NSQF QUALIFICATION FILE
Approved in 22th NSQC Meeting – NCVET – 25th August 2022

CONTACT DETAILS OF THE BODY SUBMITTING THE QUALIFICATION FILE

NCVET Code

2022/ITES/ASAP/06361

Name and address of submitting body:

ADDITIONAL SKILL ACQUISITION PROGRAMME KERALA
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Name and contact details of individual dealing with the submission

Name: Dr. Usha Titus

Position in the organisation: Chairperson and Managing Director

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List of documents submitted in support of the Qualifications File

1. Annexure 1- Industry Validation
2. Annexure 2- Model Curriculum
3. Annexure 3- International Comparability
4. Annexure 4- Job Progression
5. Annexure 5 – Justification for Extension of Qualification

SUMMARY

1	**Qualification Title**	AI -Machine learning Developer
2	**Qualification Code, if any**	2019/ITES/ASAP/3598
3	**NCO code and occupation**	NCO- 2512.0800, Programmer, Engineering and Scientific
4	**Nature and purpose of the qualification (Please specify whether qualification is short term or long term)**	• This is a Qualification Pack (QP) containing National Occupational Standards for the job role "AI - Machine Learning Developer" The proposed course has a syllabus that clearly fills the skill gaps ensuring that the trainee acquire the skills required to meet both the current and future skill demands in their given occupation. • The Curriculum gives special emphasis to the Artificial and Machine learning Skill development of the trainee.
5	**Body/bodies which will award the qualification**	Additional Skill Acquisition Programme Kerala
6	**Body which will accredit providers to offer courses leading to the qualification**	Additional Skill Acquisition Programme Kerala
7	**Whether accreditation/affiliation norms are already in place or if applicable (if yes, attach a copy)**	Any Vocational Training Provider / PSU / Educational Institution / Industry can seek affiliation/accreditation from Additional Skill Acquisition Programme (ASAP) for delivering vocational training in ASAP Qualifications under NQR. Evaluation of proposals by the interested agencies/institutions will be based on the norms of affiliation fixed for the same which gives importance to the competence in delivering NOS based training by the interested agencies. Final selection of training agencies will be done based on a comprehensive evaluation which also might involve a preliminary audit depending upon risk based assessment. The affiliation/accreditation norms have been included in detail in the document created for the purpose **not,**
8	**Occupation(s) to which the qualification gives access**	Artificial Intelligence and Machine Learning
9	**Job description of the occupation**	Individuals at this job are responsible for developing applications and platforms in AI & Machine Learning. They will be responsible for evaluating the technical performance of algorithmic models on thesystem on which it is being deployed. They will be responsible for developing, designing, building, testing and deploying AI solutions.

10	**Licensing requirements**	Nil
11	**Statutory and Regulatory requirement of the relevant sector (documentary evidence to be provided)**	Nil
12	**Level of the qualification in the NSQF**	Level 5
13	**Anticipated volume of training/learning required to complete the qualification**	Theory - 150 hrs Practical - 240 hrs Employability - 30 hrs Internship - 300 hrs **Total – 720 hrs**
14	**Indicative list of training tools required to deliver this qualification**	1. Whiteboard and Markers 2. LCD Projector and Laptop for presentations 3. Lab equipped with the following: - PCs/Laptops, Internet with Wi-Fi(Min 2 Mbps Dedicated), Latest version of statistical software packages and IDEs
15	**Entry requirements and/or recommendations and minimum age**	Graduation in the Science/Computer Science/ Electronics and Engineering /Information Technology and should clear Additional Skill OR 3-year Diploma (after 12th Class) in the Science/Computer Science/ Electronics /Information Technology and should clear Additional Skill Acquisition Programme Kerala Statistical Exam
16	**Progression from the qualification (Please show Professional and academic progression)**	Attached as annexure 4
17	**Arrangements for the Recognition of Prior learning (RPL)**	For Trainers in the area without formal qualification If skill gap is found, a maximum of 40 hours' skill training will be provided to candidates with a training fee decided by ASAP. Assessment will be carried out by Board of Skill Assessment assigned by

