Qualification Pack

AI Embedded Product Developer (Electronics) (OEM Name: SIC - Artificial Intelligence)

QP Code: ELE/Q1407

Version: 1.0

NSQF Level: 4.5

Electronics Sector Skills Council of India || 155, 2nd Floor, ESC House Okhla Industrial Area-Phase 3 New Delhi- 110020 || email:sneh@essc-india.org

Contents

Qualification Pack

ELE/Q1407: AI Embedded Product Developer (Electronics) (OEM Name: SIC - Artificial Intelligence)

Brief Job Description

The "SIC - Artificial Intelligence" Qualification will provide a comprehensive introduction to Python programming and essential libraries like NumPy and Pandas for data analysis. It will also cover data visualization using Matplotlib. The course emphasizes practical programming skills, offering hands-on experience to aspiring Python developers. Additionally, it introduces key Machine Learning concepts, allowing participants from any background to acquire the skills necessary to become an AI Engineer.

Personal Attributes

The individual in this job needs to be self-motivated, inquisitive and analytical. The individual must be willing to work in the field and travel through the day from one customer premises to another. The individual also needs to be punctual, patience, trustworthy and possess an amenable behaviour.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. ELE/N1420: Introduction to Artificial Intelligence

2. ELE/N1421: Advanced Mathematics and Exploratory Data Analysis for Artificial Intelligence

3. ELE/N1422: Machine Learning

4. ELE/N1423: NLP, Neural Networks, Deep Learning, and AI Capstone

Qualification Pack (QP) Parameters

Sector	Electronics
Sub-Sector	Semiconductor & Components
Occupation	Product Design-S&C
Country	India
NSQF Level	4.5
Credits	11.6
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2511.0106

Minimum Educational Qualification & Experience	Completed 1st year of UG (UG Certificate) (Electronics, Electrical, Computer science, Artificial Intelligence) with NA of experience OR Completed 3 year diploma after 10th (Electronics, Electrical, Computer science, Artificial Intelligence) with NA of experience OR 12th Class (Science) with 1.5 years of experience Artificial Intelligence OR 10th Class with 3 Years of experience Artificial Intelligence OR Previous relevant Qualification of NSQF Level (4) with 1.5 years of experience Artificial Intelligence
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	NA
Next Review Date	18/02/2028
NSQC Approval Date	18/02/2025
Version	1.0
Reference code on NQR	QG-4.5-EH-03602-2025-V1-ESSCI
NQR Version	1.0

ELE/N1420: Introduction to Artificial Intelligence

Description

This unit is about real-world applications of artificial intelligence (AI), covering machine learning, neural networks, and sectors like healthcare and finance.

Scope

The scope covers the following :

- Explain the core concepts and applications of AI in various industries.
- Analyze ethical issues and considerations related to AI technologies.
- Utilize AI tools like Tensor Flow and Python to implement basic AI solutions effectively.

Elements and Performance Criteria

Fundamentals of AI

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

PC1. Define AI and identify its core components, such as machine learning, neural networks, and natural language processing.

PC2. Trace the history and evolution of AI, including key milestones and pioneers.

PC3. Identify real-world applications of AI across various industries like healthcare, finance, and automotive.

PC4. Discuss ethical considerations in AI, such as privacy, bias, and transparency.

AI Techniques and Tools

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

PC5. Differentiate between symbolic AI (rule-based systems) and sub-symbolic AI (machine learning and neural networks).

PC6. Describe key AI techniques, including supervised learning, unsupervised learning, and reinforcement learning.

PC7. List and explain AI tools like TensorFlow, PyTorch, and Keras, and understand their applications.

PC8. Explore AI programming languages such as Python, R, and Julia, focusing on their strengths and use cases.

AI Project Lifecycle

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

PC9. Outline the steps in an AI project lifecycle, including data collection, preprocessing, model training, and deployment.

PC10. Understand the importance of data quality and quantity in AI projects.

