-**	**1**
PC19. organize the data in a structured manner to facilitate the 3D modelling process.	1	2	-	-
PC20. conduct quality control checks to identify and rectify any errors or inconsistencies in the collected data.	-	3	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC21. implement preprocessing steps to clean and prepare the data for 3D modelling.	1	1	-	-
PC22. verify that the data is in the appropriate coordinate system for consistent and accurate 3D modelling.	1	2	-	-
PC23. generate a high-quality point cloud from the collected data, using techniques such as photogrammetry or LiDAR processing.	-	2	-	-
PC24. reconstruct surfaces from the point cloud to create a 3D representation of the terrain or structures in the surveyed area.	-	1	-	1
PC25. convert the point cloud or surface data into a mesh model, representing the surveyed area with a network of interconnected polygons.	1	1	-	-
PC26. apply visual information from the original images onto the 3D mesh to enhance realism and detail in the generated model.	1	1	-	-
PC27. perform a thorough quality assessment of the generated 3D model, checking for completeness, accuracy, and overall fidelity to the real-world environment.	1	1	-	-
PC28. document the entire 3D modeling process, including parameters used, methodologies applied, and any adjustments made during the generation process.	1	1	-	-
Create Orthomosaics	**6**	**15**	**-**	**2**
PC29. import raw drone data, ensuring proper organization and categorization of the images or datasets to be used in orthomosaic creation.	1	2	-	1
PC30. register or align individual images, compensating for variations in perspective and orientation, to ensure seamless integration into the orthomosaic.	1	3	-	-
PC31. adjust the level of overlap between images to optimize the blending of adjacent images, reducing artifacts and enhancing overall quality.	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC32. balance colour across the orthomosaic to ensure uniformity and accurate representation of the surveyed area.	1	1	-	-
PC33. utilize image stitching algorithms to seamlessly merge individual images into a coherent orthomosaic, considering features like seamless transitions and minimal distortions.	1	2	-	1
PC34. remove any artifacts or distortions that may have occurred during the orthomosaic creation process, ensuring a clean and accurate final product.	1	2	-	-
PC35. apply orthorectification techniques to correct for terrain variations and camera tilt, producing an orthomosaic with consistent scale and minimal geometric distortions.	-	2	-	-
NOS Total	**30**	**60**	**-**	**10**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	TEL/N6275
NOS Name	Analise and Project the Collected Data
Sector	Telecom
Sub-Sector	
Occupation	Network Operation and Maintenance
NSQF Level	5
Credits	3
Version	1.0
Last Reviewed Date	30/05/2024
Next Review Date	30/05/2027
NSQC Clearance Date	30/05/2024

TEL/N6276: Analise Remote Sensing Data

Description

This OS unit is about acquisition and analysis of Thermal, Infrared, and RF data using drone technology.

Scope

The scope covers the following :

- Acquire and Analize Thermal, Infrared and RF Data
- Organize the data for quality checks
- Perform Automated Analysis of the accurate data

Elements and Performance Criteria

Acquire and Analize Thermal, Infrared and RF Data

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

PC1. calibrate TIR (Total Internal Reflection) sensors before data collection to guarantee accurate and reliable measurements, minimizing distortions and inaccuracies in the thermal imagery.

PC2. apply temperature calibration techniques to convert raw thermal data into meaningful temperature values, allowing for accurate thermal mapping and analysis.

PC3. analyse thermal and infrared data to detect anomalies, patterns, or trends that may indicate specific conditions or issues within the surveyed area.

PC4. quantify thermal variations across the landscape, providing insights into temperature gradients, heat distribution, and potential environmental changes.

PC5. generate thermal maps and visualizations to represent temperature distributions spatially, aiding in the interpretation and communication of thermal information.

PC6. integrate thermal and infrared data with Geographic Information System (GIS) platforms for spatial analysis and mapping.

PC7. retrieve the collected RF data from the drone's storage system after the flight.

PC8. conduct frequency analysis to identify the presence and strength of signals within the collected RF data.

PC9. map the identified RF signals spatially to understand their distribution across the surveyed area.

PC10. apply pattern recognition algorithms to identify trends or anomalies in the RF signals.

PC11. analyse the data to identify any interference or potential sources of RF signal degradation.

PC12. compare the acquired RF data with baseline data or industry standards to assess the performance or compliance of the RF environment.

Organize the data for quality checks

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

PC13. develop a systematic approach to categorize Thermal, Infrared, and RF data based on parameters such as location, time of acquisition, and sensor type.

PC14. implement consistent naming conventions and metadata tagging to facilitate easy retrieval and reference during quality checks.

PC15. utilize database management systems to efficiently store and organize large volumes of Thermal, Infrared, and RF data.

