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ARTIFICIAL INTELLIGENCE DATA TECHNICIAN

CBT CURRICULUM

National Vocational Certificate Level 3

Version 1 - November, 2019

NAVTTC

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Introduction

Definition/ Description of the training program for Artificial Intelligence Data Technician

In order to build the capacity of technical and vocational training institutes in Pakistan through provision of demand driven competencies-based trainings in Information technology sector the NAVTTC, and TEVT Sector Support Program (TSSP) have joined hands together to develop qualifications for Information Technology sector. These qualifications will not only build the capacity of existing workers of this sector but also support the youth to acquire skills best fit for this sector. The benefits and impact of development of these qualifications will be on both demand and supply side.

Based upon this demand of industry these competency-based qualifications for Artificial Intelligence Data Technician are developed under National Vocational Qualification Framework (NVQF) (Level 1 to 4). The qualifications mainly cover competencies along with related knowledge and professional skills which are essential for getting a job or self-employed.

The qualifications are also in line with the vision of Pakistan's National Skills Strategy (NSS), National TVET Policy and National Vocational Qualification Framework (NVQF). This provides policy directions, support and an enabling environment to the public and private sectors to impart training for skills development to enhance social and economic profile. The National Vocational & Technical Training Commission (NAVTTC) has approved the Qualification Development Committee (QDC). The QDC consists experts from the relevant industries from different geographical locations across Pakistan and academicians who were consulted during the development process to ensure input and ownership of all the stakeholders. The National Competency Standards could be used as a referral document for the development of curricula to be used by training institutions.

Purpose of the training program

The purpose of the training is to provide skilled manpower to improve the existing capacity of Information Technology sector. This training will provide the requisite skills to the trainees to become Artificial Intelligence Data Technician. It will enable the participants to meet the challenges in the field of Artificial Intelligence. Further, to improve the skill level of the technician and prepare them for the information technology industry to meet the market competition nationally and internationally.

The core purpose of this qualification is to produce employable Artificial Intelligence Data Technicians who can work as Artificial Intelligence Data Technician according to national and international standards. In addition, this qualification will prepare unemployable youth to employees in this sector.

Overall objectives of training program

The Artificial Intelligence Data Technician qualification from level 1- 4 consists of theoretical and practical details required for Artificial Intelligence Data Technician in information technology industries. However, this will require providing additional input on

entrepreneurship development for the one who is willing to start his/her own business. The main objective of the qualification is to prepare Artificial Intelligence Data technician having set of skills as follows:

- Comply with Work Health and Safety Policies
- Obey the Workplace Policies and Procedures
- Follow Basic Communication Skills (General)
- Demonstrate Basic Literacy Skills
- Operate Computer Functions (General)
- Use Word Processing Software
- Use of Spreadsheet
- Comply Personal Health and Safety Guidelines
- Communicate the Workplace Policy and Procedure
- Perform Basic Communication (Specific)
- Demonstrate Basic Numeracy Skills
- Use Multimedia Processing
- Pre-Process Data
- Perform Basic Computer Application (Specific)
- Apply Work Health and Safety Practices (WHS)
- Identify and Implement Workplace Policy and Procedures
- Communicate at Workplace
- Manage Personal Finances
- Code in Programming Language suitable for AI
- Setup Environment
- Perform Computer Application Skills
- Contribute to Work Related Health and Safety (WHS) Initiatives
- Comply with Workplace Policy and Procedures
- Perform Advanced Communication
- Manage Human Resource Services
- Scrape data from the web
- Process Images through Image Processing software
- Work with Data Manipulation Toolkit
- Work with Multidimensional Arrays' Manipulation and Computation Package
- Develop Advance Computer Application Skills
- Develop Entrepreneurial Skills

Competencies to be gained after completion of course

At the end of the course, the trainee must have attained the following competencies:

1. Comply with Work Health and Safety Policies
2. Obey the Workplace Policies and Procedures
3. Follow Basic Communication Skills (General)
4. Demonstrate Basic Literacy Skills
5. Operate Computer Functions (General)
6. Use Word Processing Software
7. Use of Spreadsheet
8. Comply Personal Health and Safety Guidelines
9. Communicate the Workplace Policy and Procedure
10. Perform Basic Communication (Specific)
11. Demonstrate Basic Numeracy Skills
12. Use Multimedia Processing
13. Pre-Process Data
14. Perform Basic Computer Application (Specific)
15. Apply Work Health and Safety Practices (WHS)
16. Identify and Implement Workplace Policy and Procedures
17. Communicate at Workplace
18. Manage Personal Finances
19. Code in Programming Language suitable for AI
20. Setup Environment
21. Perform Computer Application Skills
22. Contribute to Work Related Health and Safety (WHS) Initiatives
23. Comply with Workplace Policy and Procedures
24. Perform Advanced Communication
25. Manage Human Resource Services
26. Scrape data from the web
27. Process Images through Image Processing software
28. Work with Data Manipulation Toolkit
29. Work with Multidimensional Arrays' Manipulation and Computation Package
30. Develop Advance Computer Application Skills
31. Develop Entrepreneurial Skills

Possible available job opportunities available immediately and later in the future

Artificial Intelligence Data Technician are employed in Information Technology Sector. Experienced Artificial Intelligence Data Technician may advance through promotions with the same employer or by moving to more advanced positions with other employers. They can become:

- Artificial Intelligence Data Technician
- Stock Exchange Predictor
- Artificial Intelligence Big Data Analyst
- Data Entry Operator
- Financial Forecasting
- Media House Data Technician

Trainee entry level

- Middle (Grade 8) for level-1
- Level-1 for level-2
- Level-2 for level-3
- Level-3 for level-4

Minimum qualification for trainer

- BS in (Artificial Intelligence/Data Science/Computer Science/Computer Engineering/Software Engineering/Information Technology/Electrical/Mechatronics) or relevant fields.

Recommended trainer: trainee ratio

The recommended maximum trainer: trainee ratio for this program is 1 trainer for 20 trainees

Medium of instruction i.e. language of instruction

Instructions will be in English/Urdu language.

Duration of the course (Total time, Theory & Practical time)

This curriculum for level 3 comprises of 07 modules. The recommended delivery time for technical modules is 250 hours.

- Delivery of the course can therefore be full time (8 hours a business day), 6 days a week, for 24 months (on average 26 working days a month) for each level. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery. OR
- Delivery of the course can therefore be full time (9 hours a business day), 5 days a week, for 24 months (on average 22 working days a month). Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.

The full structure of the course is as follows:

Sr. No.	Module	Theory hours	Workplace hours	Total hours
01	Apply Work Health and Safety Practices (WHS)			
02	Identify and Implement Workplace Policy and Procedures			
03	Communicate at Workplace			
04	Manage Personal Finances			
05	Code in Programming Language suitable for AI	50	150	200
06	Setup Environment	10	40	50
07	Perform Computer Application Skills			

Sequence of the modules

This qualification is made up of 07 modules. A suggested distribution of these modules is presented overleaf. This is not prescriptive and training providers may modify this if they wish.

The following technical module will be followed as require for the training purpose.

Module 05

Module 06

Each module covers a range of learning components. These are intended to provide detailed guidance to teachers (for example the Learning Elements component) and give them additional support for preparing their lessons (for example the Materials Required component). The detail provided by each module will contribute to a standardized approach to teaching, ensuring that training providers in different parts of the country have clear information on what should be taught. Each module also incorporates the industrial demand of Pakistan that make this qualification unique to Pakistan's industry needs.

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Module-5

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Summary – Overview of the curriculum

After completing this level candidate will be able to perform basic and specific computer application, work safely at workplace, implement work policy and procedures, mange finance and code in suitable programing languages for AI application.

Module 05: 061900928 Code in Programming Language suitable for AI

Objective of the Module: This module will give skill to candidate that will be used for the programming purposes in the applied Languages used in the field of AI.

Duration: 200 hrs. Theory: 50 hrs. Practice: 150 hrs.

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material/Tools Required	Learning Place
LU1: Perform Python Installation	**You will be able to** 1. Navigate to python website to Downloads 2. Choose an appropriate Python version 3. Check system requirements 4. Download the chosen Python setup files 5. Double click on the downloaded setup files 6. Enter admin username-password to authorize installation 7. Choose	• Demonstrate basic browser use and navigation • Understand the concept of given software version requirements based on system specification. • Demonstrate installing software from source Practical-1 Given a clean system, download and install the appropriate python version and run the python terminal to confirm successful installation	**Total 10 Hrs** **Theory: 02 Hrs** **Practical: 08 Hrs**	• Computer system with support for python • Internet facility • Terminal/cmd application • Text/Code editing application	Theory: Class Practical: Lab