PC11. Describe the model building process, including algorithm selection and hyperparameter tuning.

PC12. Explain model evaluation and deployment strategies, including monitoring and maintenance.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. Define AI and its core components (ML, NN, NLP).
KU2. Trace the history and evolution of AI.
KU3. Identify AI applications in healthcare, finance, and automotive.
KU4. Discuss ethical issues in AI (privacy, bias, transparency).
KU5. Differentiate between symbolic and sub-symbolic AI.
KU6. Describe key AI techniques: supervised, unsupervised, and reinforcement learning.
KU7. List AI tools: TensorFlow, PyTorch, Keras.
KU8. Explore AI programming languages: Python, R, Julia.
KU9. Outline the AI project lifecycle: data collection, preprocessing, model training.

Generic Skills (GS)

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

GS1. Programming in Python, R, and Julia
GS2. Understanding of machine learning algorithms
GS3. Data collection and preprocessing
GS4. Model development and hyperparameter tuning
GS5. Familiarity with AI frameworks (TensorFlow, PyTorch, Keras)
GS6. Cloud computing for AI deployment
GS7. Version control with Git
GS8. Statistical analysis and data interpretation
GS9. Model evaluation and validation

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Fundamentals of AI	**32**	**-**	**-**	**-**
PC1. Define AI and identify its core components, such as machine learning, neural networks, and natural language processing.	8	-	-	-
PC2. Trace the history and evolution of AI, including key milestones and pioneers.	8	-	-	-
PC3. Identify real-world applications of AI across various industries like healthcare, finance, and automotive.	8	-	-	-
PC4. Discuss ethical considerations in AI, such as privacy, bias, and transparency.	8	-	-	-
AI Techniques and Tools	**32**	**-**	**-**	**-**
PC5. Differentiate between symbolic AI (rule-based systems) and sub-symbolic AI (machine learning and neural networks).	8	-	-	-
PC6. Describe key AI techniques, including supervised learning, unsupervised learning, and reinforcement learning.	8	-	-	-
PC7. List and explain AI tools like TensorFlow, PyTorch, and Keras, and understand their applications.	8	-	-	-
PC8. Explore AI programming languages such as Python, R, and Julia, focusing on their strengths and use cases.	8	-	-	-
AI Project Lifecycle	**36**	**-**	**-**	**-**
PC9. Outline the steps in an AI project lifecycle, including data collection, preprocessing, model training, and deployment.	9	-	-	-
PC10. Understand the importance of data quality and quantity in AI projects.	9	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. Describe the model building process, including algorithm selection and hyperparameter tuning.	9	-	-	-
PC12. Explain model evaluation and deployment strategies, including monitoring and maintenance.	9	-	-	-
NOS Total	**100**	-	-	-

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N1420
NOS Name	Introduction to Artificial Intelligence
Sector	Electronics
Sub-Sector	
Occupation	Product Design-S&C
NSQF Level	4.5
Credits	1
Version	1.0
Last Reviewed Date	18/02/2025
Next Review Date	18/02/2028
NSQC Clearance Date	18/02/2025

ELE/N1421: Advanced Mathematics and Exploratory Data Analysis for Artificial Intelligence

Description

This NOS unit deals with mathematical and statistical concepts, including algebra, calculus, probability theory, and hypothesis testing, essential for data science.

Scope

The scope covers the following :

- Apply mathematical concepts to solve data science problems effectively.
- Utilize statistical methods for data analysis and inference.
- Implement mathematical and statistical techniques in machine learning and AI applications.

Elements and Performance Criteria

Foundational Mathematics for Data Science

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

PC1. Review basic algebra, including equations, inequalities, and their applications in data science problems.

PC2. Solve functions and analyze their behavior using graphs for trend identification and predictive modeling.

PC3. Understand probability principles, including random variables, probability distributions, and cumulative distribution functions.

PC4. Apply probability distributions (e.g., normal, binomial) for uncertainty modeling in AI datasets.