PC16. establish a hierarchical structure within the database, ensuring logical organization and easy navigation for subsequent analyses.

PC17. incorporate relevant metadata, including sensor specifications, environmental conditions, and flight details, to enhance the contextual understanding of the acquired data.

PC18. ensure metadata consistency across all datasets to streamline the quality checking process.

PC19. arrange the acquired data using appropriate coordinate systems and projections, ensuring spatial consistency and alignment with standard mapping systems.

PC20. verify the accuracy of spatial referencing through cross-referencing with ground control points or other reliable geospatial data sources.

PC21. align temporal aspects of the data, ensuring synchronization across multiple datasets acquired at different times.

PC22. account for temporal variations, such as changes in environmental conditions or the dynamic nature of RF signals.

Perform Automated Analysis of the accurate data

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

PC23. demonstrate proficiency in using industry-standard software tools designed for automated analysis of Thermal, Infrared, and RF data.

PC24. navigate and manipulate datasets within the software environment to prepare for automated processing.

PC25. apply knowledge of algorithms tailored to Thermal, Infrared, and RF data analysis, ensuring the extraction of meaningful insights.

PC26. customize or develop algorithms as needed to address specific requirements or challenges posed by the dataset.

PC27. incorporate machine learning models and techniques to automate the identification of patterns, anomalies, or relevant features within the data.

PC28. define appropriate thresholds and criteria for automated analysis, considering the unique characteristics of Thermal, Infrared, and RF datasets.

PC29. set parameters to identify and flag outliers, potential issues, or significant changes in the data.

PC30. develop and implement streamlined processing workflows to handle large volumes of Thermal, Infrared, and RF data efficiently.

PC31. incorporate parallel processing or distributed computing solutions to expedite the analysis process.

PC32. implement validation procedures to assess the accuracy and reliability of automated analysis results.

PC33. compare automated findings with manual or ground truth assessments to ensure consistency and identify potential discrepancies.

PC34. design automated reporting mechanisms to present analysis results in a clear and understandable format.

PC35. include key metrics, visualizations, and insights derived from the automated analysis process.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. fundamentals of TIR and how it applies to sensor calibration for accurate thermal imagery.

KU2. various methods to calibrate raw thermal data into temperature values, ensuring precise thermal mapping.

KU3. techniques for identifying anomalies, patterns, and trends in thermal and infrared data that may indicate specific conditions or issues.

KU4. methods to quantify and interpret thermal variations across landscapes, including temperature gradients, heat distribution, and potential environmental changes.

KU5. thermal maps and visualizations to represent temperature distributions spatially for interpretation and communication purposes.

KU6. techniques to conduct frequency analysis on collected RF data to identify signal presence and strength.

KU7. pattern recognition algorithms to identify trends or anomalies in the collected RF signals.

KU8. methods to analyze data and identify potential sources of interference or degradation in RF signals.

KU9. Thermal, Infrared, and RF data systematically based on parameters such as location, time, and sensor type.

KU10. the importance of incorporating relevant metadata, including sensor specifications, environmental conditions, and flight details, to enhance contextual understanding.

Generic Skills (GS)

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

GS1. understanding of project need

GS2. assignment of band width

GS3. in the text, voice and video

GS4. communicate with client for specific need

GS5. either need of intranet or internet

GS6. sound knowledge of LAN and wireless devices

GS7. liaising and coordination skills

GS8. probe customers using appropriate open and close ended questions to understand the nature of problem, without any pre-conclusions