	appropriate install options 8. Click install 9. Click add python to PATH environment variable				
LU2: Create and Execute a Program	**You will be able to** 1. Open a text document 2. Code a python program 3. Save the text file as .py file 4. Open terminal/cmd application 5. Navigate to directory containing python program 6. Run the program with python	• Demonstrate basic file operations • Have introductory knowledge of python • Demonstrate basic python operation: Keywords, identifiers, statements, comments, variables, data types, operations and namespaces. Practical-1 Write a “Hello World” program in a text file, save it as a .py file and execute that .py file in python terminal. Practical-2 Write python program to perform given mathematical operations and print the results over terminal.	**Total 20 Hrs** **Theory: 04 Hrs** **Practical: 16 Hrs**		Theory: Class Practical: Lab
LU3: Control Flow of Program	**You will be able to** 1. Code an “if” statement 2. Code an “elif” statement 3. Code an “else”	• Demonstrate conditional statements • Demonstrate controlled loops. • Demonstrate program execution sequence. Practical-1 Code python programs according to given tasks incorporating Inline comparisons, single	**Total 60 Hrs** **Theory: 20 Hrs** **Practical: 40 Hrs**		Theory: Class Practical: Lab

	statement 4. Code a "while" loop 5. Code a "for" loop 6. Write a "switch" statement 7. Use "continue" & "break" statements in loops	conditions, compound conditions, string comparisons and nested conditions. Practical-2 Code python programs according to given tasks incorporating counter loops, conditional loops, nested loops and loop combinations. Practical-3 Code python programs according to given tasks incorporating both conditional statements and loops.			
LU4: Write Modular Programs	**You will be able to** 1. Write a "def" statement to define a function 2. Write a "class" statement to create a class with multiple functions and data elements	• Understand and demonstrate the concept of functions. • Demonstrate how class objects work in python. Practical-1 Write python program(s) to perform given mathematical operations using functions and print the results over terminal. Practical-2 Code a class object from scratch incorporating certain functions to be reused in a separate program according to given task specifications.	**Total 50 Hrs** **Theory: 15 Hrs** **Practical: 35 Hrs**		Theory: Class Practical: Lab
LU5: Handle Errors and Exceptions	**You will be able to** 1. Define a "try" block 2. Apply some error prone code in try block 3. Handle the	• Demonstrate different types of exceptions Practical-1 Write a program to identify and handle following exceptions: 1. NULL exceptions 2. Overflow exceptions 3. Underflow exceptions 4. TypeError 5. ZeroDivisionError	**Total 20 Hrs** **Theory: 03 Hrs** **Practical: 17 Hrs**		Theory: Class Practical: Lab

	possible exceptions using "except" block 4. Apply "finally" block to statements that will always run	Also perform object disposal / resource de-allocation using "finally" block			
LU6: Perform File Handling	**You will be able to** 1. Open a python script file 2. Open a file with "r" flag in read mode using "open" statement 3. Read the file line by line or all at once into a python variable 4. Open a file with "w" flag in write mode	• Understand the concept of read and write operations and permissions Practical-1 Open a file as "read only" and display its contents over terminal both line-by-line and as whole. Practical-2 Open a file with write permissions, alter that file and show its contents over the terminal	**Total 20 Hrs** **Theory: 03 Hrs** **Practical: 17 Hrs**		Theory: Class Practical: Lab
LU7: Use Package Manager	**You will be able to** 1. Select an appropriate package to install 2. Open terminal/cm	• Demonstrate the use of package manager Practical-1 Install "numpy" and "beautifulsoupX" using pip install manager and import these package in a python file to validate installation. Afterwards uninstall these	**Total 20 Hrs** **Theory: 03 Hrs** **Practical: 17 Hrs**		Theory: Class Practical: Lab

	d application 3. Use “pip install <package name>” command to install the package 4. Uninstall a package with “pip uninstall <package name>” command	packages using “pip uninstall <package name>” command.			

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Module-6

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Module 06: 061900929 Setup Environment

Objective of the Module: After this competency standard the candidate will be able to setup environment in order to work on the programming and a variety of applications of the software's/hardware's

Duration: 50 hrs. Theory: 10 hrs. Practice: 40 hrs.