PC5. Explore linear algebra concepts like vector spaces and matrix operations for data transformation.

PC6. Utilize calculus concepts (differentiation and integration) to optimize functions and minimize error in AI models.

Advanced Mathematics for Data Science

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

PC7. Define vectors and perform operations like scalar multiplication, dot product, and cross product.

PC8. Use matrix operations (addition, multiplication, inversion) to manipulate datasets and AI features.

PC9. Apply eigenvalues and eigenvectors in dimensionality reduction for machine learning models.

PC10. Use NumPy to efficiently perform matrix computations, including slicing, indexing, and broadcasting.

PC11. Understand confidence intervals to measure the reliability of statistical conclusions.

PC12. Explore statistical measures (mean, median, variance) to summarize data characteristics.

Data Exploration with NumPy and Pandas

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

PC13. Create and manipulate NumPy arrays, including reshaping and handling multidimensional arrays.

PC14. Perform vectorized computations and broadcasting using NumPy for scalable AI workflows.

PC15. Use Pandas for loading, cleaning, and merging datasets, addressing missing values and duplicates.

PC16. Explore datasets with Pandas DataFrames and Series to summarize and transform data.

PC17. Perform advanced group-by operations with Pandas for aggregation and analytical insights.

PC18. Use NumPy and Pandas together to preprocess large datasets for machine learning models.

Data Visualization and Insights

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

PC19. Create visualizations like histograms, line plots, and bar charts using Matplotlib for trend analysis.

PC20. Use Seaborn for advanced plotting, including heatmaps, pair plots, and violin plots.

PC21. Visualize data distributions and correlations using Seaborn's pair grid and categorical plots.

PC22. Interpret visual data insights to identify trends, outliers, and relationships in datasets.

PC23. Customize visualizations with annotations, legends, and styles to effectively communicate insights

PC24. Use Matplotlib and Seaborn together to create publication-quality graphs for AI presentations.

Probability and Statistical Analysis

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

PC25. Explain concepts of Bayesian probability and conditional probability in decision-making scenarios.

PC26. Conduct hypothesis testing using methods like t-tests, chi-square tests, and ANOVA.

PC27. Understand and interpret sampling distributions to assess variability in data analysis.

PC28. Apply probability distributions to model data uncertainty, including normal, Poisson, and uniform distributions.

PC29. Perform correlation and regression analysis to identify relationships and trends in datasets.

PC30. Conduct statistical significance testing to validate hypotheses and evaluate model performance.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. Understand the role of algebra in solving equations and inequalities within data science applications, including real-world problems.

KU2. Comprehend the use of functions and graphs in analyzing trends and making predictive models.

KU3. Grasp probability principles, such as random variables, probability distributions, and cumulative distribution functions, and their relevance in data science.

KU4. Understand the application of probability distributions (e.g., normal, binomial) to model uncertainty in data science and AI.

KU5. Familiarize with key linear algebra concepts like vector spaces and matrix operations for manipulating and transforming data.

KU6. Understand the significance of confidence intervals in statistical analysis and their role in quantifying uncertainty in conclusions.

KU7. Grasp the concepts of Bayesian probability, conditional probability and especially in making informed decisions and analyzing data.

KU8. Develop knowledge of using Pandas for data preprocessing tasks such as loading, cleaning, and merging datasets.

KU9. Understand how to visualize data distributions and correlations using Seaborn's pair grid and categorical plots.

Generic Skills (GS)

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

GS1. Proficiency in algebra, including solving equations and inequalities.

GS2. Ability to analyze function behaviors for trend identification and predictive modeling.

GS3. Knowledge of probability principles and probability distributions for AI applications.

GS4. Proficiency in matrix operations for AI feature manipulation.

GS5. Ability to clean, manipulate, and preprocess datasets using NumPy and Pandas.

GS6. Understanding and applying calculus concepts to minimize errors in AI models.