GS9. plan the development activities

GS10. organize all hardware/software components required for setup

GS11. plan testing and deployment activities

GS12. time and work management

GS13. read and comprehend/understand equipment installation manual

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Acquire and Analize Thermal, Infrared and RF Data	**10**	**20**	**-**	**3**
PC1. calibrate TIR (Total Internal Reflection) sensors before data collection to guarantee accurate and reliable measurements, minimizing distortions and inaccuracies in the thermal imagery.	1	3	-	-
PC2. apply temperature calibration techniques to convert raw thermal data into meaningful temperature values, allowing for accurate thermal mapping and analysis.	1	1	-	1
PC3. analyse thermal and infrared data to detect anomalies, patterns, or trends that may indicate specific conditions or issues within the surveyed area.	1	2	-	-
PC4. quantify thermal variations across the landscape, providing insights into temperature gradients, heat distribution, and potential environmental changes.	1	1	-	-
PC5. generate thermal maps and visualizations to represent temperature distributions spatially, aiding in the interpretation and communication of thermal information.	1	1	-	1
PC6. integrate thermal and infrared data with Geographic Information System (GIS) platforms for spatial analysis and mapping.	-	3	-	-
PC7. retrieve the collected RF data from the drone's storage system after the flight.	1	2	-	-
PC8. conduct frequency analysis to identify the presence and strength of signals within the collected RF data.	1	3	-	-
PC9. map the identified RF signals spatially to understand their distribution across the surveyed area.	1	1	-	1
PC10. apply pattern recognition algorithms to identify trends or anomalies in the RF signals.	-	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. analyse the data to identify any interference or potential sources of RF signal degradation.	1	1	-	-
PC12. compare the acquired RF data with baseline data or industry standards to assess the performance or compliance of the RF environment.	1	1	-	-
Organize the data for quality checks	**10**	**20**	**-**	**3**
PC13. develop a systematic approach to categorize Thermal, Infrared, and RF data based on parameters such as location, time of acquisition, and sensor type.	1	2	-	1
PC14. implement consistent naming conventions and metadata tagging to facilitate easy retrieval and reference during quality checks.	1	2	-	-
PC15. utilize database management systems to efficiently store and organize large volumes of Thermal, Infrared, and RF data.	1	2	-	-
PC16. establish a hierarchical structure within the database, ensuring logical organization and easy navigation for subsequent analyses.	1	2	-	-
PC17. incorporate relevant metadata, including sensor specifications, environmental conditions, and flight details, to enhance the contextual understanding of the acquired data.	1	2	-	-
PC18. ensure metadata consistency across all datasets to streamline the quality checking process.	1	2	-	1
PC19. arrange the acquired data using appropriate coordinate systems and projections, ensuring spatial consistency and alignment with standard mapping systems.	1	2	-	-
PC20. verify the accuracy of spatial referencing through cross-referencing with ground control points or other reliable geospatial data sources.	1	2	-	-
PC21. align temporal aspects of the data, ensuring synchronization across multiple datasets acquired at different times.	1	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC22. account for temporal variations, such as changes in environmental conditions or the dynamic nature of RF signals.	1	2	-	-
Perform Automated Analysis of the accurate data	**10**	**20**	**-**	**4**
PC23. demonstrate proficiency in using industry-standard software tools designed for automated analysis of Thermal, Infrared, and RF data.	1	-	-	1
PC24. navigate and manipulate datasets within the software environment to prepare for automated processing.	1	2	-	-
PC25. apply knowledge of algorithms tailored to Thermal, Infrared, and RF data analysis, ensuring the extraction of meaningful insights.	1	2	-	-
PC26. customize or develop algorithms as needed to address specific requirements or challenges posed by the dataset.	1	-	-	-
PC27. incorporate machine learning models and techniques to automate the identification of patterns, anomalies, or relevant features within the data.	1	2	-	1
PC28. define appropriate thresholds and criteria for automated analysis, considering the unique characteristics of Thermal, Infrared, and RF datasets.	1	2	-	-
PC29. set parameters to identify and flag outliers, potential issues, or significant changes in the data.	1	2	-	-
PC30. develop and implement streamlined processing workflows to handle large volumes of Thermal, Infrared, and RF data efficiently.	1	2	-	1
PC31. incorporate parallel processing or distributed computing solutions to expedite the analysis process.	1	2	-	1
PC32. implement validation procedures to assess the accuracy and reliability of automated analysis results.	1	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC33. compare automated findings with manual or ground truth assessments to ensure consistency and identify potential discrepancies.	-	2	-	-
PC34. design automated reporting mechanisms to present analysis results in a clear and understandable format.	-	1	-	-
PC35. include key metrics, visualizations, and insights derived from the automated analysis process.	-	1	-	-
NOS Total	**30**	**60**	**-**	**10**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	TEL/N6276
NOS Name	Analise Remote Sensing Data
Sector	Telecom
Sub-Sector	
Occupation	Network Operation and Maintenance
NSQF Level	5
Credits	3
Version	1.0
Last Reviewed Date	30/05/2024
Next Review Date	30/05/2027
NSQC Clearance Date	30/05/2024

TEL/N6277: Identify Equipment and Infra Faults

Description

This OS unit is about comprehensive analysis of thermal imagery, RF signal strength, and geospatial mapping to identify abnormalities in communication infrastructure.

Scope

The scope covers the following :

- Thermal Imaging Analysis
- RF Signal Strength Analysis
- Geospatial Mapping

Elements and Performance Criteria

Analysing Thermal Image

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

PC1. plan drone flight paths to ensure complete coverage of the target area for telecom equipment inspection.

PC2. effectively use software tools like (Pix4D, Metashape, DroneDeploy, WebODM, etc.) to analyse thermal images.

PC3. recognise normal operating temperatures for various telecom equipment and identifying areas with abnormal heat patterns.