Learning Unit	Learning Outcomes	Learning Elements	Duration	Material/Tools Required	Learning Place
LU1: Initialize application program interface	**You will be able to** 1. Open terminal/cmd 2. Change directories 3. Rename files 4. Move files from one directory to another 5. Copy files from one directory to another 6. Select/delete only particular types of files 7. Open a file 8. Open an application 9. Zip and unzip files/folders 10. Download files from a source (network location) 11. Connect to a server using ssh	• Introduction to terminals/CMD • Demonstrate execution of commands. • Demonstrate of files and compressed files. Practical-1 • Changes, Rename, Move, Copy and Delete files as per instruction. • Download and install given version of python and connect to server. • Given list of commands, enter those to install python on operating system.	**Total 19 Hrs** **Theory: 04 Hrs** **Practical: 15 Hrs**	• Computer system with python and pip installed • Stable internet connection • Terminal/cmd application • Text/Code editing application • Virtual environment package	Theory: Class Practical Lab
LU2: Create and manage specific	**You will be able to** 1. Install virtual environment	• Demonstrate basic of virtual environment. • Demonstrate	**Total 18 Hrs** **Theory:**		Theory: Class

working environment	with pip 2. Create a virtual environment 3. Activate a virtual environment 4. Deactivate a virtual environment 5. Check if the environment is active for a python/pip version 6. Install packages in virtual environment 7. Run scripts in virtual environment	compatibility between different version of pip and Python. Practical-1 • Follow given steps to install virtual environment in python using pip package manager. • Perform a task by writing and executing python script in virtual environment	**03 Hrs** **Practical: 15 Hrs**		Practical Lab
LU3: Install Packages with Pip	**You will be able to** 1. Select an appropriate package to install 2. Open terminal/cmd 3. Activate a virtual environment if required 4. Use “pip install <package name>” command to install the package 5. Import package in a python environment 6. Uninstall a	• Demonstrate the use of package manager Practical-1 Install “numpy” and “beautifulsoupX” using pip install manager and import these package in a python file to validate installation. Afterwards uninstall these packages using “pip uninstall <package name>” command.	**Total 13 Hrs** **Theory: 03 Hrs** **Practical: 10 Hrs**		Theory: Class Practical Lab

	package with “pip uninstall <package name>” command				

General assessment guidance for *Artificial Intelligence Data Technician*

Good practice in Pakistan makes, use of sessional and final assessments, the basis of which is described below. Good practice by vocational training providers in Pakistan, is to use a combination of these sessional and final assessments, combined to produce the final qualification result.

Sessional assessment is going on all the time. Its purpose is to provide feedback on what students are learning:

- To the student: to identify achievement and areas for further work
- To the teacher: to evaluate the effectiveness of teaching to date, and to focus future plans.

Assessors need to devise sessional assessments for both theoretical and practical work. Guidance is provided in the assessment strategy

Final assessment is the assessment, usually on completion of a course or Level, which says whether or not the student has "passed". It is – or should be – undertaken with reference to all the objectives or outcomes of the course, and is usually fairly formal. Considerations of security – ensuring that the student who gets the credit is the person who did the work – assume considerable importance in final assessment.

Methods of assessment

For lessons with a high quantity of theory, written or oral tests related to learning outcomes and/ or learning content can be conducted. For workplace lessons, assessment can focus on the quality of planning the related process, the quality of executing the process, the quality of the product and/or evaluation of the process.

Methods include direct assessment, which is the most desirable form of assessment. For this method, evidence is obtained by direct observation of the student's performance.

Examples for direct assessment of Artificial Intelligence Data Technician Lev-3 include:

- Demonstrations, for example demonstrating coding skill in python language by coding program script.
- Paper-based tests, such as multiple choice or short answer questions on data processing and program installation.

Indirect assessment is the method used where the performance could not be watched and evidence is gained indirectly. Indirect assessment should only be a second choice. (In some cases, it may not even be guaranteed that the work products were produced by the person being assessed.)

Examples for direct assessment of Artificial Intelligence Data Technician Lev-3 include:

- Portfolio, for example student is asked to show his previous programming skills by showing old python programming scripts.

Principles of assessment

All assessments must meet all the following principles, regardless of the method of assessment used to evidence learners' attainment.