GS7. Proficiency in creating visualizations (e.g., histograms, heatmaps) for data insights.

GS8. Understanding Bayesian probability and conducting hypothesis testing.

GS9. Ability to perform correlation and regression analysis to identify relationships.

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Foundational Mathematics for Data Science	**20**	-	-	-
PC1. Review basic algebra, including equations, inequalities, and their applications in data science problems.	3	-	-	-
PC2. Solve functions and analyze their behavior using graphs for trend identification and predictive modeling.	3	-	-	-
PC3. Understand probability principles, including random variables, probability distributions, and cumulative distribution functions.	3	-	-	-
PC4. Apply probability distributions (e.g., normal, binomial) for uncertainty modeling in AI datasets.	3	-	-	-
PC5. Explore linear algebra concepts like vector spaces and matrix operations for data transformation.	4	-	-	-
PC6. Utilize calculus concepts (differentiation and integration) to optimize functions and minimize error in AI models.	4	-	-	-
Advanced Mathematics for Data Science	**20**	-	-	-
PC7. Define vectors and perform operations like scalar multiplication, dot product, and cross product.	3	-	-	-
PC8. Use matrix operations (addition, multiplication, inversion) to manipulate datasets and AI features.	3	-	-	-
PC9. Apply eigenvalues and eigenvectors in dimensionality reduction for machine learning models.	3	-	-	-
PC10. Use NumPy to efficiently perform matrix computations, including slicing, indexing, and broadcasting.	4	-	-	-
PC11. Understand confidence intervals to measure the reliability of statistical conclusions.	3	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. Explore statistical measures (mean, median, variance) to summarize data characteristics.	4	-	-	-
Data Exploration with NumPy and Pandas	**20**	**-**	**-**	**-**
PC13. Create and manipulate NumPy arrays, including reshaping and handling multidimensional arrays.	3	-	-	-
PC14. Perform vectorized computations and broadcasting using NumPy for scalable AI workflows.	3	-	-	-
PC15. Use Pandas for loading, cleaning, and merging datasets, addressing missing values and duplicates.	3	-	-	-
PC16. Explore datasets with Pandas DataFrames and Series to summarize and transform data.	4	-	-	-
PC17. Perform advanced group-by operations with Pandas for aggregation and analytical insights.	3	-	-	-
PC18. Use NumPy and Pandas together to preprocess large datasets for machine learning models.	4	-	-	-
Data Visualization and Insights	**20**	**-**	**-**	**-**
PC19. Create visualizations like histograms, line plots, and bar charts using Matplotlib for trend analysis.	3	-	-	-
PC20. Use Seaborn for advanced plotting, including heatmaps, pair plots, and violin plots.	3	-	-	-
PC21. Visualize data distributions and correlations using Seaborn's pair grid and categorical plots.	3	-	-	-
PC22. Interpret visual data insights to identify trends, outliers, and relationships in datasets.	3	-	-	-
PC23. Customize visualizations with annotations, legends, and styles to effectively communicate insights	4	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC24. Use Matplotlib and Seaborn together to create publication-quality graphs for AI presentations.	4	-	-	-
Probability and Statistical Analysis	**20**	**-**	**-**	**-**
PC25. Explain concepts of Bayesian probability and conditional probability in decision-making scenarios.	3	-	-	-
PC26. Conduct hypothesis testing using methods like t-tests, chi-square tests, and ANOVA.	3	-	-	-
PC27. Understand and interpret sampling distributions to assess variability in data analysis.	3	-	-	-
PC28. Apply probability distributions to model data uncertainty, including normal, Poisson, and uniform distributions.	4	-	-	-
PC29. Perform correlation and regression analysis to identify relationships and trends in datasets.	4	-	-	-
PC30. Conduct statistical significance testing to validate hypotheses and evaluate model performance.	3	-	-	-
NOS Total	**100**	**-**	**-**	**-**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N1421
NOS Name	Advanced Mathematics and Exploratory Data Analysis for Artificial Intelligence
Sector	Electronics
Sub-Sector	
Occupation	Product Design-S&C
NSQF Level	4.5
Credits	3
Version	1.0
Last Reviewed Date	18/02/2025
Next Review Date	18/02/2028
NSQC Clearance Date	18/02/2025

ELE/N1422: Machine Learning

Description

This NOS deals with supervised and unsupervised learning techniques, including regression, classification, and clustering models, and explores the machine learning pipeline.