PC4. correlate abnormal heat signatures with potential equipment malfunctions like, a hot spot on a transmitter could indicate an overheating amplifier.

PC5. apply temperature calibration techniques to convert raw thermal data into meaningful temperature values, enhancing the accuracy of fault detection.

PC6. correlate thermal anomalies with visible signs of damage or wear observed in high-resolution images.

PC7. apply machine learning models for the automated detection of thermal anomalies associated with equipment faults.

PC8. generate thermal maps representing temperature distributions across the telecom equipment.

Analysing RF Signal Strength

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

PC9. interpret visualizations of RF signal strength data collected by the drone.

PC10. collect data on the Radio Frequency (RF) signals emitted by telecom equipment (cell towers, base stations etc.).

PC11. compare the collected RF signal strength data to established baselines or reference points for healthy equipment operation.

PC12. correlate signal strength variations with specific types of equipment issues.

PC13. effectively communicate identified faults and potential causes in reports.

PC14. translate technical findings into actionable recommendations for field technicians.

Geospatial Mapping

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

PC15. collect data during optimal weather conditions (e.g., clear skies, moderate wind) to minimize image distortion and ensure data accuracy of the telecom site.

PC16. analyse the captured data (images and orthomosaics) to identify potential faults in telecom equipment, such as loose connections, antenna damage, or corrosion.

PC17. integrate acquired geospatial data with existing maps or infrastructure layouts of telecom equipment.

PC18. correlate spatial information to accurately locate and identify the position of telecom assets.

PC19. ensure precision in aligning geospatial information with real-world coordinates for reliable fault identification.

PC20. analyse the spatial distribution of telecom equipment, such as towers, antennas, and supporting infrastructure, to identify irregularities or misalignments.

PC21. use geospatial mapping to identify discrepancies in the physical alignment or placement of telecom equipment components.

PC22. detect deviations from expected spatial configurations that may indicate faults or structural issues.

PC23. utilize automated spatial analysis tools and algorithms to systematically process and interpret geospatial data.

PC24. apply machine learning models for automated fault detection based on spatial patterns and anomalies.

PC25. generate three-dimensional (3D) models of telecom infrastructure using geospatial data.

PC26. use 3D models to visualize the spatial relationships between equipment components and identify potential faults in the third dimension.

PC27. analyse geospatial data collected at different times to map temporal changes in the positioning or alignment of telecom equipment.

PC28. identify shifts or movements that may indicate developing faults or structural issues.

PC29. document the location, severity, and nature of identified faults based on geospatial mapping.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. principles of planning drone flight paths to ensure comprehensive coverage of the target area for telecom equipment inspection.

KU2. use of software tools like Pix4D, Metashape, DroneDeploy, WebODM, etc., for the analysis of thermal images.

KU3. normal operating temperatures for various telecom equipment types.

KU4. correlation between abnormal heat signatures in thermal images and potential equipment malfunctions.

KU5. specific faults, such as overheating amplifiers, can manifest as abnormal heat patterns.

KU6. temperature calibration techniques to convert raw thermal data into meaningful temperature values.

KU7. impact of calibration on the accuracy of fault detection in thermal imaging analysis.

KU8. geospatial data with existing maps or infrastructure layouts of telecom equipment.
KU9. spatial distribution of telecom equipment to identify irregularities or misalignments.
KU10. machine learning models for automated fault detection.

Generic Skills (GS)

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

GS1. understanding of project need
GS2. assignment of band width
GS3. in the text, voice and video
GS4. communicate with client for specific need
GS5. either need of intranet or internet
GS6. sound knowledge of LAN and wireless devices
GS7. liaising and coordination skills
GS8. probe customers using appropriate open and close ended questions to understand the nature of problem, without any pre-conclusions
GS9. plan the development activities
GS10. organize all hardware/software components required for setup
GS11. plan testing and deployment activities
GS12. time and work management
GS13. read and comprehend/understand equipment installation manual