All assessments must produce outcomes that are:

1. Valid: the assessment evidence meets all assessment criteria and all learning outcomes
2. Authentic: all the work is the learner's own
3. Reliable: assessment evidence is consistent and generates outcomes that would be replicated were the assessment repeated
4. Current: assessment evidence is up-to-date
5. Sufficient: enough work is available to justify the credit value, and to enable a consistent and reliable judgement about the learner's achievement
6. Comparable: all assessment evidence is comparable in standard between assessments within a unit/qualification, and between learners of the same level
7. Manageable: all assessment places reasonable demands on all learners
8. Fair and minimize bias: assessments are fair to all learners irrespective of their characteristics (for example, age, gender, etc.)

Assessment strategy for Artificial Intelligence Data Technician Level 3 Curriculum

This curriculum consists of 07 modules:

Module-01	Apply Work Health and Safety Practices (WHS)
Module-02	Identify and Implement Workplace Policy and Procedures
Module-03	Communicate at Workplace
Module-04	Manage Personal Finances
Module-05	Code in Programming Language suitable for AI
Module-06	Setup Environment
Module-07	Perform Computer Application Skills

Sessional or Developmental assessment

The sessional/developmental assessment shall be conducted after completion of each module in two parts: theoretical assessment and practical assessment.

Theoretical assessment for all learning modules must consist of a written paper lasting at least 30 minutes per module. This can be a combination of multiple choice and short answer questions.

For practical assessment, all procedures and methods for the modules must be assessed on a sessional basis. Guidance is provided below under Planning for assessment.

Final assessment

Final assessment shall also be in two parts: theoretical assessment and practical assessment.

For the final practical assessment, each student shall be assessed over a period of 4-5 hours' session. During this period, each student must be assessed on his ability to perform a complete job for all Technical and functional modules.

Generic modules shall be assessed comprising with other modules at the time of final assessment. Practical work for this module could be assessed on a sessional basis.

Planning of assessment.

Plaining of assessment will plan by the assessment Centre as per CBT/A policy. But for development assessment it could be plan by the Trainer during the course.

As for final assessment as concern, certified assessor must be contacted and the assessor must meet the needs of the students and the training provider. For example, where two assessors are conducting the assessment, there must be a maximum of five students per assessor. In this example, a group of 20 students shall therefore require assessments to be carried out over a four-day period. For a group of only 10 students, assessments would be carried out over a two-day period only or it could be formulated as per CBT/A Centre policies.

Complete list of tools and equipment – Non Consumable

S. No	Description	Quantity
1	Printer	5
2	High performance Computer system with • GPU(s) • Audio card • High speed high capacity storage • Drivers • Compatibility with Python, OpenCV	20
3	Software and Libraries packages: • Microsoft Office • Python Software Package • BeautifulSoup Python Library • Request Python Library • OpenCV software package (latest version) • Pip package manager • Stable version of pandas • Stable version of numpy and pickle	20
4	High quality sound system	20
5	High resolution display	20
6	Software application(s) for image manipulation	20
7	Software application(s) for audio editing	20
8	Software application(s) for video manipulation and processing	20
9	Noise absorbers	20
1(	Scanner	05
1	Digital Camera	05
1	Internet facility	-
1	Virtual environment package	20

Complete list of tools and equipment - Consumable

S. No.	Items
1.	Different Tags and Locks
2.	Paper rim
3.	Process SOPs
4.	Equipment Maintenance Manuals
5.	Log Book
6.	Handbooks
7.	Design Books/ Sheets
8.	Pencils
9.	Erasers
10.	Pencil Sharpeners
11.	Paper Cutter
12.	Scissors
13.	Color Pencils
14.	White chart paper
15.	Brown Sheets
16.	White Board Markers (red, blue, green, black)
17.	Permanent markers (black)
18.	File covers

Credit values

The credit value of the National Certificate Level 3 in Artificial Intelligence Data Technician is defined by estimating the amount of time/ instruction hours required to complete each competency unit and competency standard. The NVQF uses a standard credit value of 1 credit = 10 hours of learning (Following TVET guidelines.

The credit values are as follows:

Code	Name of Duty or (Module)	Level	Credit	Category
	Apply Work Health and Safety Practices (WHS)	3		Generic
	Identify and Implement Workplace Policy and Procedures	3		Generic
	Communicate at Workplace	3		Generic
	Manage Personal Finances	3		Generic
	Code in Programming Language suitable for AI	3	20	Technical
	Setup Environment	3	5	Technical
	Perform Computer Application Skills	3		Generic

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