Scope

The scope covers the following :

- Develop and apply supervised learning models for various predictive tasks.
- Understand and implement decision trees and ensemble methods.
- Evaluate and optimize machine learning models using appropriate metrics and techniques.

Elements and Performance Criteria

Fundamentals of Machine Learning

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

PC1. Define supervised, unsupervised, and reinforcement learning, and explain their applications in AI.

PC2. Describe the machine learning pipeline, including data preprocessing, feature selection, model training, and evaluation.

PC3. Explain common evaluation metrics (e.g., accuracy, precision, recall, F1 score, confusion matrix, ROC curve, AUC).

Supervised Learning and Models

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

PC4. Apply regression models (e.g., linear regression, polynomial regression) for numerical prediction.

PC5. Implement classification models (e.g., logistic regression, decision trees) for categorical prediction.

PC6. Define decision trees, describe tree-building algorithms (e.g., CART, ID3), and prune trees to avoid overfitting.

PC7. Explain ensemble methods (e.g., Random Forest, Gradient Boosting) and their advantages over single models.

PC8. Describe the Naïve Bayes algorithm and its assumptions, and apply it to classification tasks like text classification.

Advanced Supervised Learning

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

PC9. Define Support Vector Machines (SVM), and explain concepts like hyperplanes, margins, and kernel tricks.

PC10. Implement SVM models, tune parameters, and evaluate performance using metrics.

PC11. Describe the K-Nearest Neighbors (KNN) algorithm and its applications in classification and regression.

PC12. Implement KNN models, optimize parameters (e.g., number of neighbors, distance metrics), and evaluate performance.

Unsupervised Learning and Dimensionality Reduction

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

PC13. Define unsupervised learning and explain its role in discovering hidden patterns in data.

PC14. Explain clustering techniques (e.g., K-means, hierarchical clustering) and their use in grouping similar data points.

PC15. Apply K-means clustering to datasets and interpret resulting clusters.

PC16. Perform hierarchical clustering and visualize results using dendrograms.

PC17. Describe Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA), and apply them for dimensionality reduction in high-dimensional data.

Advanced Techniques and Reinforcement Learning

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

PC18. Explore advanced clustering methods (e.g., DBSCAN, Gaussian Mixture Models) and evaluate their suitability for datasets.

PC19. Define reinforcement learning and explain key concepts such as agents, environments, states, actions, rewards, and policies.

PC20. Implement basic reinforcement learning algorithms such as Q-learning and policy gradients.

PC21. Apply reinforcement learning to practical problems like game-playing or robotic control.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. Understand the distinctions between supervised, unsupervised, and reinforcement learning, and their specific applications in artificial intelligence (AI).

KU2. Comprehend the stages of the machine learning pipeline, including data preprocessing, feature selection, model training, and model evaluation.

KU3. Grasp the key machine learning evaluation metrics such as accuracy, precision, recall, F1 score, confusion matrix, ROC curve, and AUC, and their use in assessing model performance.

KU4. Understand how regression models (e.g., linear regression, polynomial regression) are used for predicting continuous numerical values.

KU5. Comprehend the principles of classification models (e.g., logistic regression, decision trees) for categorizing data into discrete classes.

KU6. Grasp the benefits of ensemble methods (e.g., Random Forest, Gradient Boosting) and their advantages over using individual models.

KU7. Understand the principles of Support Vector Machines (SVM), including the concepts of hyperplanes, margins, and the kernel trick for handling non-linear data.