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Analysing Thermal Image	**10**	**20**	**-**	**3**
PC1. plan drone flight paths to ensure complete coverage of the target area for telecom equipment inspection.	2	2	-	-
PC2. effectively use software tools like (Pix4D, Metashape, DroneDeploy, WebODM, etc.) to analyse thermal images.	1	2	-	1
PC3. recognise normal operating temperatures for various telecom equipment and identifying areas with abnormal heat patterns.	1	3	1	-
PC4. correlate abnormal heat signatures with potential equipment malfunctions like, a hot spot on a transmitter could indicate an overheating amplifier.	1	4	-	1
PC5. apply temperature calibration techniques to convert raw thermal data into meaningful temperature values, enhancing the accuracy of fault detection.	1	1	-	-
PC6. correlate thermal anomalies with visible signs of damage or wear observed in high-resolution images.	2	2	-	-
PC7. apply machine learning models for the automated detection of thermal anomalies associated with equipment faults.	1	3	-	1
PC8. generate thermal maps representing temperature distributions across the telecom equipment.	1	3	-	-
Analysing RF Signal Strength	**10**	**20**	**-**	**3**
PC9. interpret visualizations of RF signal strength data collected by the drone.	2	3	-	1
PC10. collect data on the Radio Frequency (RF) signals emitted by telecom equipment (cell towers, base stations etc.).	1	4	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. compare the collected RF signal strength data to established baselines or reference points for healthy equipment operation.	2	2	-	-
PC12. correlate signal strength variations with specific types of equipment issues.	1	3	-	1
PC13. effectively communicate identified faults and potential causes in reports.	2	4	-	1
PC14. translate technical findings into actionable recommendations for field technicians.	2	4	-	-
Geospatial Mapping	**10**	**20**	**-**	**4**
PC15. collect data during optimal weather conditions (e.g., clear skies, moderate wind) to minimize image distortion and ensure data accuracy of the telecom site.	1	1	-	-
PC16. analyse the captured data (images and orthomosaics) to identify potential faults in telecom equipment, such as loose connections, antenna damage, or corrosion.	1	1	-	1
PC17. integrate acquired geospatial data with existing maps or infrastructure layouts of telecom equipment.	-	1	-	1
PC18. correlate spatial information to accurately locate and identify the position of telecom assets.	1	2	-	1
PC19. ensure precision in aligning geospatial information with real-world coordinates for reliable fault identification.	-	1	-	-
PC20. analyse the spatial distribution of telecom equipment, such as towers, antennas, and supporting infrastructure, to identify irregularities or misalignments.	1	1	-	-
PC21. use geospatial mapping to identify discrepancies in the physical alignment or placement of telecom equipment components.	1	2	-	-
PC22. detect deviations from expected spatial configurations that may indicate faults or structural issues.	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC23. utilize automated spatial analysis tools and algorithms to systematically process and interpret geospatial data.	1	2	-	-
PC24. apply machine learning models for automated fault detection based on spatial patterns and anomalies.	1	2	-	-
PC25. generate three-dimensional (3D) models of telecom infrastructure using geospatial data.	-	1	-	1
PC26. use 3D models to visualize the spatial relationships between equipment components and identify potential faults in the third dimension.	1	1	-	-
PC27. analyse geospatial data collected at different times to map temporal changes in the positioning or alignment of telecom equipment.	-	2	-	-
PC28. identify shifts or movements that may indicate developing faults or structural issues.	-	1	-	-
PC29. document the location, severity, and nature of identified faults based on geospatial mapping.	1	1	-	-
NOS Total	**30**	**60**	**-**	**10**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	TEL/N6277
NOS Name	Identify Equipment and Infra Faults
Sector	Telecom
Sub-Sector	
Occupation	Network Operation and Maintenance
NSQF Level	5
Credits	2
Version	1.0
Last Reviewed Date	30/05/2024
Next Review Date	30/05/2027
NSQC Clearance Date	30/05/2024

TEL/N6278: RF Mapping and Optimization

Description

This OS unit is about collecting RF signal data to systematically assess and optimize the performance of telecom equipment through the application of advanced data processing techniques.

Scope

The scope covers the following :

- RF Signal Data Collection
- Analyse RF Signal Strength
- Interference Detection
- Frequency Analysis

Elements and Performance Criteria

RF Signal Data Collection

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

PC1. plan drone flight paths to ensure comprehensive coverage of the target area for RF signal data collection.

PC2. predetermine factors such as building structures, vegetation, and environmental conditions that may impact RF signal propagation.

PC3. capture RF signal data across various frequency bands used by telecom equipment in the specified site.

PC4. ensure a comprehensive dataset that covers the entire RF spectrum relevant to the site.

PC5. operate drone equipped with a Software-Defined Radio (SDR) or other suitable RF signal collection equipment.

Analyse RF Signal Strength

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

PC6. collect RF signal strength data from different points within the telecom site using the deployed drones.

PC7. analyse variations in RF signal strength across different areas of the site.

PC8. identify regions with strong signals, weak signals, or unexpected signal patterns that may indicate interference or optimization opportunities.

PC9. identify areas with potential coverage gaps or signal irregularities that could impact overall network performance.

PC10. detect and analyse instances of signal drop-offs or attenuation within the site.

PC11. investigate the causes of signal loss, considering obstacles, interference sources, or equipment malfunctions.

PC12. utilize RF signal strength data to identify sources of interference within the constructed or pre-constructed telecom site.

PC13. investigate potential sources such as neighbouring electronic devices, competing signals, or environmental factors.

Interference Detection

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

PC14. effectively use specialized software tools (Pix4D, Metashape, DroneDeploy, ctc.,) designed for RF mapping and optimization, enabling accurate analysis of collected data.

PC15. analyse RF signal strength data to assess the overall health of the telecom site.

PC16. identify areas with weak or strong signal strength and determine signal distribution patterns.

PC17. distinguish between external interference and signals emitted by the telecom equipment.

Frequency Analysis

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

PC18. execute drone flights to collect RF data, capturing information on signal strength, frequencies, and variations across the entire telecom site.

PC19. analyse RF data to identify specific frequency bands used by the telecom equipment on the site.

PC20. utilize frequency analysis to detect variations in RF signal strength across different frequency bands.

PC21. identify potential sources of interference, such as neighbouring equipment, electronic devices, or environmental factors.

PC22. identify potential correlations between RF signal variations and the placement of equipment or structural elements.

PC23. document the results of frequency analysis and optimization efforts in comprehensive reports.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. principles of planning drone flight paths to ensure comprehensive coverage for RF signal data collection.

KU2. frequency allocations for different communication systems and services.

KU3. Strategies for capturing RF signal data across various frequency bands used by telecom equipment in the specified site.

KU4. Software-Defined Radio (SDR) or other suitable RF signal collection equipment.

KU5. RF signal strength data from different points within the telecom site using deployed drones.

KU6. the importance of strategic data collection to represent the site comprehensively.

KU7. variations in RF signal strength across different areas of the site.

KU8. signal strength data.

KU9. potential causes and assessing the severity of signal loss.

KU10. RF signal strength data to identify sources of interference within the constructed or pre-constructed telecom site.

KU11. software tools (Pix4D, Metashape, DroneDeploy, etc.) designed for RF mapping and optimization.

KU12. external interference and signals emitted by the telecom equipment.

Generic Skills (GS)

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

GS1. understanding of project need
GS2. assignment of band width
GS3. in the text, voice and video
GS4. communicate with client for specific need
GS5. either need of intranet or internet
GS6. sound knowledge of LAN and wireless devices
GS7. liaising and coordination skills
GS8. probe customers using appropriate open and close ended questions to understand the nature of problem, without any pre-conclusions
GS9. plan the development activities
GS10. organize all hardware/software components required for setup
GS11. plan testing and deployment activities
GS12. time and work management
GS13. read and comprehend/understand equipment installation manual

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
RF Signal Data Collection	**5**	**20**	**-**	**1**
PC1. plan drone flight paths to ensure comprehensive coverage of the target area for RF signal data collection.	1	4	-	-
PC2. predetermine factors such as building structures, vegetation, and environmental conditions that may impact RF signal propagation.	1	2	-	-
PC3. capture RF signal data across various frequency bands used by telecom equipment in the specified site.	1	4	-	1
PC4. ensure a comprehensive dataset that covers the entire RF spectrum relevant to the site.	1	5	-	-
PC5. operate drone equipped with a Software-Defined Radio (SDR) or other suitable RF signal collection equipment.	1	5	-	-
Analyse RF Signal Strength	**10**	**10**	**-**	**2**
PC6. collect RF signal strength data from different points within the telecom site using the deployed drones.	1	2	-	-
PC7. analyse variations in RF signal strength across different areas of the site.	2	2	-	-
PC8. identify regions with strong signals, weak signals, or unexpected signal patterns that may indicate interference or optimization opportunities.	1	-	-	-
PC9. identify areas with potential coverage gaps or signal irregularities that could impact overall network performance.	1	2	-	1
PC10. detect and analyse instances of signal drop-offs or attenuation within the site.	2	1	-	-
PC11. investigate the causes of signal loss, considering obstacles, interference sources, or equipment malfunctions.	1	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. utilize RF signal strength data to identify sources of interference within the constructed or pre-constructed telecom site.	1	2	-	1
PC13. investigate potential sources such as neighbouring electronic devices, competing signals, or environmental factors.	1	1	-	-
Interference Detection	**5**	**10**	**-**	**3**
PC14. effectively use specialized software tools (Pix4D, Metashape, DroneDeploy, ctc.,) designed for RF mapping and optimization, enabling accurate analysis of collected data.	1	2	-	1
PC15. analyse RF signal strength data to assess the overall health of the telecom site.	1	3	-	1
PC16. identify areas with weak or strong signal strength and determine signal distribution patterns.	1	1	-	-
PC17. distinguish between external interference and signals emitted by the telecom equipment.	2	4	-	1
Frequency Analysis	**10**	**20**	**-**	**4**
PC18. execute drone flights to collect RF data, capturing information on signal strength, frequencies, and variations across the entire telecom site.	2	2	-	1
PC19. analyse RF data to identify specific frequency bands used by the telecom equipment on the site.	2	4	-	-
PC20. utilize frequency analysis to detect variations in RF signal strength across different frequency bands.	3	4	-	1
PC21. identify potential sources of interference, such as neighbouring equipment, electronic devices, or environmental factors.	1	1	-	-
PC22. identify potential correlations between RF signal variations and the placement of equipment or structural elements.	1	5	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC23. document the results of frequency analysis and optimization efforts in comprehensive reports.	1	4	-	1
NOS Total	**30**	**60**	**-**	**10**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	TEL/N6278
NOS Name	RF Mapping and Optimization
Sector	Telecom
Sub-Sector	
Occupation	Network Operation and Maintenance
NSQF Level	5
Credits	2
Version	1.0
Last Reviewed Date	30/05/2024
Next Review Date	30/05/2027
NSQC Clearance Date	30/05/2024