KU8. Understand the concept of decision trees, tree-building algorithms (e.g., CART, ID3), and the importance of pruning trees to prevent overfitting.

KU9. Grasp the key concepts of reinforcement learning, including agents, environments, states, actions, rewards, and policies.

Generic Skills (GS)

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

GS1. Understanding of supervised, unsupervised, and reinforcement learning and their AI applications.

GS2. Knowledge of the machine learning pipeline, including data preprocessing, feature selection, model training, and evaluation.

GS3. Familiarity with common evaluation metrics such as accuracy, precision, recall, F1 score, confusion matrix, ROC curve, and AUC.

GS4. Ability to apply regression models (e.g., linear regression, polynomial regression) for numerical predictions.

GS5. Proficiency in implementing classification models (e.g., logistic regression, decision trees) for categorical predictions.

GS6. Understanding decision trees, tree-building algorithms (e.g., CART, ID3), and techniques for pruning to avoid overfitting.

GS7. Knowledge of ensemble methods (e.g., Random Forest, Gradient Boosting) and their advantages over individual models.

GS8. Ability to implement and tune Support Vector Machines (SVM), including concepts like hyperplanes.

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Fundamentals of Machine Learning	**10**	-	-	-
PC1. Define supervised, unsupervised, and reinforcement learning, and explain their applications in AI.	3	-	-	-
PC2. Describe the machine learning pipeline, including data preprocessing, feature selection, model training, and evaluation.	3	-	-	-
PC3. Explain common evaluation metrics (e.g., accuracy, precision, recall, F1 score, confusion matrix, ROC curve, AUC).	4	-	-	-
Supervised Learning and Models	**25**	-	-	-
PC4. Apply regression models (e.g., linear regression, polynomial regression) for numerical prediction.	5	-	-	-
PC5. Implement classification models (e.g., logistic regression, decision trees) for categorical prediction.	5	-	-	-
PC6. Define decision trees, describe tree-building algorithms (e.g., CART, ID3), and prune trees to avoid overfitting.	5	-	-	-
PC7. Explain ensemble methods (e.g., Random Forest, Gradient Boosting) and their advantages over single models.	5	-	-	-
PC8. Describe the Naïve Bayes algorithm and its assumptions, and apply it to classification tasks like text classification.	5	-	-	-
Advanced Supervised Learning	**20**	-	-	-
PC9. Define Support Vector Machines (SVM), and explain concepts like hyperplanes, margins, and kernel tricks.	5	-	-	-
PC10. Implement SVM models, tune parameters, and evaluate performance using metrics.	5	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. Describe the K-Nearest Neighbors (KNN) algorithm and its applications in classification and regression.	5	-	-	-
PC12. Implement KNN models, optimize parameters (e.g., number of neighbors, distance metrics), and evaluate performance.	5	-	-	-
Unsupervised Learning and Dimensionality Reduction	**25**	**-**	**-**	**-**
PC13. Define unsupervised learning and explain its role in discovering hidden patterns in data.	5	-	-	-
PC14. Explain clustering techniques (e.g., K-means, hierarchical clustering) and their use in grouping similar data points.	5	-	-	-
PC15. Apply K-means clustering to datasets and interpret resulting clusters.	5	-	-	-
PC16. Perform hierarchical clustering and visualize results using dendrograms.	5	-	-	-
PC17. Describe Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA), and apply them for dimensionality reduction in high-dimensional data.	5	-	-	-
Advanced Techniques and Reinforcement Learning	**20**	**-**	**-**	**-**
PC18. Explore advanced clustering methods (e.g., DBSCAN, Gaussian Mixture Models) and evaluate their suitability for datasets.	5	-	-	-
PC19. Define reinforcement learning and explain key concepts such as agents, environments, states, actions, rewards, and policies.	5	-	-	-
PC20. Implement basic reinforcement learning algorithms such as Q-learning and policy gradients.	5	-	-	-
PC21. Apply reinforcement learning to practical problems like game-playing or robotic control.	5	-	-	-
NOS Total	**100**	**-**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N1422
NOS Name	Machine Learning
Sector	Electronics
Sub-Sector	
Occupation	Product Design-S&C
NSQF Level	4.5
Credits	3
Version	1.0
Last Reviewed Date	18/02/2025
Next Review Date	18/02/2028
NSQC Clearance Date	18/02/2025

ELE/N1423: NLP, Neural Networks, Deep Learning, and AI Capstone

Description

This course deals with the fundamentals of neural networks, including backpropagation, and explores advanced architectures like CNNs, RNNs, and GANs.

Scope

The scope covers the following :

- Develop and implement deep learning models using neural networks.
- Apply advanced deep learning techniques to various data types and problems.
- Execute an AI capstone project demonstrating learned concepts and skills

Elements and Performance Criteria

Natural Language Processing (NLP) and Text Mining

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

PC1. Understand the fundamentals of Text Mining.

PC2. Perform Text Preprocessing (e.g., tokenization, stemming, and lemmatization).

PC3. Explore various types of Language Models (e.g., statistical, neural-based).

PC4. Practice NLP tasks using frameworks like Keras, including sentiment analysis and entity recognition.

Basics of Neural Networks and Deep Learning

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

PC5. Define Neural Networks and explain their structure, including neurons, layers, and activation functions.

PC6. Describe the Backpropagation Algorithm and its role in training models.

PC7. Implement basic Neural Network models using TensorFlow/Keras.

PC8. Train and evaluate neural networks on simple datasets.

Advanced Deep Learning Techniques

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

PC9. Explore advanced architectures like Convolutional Neural Networks (CNNs) for image processing.

PC10. Implement CNNs using TensorFlow/Keras and train them on image datasets.

PC11. Understand Recurrent Neural Networks (RNNs) for sequential data (e.g., time series, text).

PC12. Implement RNNs and Long Short-Term Memory (LSTM) networks for sequence prediction tasks.

Specialized Deep Learning Models

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

PC13. Learn about Generative Adversarial Networks (GANs) for synthetic data generation.

PC14. Implement GANs for generating non-existent images and understand their dynamics.

PC15. Explore Autoencoders for unsupervised learning and data compression.

PC16. Apply Autoencoders for anomaly detection and denoising tasks.

AI Capstone Project and Design Thinking

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

PC17. Understand Design Thinking and its importance in problem-solving.

PC18. Apply the Five Steps of Design Thinking to AI projects.

PC19. Design and implement a complete AI project from scratch, incorporating NLP and deep learning concepts.

PC20. Select a problem domain, preprocess data, build, evaluate, and deploy AI models.

PC21. Present project outcomes, highlight challenges, findings, and propose future improvements.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. Understand the fundamentals of Text Mining and its role in extracting insights from unstructured text data.

KU2. Comprehend text preprocessing techniques such as tokenization, stemming, and lemmatization, and their importance in preparing text data for analysis.

KU3. Grasp the different types of Language Models (e.g., statistical, neural-based) and their use in NLP tasks.

KU4. Understand how to use NLP frameworks like Keras for tasks such as sentiment analysis and entity recognition.

KU5. Grasp the structure of Neural Networks, including neurons, layers, and activation functions, and how they function in deep learning models.

KU6. Comprehend the role of the Backpropagation Algorithm in training neural networks by adjusting weights to minimize errors.

KU7. Understand advanced deep learning architectures, such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), and their applications in image and sequence data.

KU8. Understand how to implement and train basic Neural Network models using frameworks like TensorFlow/Keras on simple datasets.

KU9. Grasp the purpose and implementation of specialized models like GANs for synthetic data generation and Autoencoders for tasks like anomaly detection.

Generic Skills (GS)

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

GS1. Understanding the fundamentals of text mining.

GS2. Proficiency in text preprocessing techniques such as tokenization, stemming, and lemmatization.