DGT/VSQ/N0102: Employability Skills (60 Hours)

Description

This unit is about employability skills, Constitutional values, becoming a professional in the 21st Century, digital, financial, and legal literacy, diversity and Inclusion, English and communication skills, customer service, entrepreneurship, and apprenticeship, getting ready for jobs and career development.

Scope

The scope covers the following :

- Introduction to Employability Skills
- Constitutional values - Citizenship
- Becoming a Professional in the 21st Century
- Basic English Skills
- Career Development & Goal Setting
- Communication Skills
- Diversity & Inclusion
- Financial and Legal Literacy
- Essential Digital Skills
- Entrepreneurship
- Customer Service
- Getting ready for Apprenticeship & Jobs

Elements and Performance Criteria

Introduction to Employability Skills

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

PC1. identify employability skills required for jobs in various industries

PC2. identify and explore learning and employability portals

Constitutional values – Citizenship

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

PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.

PC4. follow environmentally sustainable practices

Becoming a Professional in the 21st Century

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

PC5. recognize the significance of 21st Century Skills for employment

PC6. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life

Basic English Skills

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

PC7. use basic English for everyday conversation in different contexts, in person and over the telephone

PC8. read and understand routine information, notes, instructions, mails, letters etc. written in English

PC9. write short messages, notes, letters, e-mails etc. in English

Career Development & Goal Setting

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

PC10. understand the difference between job and career

PC11. prepare a career development plan with short- and long-term goals, based on aptitude

Communication Skills

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

PC12. follow verbal and non-verbal communication etiquette and active listening techniques in various settings

PC13. work collaboratively with others in a team

Diversity & Inclusion

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

PC14. communicate and behave appropriately with all genders and PwD

PC15. escalate any issues related to sexual harassment at workplace according to POSH Act

Financial and Legal Literacy

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

PC16. select financial institutions, products and services as per requirement

PC17. carry out offline and online financial transactions, safely and securely

PC18. identify common components of salary and compute income, expenses, taxes, investments etc

PC19. identify relevant rights and laws and use legal aids to fight against legal exploitation

Essential Digital Skills

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

PC20. operate digital devices and carry out basic internet operations securely and safely

PC21. use e- mail and social media platforms and virtual collaboration tools to work effectively

PC22. use basic features of word processor, spreadsheets, and presentations

Entrepreneurship

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

PC23. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research

PC24. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion

PC25. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity

Customer Service

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

PC26. identify different types of customers

PC27. identify and respond to customer requests and needs in a professional manner.

PC28. follow appropriate hygiene and grooming standards

Getting ready for apprenticeship & Jobs

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

PC29. create a professional Curriculum vitae (Résumé)

PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively

PC31. apply to identified job openings using offline /online methods as per requirement

PC32. answer questions politely, with clarity and confidence, during recruitment and selection

PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. need for employability skills and different learning and employability related portals

KU2. various constitutional and personal values

KU3. different environmentally sustainable practices and their importance

KU4. Twenty first (21st) century skills and their importance

KU5. how to use English language for effective verbal (face to face and telephonic) and written communication in formal and informal set up

KU6. importance of career development and setting long- and short-term goals

KU7. about effective communication

KU8. POSH Act

KU9. Gender sensitivity and inclusivity

KU10. different types of financial institutes, products, and services

KU11. how to compute income and expenditure

KU12. importance of maintaining safety and security in offline and online financial transactions

KU13. different legal rights and laws

KU14. different types of digital devices and the procedure to operate them safely and securely

KU15. how to create and operate an e- mail account and use applications such as word processors, spreadsheets etc.

KU16. how to identify business opportunities

KU17. types and needs of customers

KU18. how to apply for a job and prepare for an interview

KU19. apprenticeship scheme and the process of registering on apprenticeship portal

Generic Skills (GS)

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

GS1. read and write different types of documents/instructions/correspondence

GS2. communicate effectively using appropriate language in formal and informal settings

GS3. behave politely and appropriately with all
GS4. how to work in a virtual mode
GS5. perform calculations efficiently
GS6. solve problems effectively
GS7. pay attention to details
GS8. manage time efficiently
GS9. maintain hygiene and sanitization to avoid infection

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Introduction to Employability Skills	**1**	**1**	**-**	**-**
PC1. identify employability skills required for jobs in various industries	-	-	-	-
PC2. identify and explore learning and employability portals	-	-	-	-
Constitutional values – Citizenship	**1**	**1**	**-**	**-**
PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-	-
PC4. follow environmentally sustainable practices	-	-	-	-
Becoming a Professional in the 21st Century	**2**	**4**	**-**	**-**
PC5. recognize the significance of 21st Century Skills for employment	-	-	-	-
PC6. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life	-	-	-	-
Basic English Skills	**2**	**3**	**-**	**-**
PC7. use basic English for everyday conversation in different contexts, in person and over the telephone	-	-	-	-
PC8. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-	-
PC9. write short messages, notes, letters, e-mails etc. in English	-	-	-	-
Career Development & Goal Setting	**1**	**2**	**-**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. understand the difference between job and career	-	-	-	-
PC11. prepare a career development plan with short- and long-term goals, based on aptitude	-	-	-	-
Communication Skills	**2**	**2**	**-**	**-**
PC12. follow verbal and non-verbal communication etiquette and active listening techniques in various settings	-	-	-	-
PC13. work collaboratively with others in a team	-	-	-	-
Diversity & Inclusion	**1**	**2**	**-**	**-**
PC14. communicate and behave appropriately with all genders and PwD	-	-	-	-
PC15. escalate any issues related to sexual harassment at workplace according to POSH Act	-	-	-	-
Financial and Legal Literacy	**2**	**3**	**-**	**-**
PC16. select financial institutions, products and services as per requirement	-	-	-	-
PC17. carry out offline and online financial transactions, safely and securely	-	-	-	-
PC18. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-	-
PC19. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-	-
Essential Digital Skills	**3**	**4**	**-**	**-**
PC20. operate digital devices and carry out basic internet operations securely and safely	-	-	-	-
PC21. use e- mail and social media platforms and virtual collaboration tools to work effectively	-	-	-	-
PC22. use basic features of word processor, spreadsheets, and presentations	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Entrepreneurship	**2**	**3**	**-**	**-**
PC23. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research	-	-	-	-
PC24. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-	-
PC25. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity	-	-	-	-
Customer Service	**1**	**2**	**-**	**-**
PC26. identify different types of customers	-	-	-	-
PC27. identify and respond to customer requests and needs in a professional manner.	-	-	-	-
PC28. follow appropriate hygiene and grooming standards	-	-	-	-
Getting ready for apprenticeship & Jobs	**2**	**3**	**-**	**-**
PC29. create a professional Curriculum vitae (Résumé)	-	-	-	-
PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-	-
PC31. apply to identified job openings using offline /online methods as per requirement	-	-	-	-
PC32. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-	-
PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-	-
NOS Total	**20**	**30**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	DGT/VSQ/N0102
NOS Name	Employability Skills (60 Hours)
Sector	Cross Sectoral
Sub-Sector	Professional Skills
Occupation	Employability
NSQF Level	4
Credits	2
Version	1.0
Last Reviewed Date	29/03/2023
Next Review Date	29/03/2028
NSQC Clearance Date	29/03/2023

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Element/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 Element/PC.

2. The assessment for the theory part will be based on 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 center (as per assessment criteria below).

5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/ training center based on these criteria.

6. To pass the Qualification Pack assessment, every trainee should score the Recommended Pass 70% aggregate for the QP.

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

Minimum Aggregate Passing % at QP Level : 70

(**Please note**: Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
TEL/N6273.Data extraction/collection	30	60	-	10	100	15
TEL/N6274.Processing of Collected Data	30	60	-	10	100	15
TEL/N6275.Analise and Project the Collected Data	30	60	-	10	100	15
TEL/N6276.Analise Remote Sensing Data	30	60	-	10	100	15
TEL/N6277.Identify Equipment and Infra Faults	30	60	-	10	100	15
TEL/N6278.RF Mapping and Optimization	30	60	-	10	100	15
DGT/VSQ/N0102.Employability Skills (60 Hours)	20	30	-	-	50	10
Total	**200**	**390**	**-**	**60**	**650**	**100**

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training

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.