GS3. Practice with NLP tasks using frameworks like Keras for sentiment analysis and entity recognition.

GS4. Exploration of various types of language models (e.g., statistical, neural-based).

GS5. Understanding the structure of neural networks, including neurons, layers, and activation functions.

GS6. Knowledge of the backpropagation algorithm and its role in training neural networks.

GS7. Ability to implement basic neural network models using TensorFlow/Keras.

GS8. Exploration of advanced neural network architectures like Convolutional Neural Networks (CNNs) for image processing.

GS9. Knowledge of Generative Adversarial Networks (GANs).

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Natural Language Processing (NLP) and Text Mining	**10**	-	-	-
PC1. Understand the fundamentals of Text Mining.	2	-	-	-
PC2. Perform Text Preprocessing (e.g., tokenization, stemming, and lemmatization).	2	-	-	-
PC3. Explore various types of Language Models (e.g., statistical, neural-based).	3	-	-	-
PC4. Practice NLP tasks using frameworks like Keras, including sentiment analysis and entity recognition.	3	-	-	-
Basics of Neural Networks and Deep Learning	**10**	-	-	-
PC5. Define Neural Networks and explain their structure, including neurons, layers, and activation functions.	2	-	-	-
PC6. Describe the Backpropagation Algorithm and its role in training models.	2	-	-	-
PC7. Implement basic Neural Network models using TensorFlow/Keras.	3	-	-	-
PC8. Train and evaluate neural networks on simple datasets.	3	-	-	-
Advanced Deep Learning Techniques	**15**	-	-	-
PC9. Explore advanced architectures like Convolutional Neural Networks (CNNs) for image processing.	3	-	-	-
PC10. Implement CNNs using TensorFlow/Keras and train them on image datasets.	4	-	-	-
PC11. Understand Recurrent Neural Networks (RNNs) for sequential data (e.g., time series, text).	4	-	-	-

Qualification Pack

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. Implement RNNs and Long Short-Term Memory (LSTM) networks for sequence prediction tasks.	4	-	-	-
Specialized Deep Learning Models	**15**	**-**	**-**	**-**
PC13. Learn about Generative Adversarial Networks (GANs) for synthetic data generation.	3	-	-	-
PC14. Implement GANs for generating non-existent images and understand their dynamics.	4	-	-	-
PC15. Explore Autoencoders for unsupervised learning and data compression.	4	-	-	-
PC16. Apply Autoencoders for anomaly detection and denoising tasks.	4	-	-	-
AI Capstone Project and Design Thinking	**-**	**20**	**30**	**-**
PC17. Understand Design Thinking and its importance in problem-solving.	-	4	6	-
PC18. Apply the Five Steps of Design Thinking to AI projects.	-	4	6	-
PC19. Design and implement a complete AI project from scratch, incorporating NLP and deep learning concepts.	-	4	6	-
PC20. Select a problem domain, preprocess data, build, evaluate, and deploy AI models.	-	4	6	-
PC21. Present project outcomes, highlight challenges, findings, and propose future improvements.	-	4	6	-
NOS Total	**50**	**20**	**30**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N1423
NOS Name	NLP, Neural Networks, Deep Learning, and AI Capstone
Sector	Electronics
Sub-Sector	
Occupation	Product Design-S&C
NSQF Level	4.5
Credits	4.6
Version	1.0
Last Reviewed Date	18/02/2025
Next Review Date	18/02/2028
NSQC Clearance Date	18/02/2025

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 %

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
ELE/N1420.Introduction to Artificial Intelligence	100	0	0	0	100	20
ELE/N1421.Advanced Mathematics and Exploratory Data Analysis for Artificial Intelligence	100	0	0	0	100	25
ELE/N1422.Machine Learning	100	0	0	0	100	25
ELE/N1423.NLP, Neural Networks, Deep Learning, and AI Capstone	50	20	30	0	100	30
Total	**350**	**20**	**30**	**-**	**400**	**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.