		Curriculum Committee, ASAP and successful candidates will be awarded certification against the prescribed job role
18	**International comparability :**	• Master of Engineering in Applied Artificial Intelligence,Stevens Institute of Technology • Master of Science in Machine Learning and Autonomous Systems, University of Bath UK • MSc Artificial Intelligence and Applications, University of Strathclyde, UK International Comparability has been attached as Annexure 2 in detail.
19	**Date of planned review of the qualification**	25/08/2025

20	**Formal structure of the qualification** **Mandatory components**		
	Title of component and (learning hours) code/NOSs /Learning outcomes	**Estimated size**	**Level identification**
1.	ASP/ITS/N0101 - Foundations for Machine Learning	90 Hrs	5
2.	ASP/ITS/N0102 - Machine Learning Techniques	150 Hrs	5
3	ASP/ITS/N0103 - Deep Learning	150 Hrs	5
4	DGT/VSQ/N0101 - Employability Skills	30 Hrs	5
5	ASP/ITS/N0104 - Project / Internship	300 Hrs	5
	Sub Total (A)	**720 hrs**	5
	Optional Components	NIL	
	Sub Total (B)	**0 hrs**	
Total (A+B)		**720 hrs**	5

SECTION 1
ASSESSMENT

21	**Body/Bodies which will carry out assessment:** Additional Skill Acquisition Programme Kerala
22	**How will RPL assessment be managed and who will carry it out?** ASAP will be responsible for conduct of RPL Assessment. Assessors identified by ASAP's Board of Skill Assessment will be responsible for the conduct of the RPL assessment. RPL theory exam can be conducted at examination hall and practical exam at field. The level of difficulty of question will be more compared to trainees who attend the regular program. The weightage for skill part assessment will be more compared to that of theory part, for the candidates undergoing RPL.
23	**Describe the overall assessment strategy and specific arrangements which have been put in place to ensure that assessment is always valid, reliable and fair and show that these are in line with the requirements of the NSQF.** ASAP follows an assessment framework which has got weightage for all the activities in which students get involved during the training program. The components of assessment include Attendance, Internal Assessment and student involvement, Final Assessment. Of these, attendance and internal assessment come under continuous and comprehensive evaluation (CCE). All Assessments with regard to the academic status of the student shall be done in marks and overall assessment will be done in grades. The report card/certificate will sta

TABLE 1

TYPE OF ASSESSMENT			WEIGHTAGE
CONTINOUS & COMPREHENSIVE EVALUATION	ATTENDANCE		10%
	STUDENTS INVOLVEMENT	ASSIGNMENT	10%
		INTERNAL EXAM	10%
PRACTICAL/LABWORK/APPRENTICESHIP/HANDS ON EXPERIENCE BY THE INDUSTRY			30%
SKILL PROFICIENCY TEST BY THE INDUSTRY/ASSESSMENT AGENCY			40%
TOTAL			100%

1. **ATTENDANCE:** Many classes use lectures, discussions, demonstrations, experiments, and student participation as part of the daily learning activities and those who miss these sessions will not be able to compensate for the loss. Regular student participation in daily classroom activities plays a significant role in student's success. For each course, the student's attendance will be marked daily and grades will be awarded accordingly. The corresponding grade points shall be generated by a system designed for this purpose (MIS). The grade points shall be given as per the table below.

POINT SCALE	GRADE POINT
Attendance above 90%	10
86 to 90 %	8
80 to 85 %	5
Below 80% (permissible only in the event of condonation)	3

2. INTERNAL ASSESSMENT & STUDENT INVOLVEMENT:

a) Assignments: Each Student has the opportunity to complete the assignment according to his/her preferred approach. This might involve reading textbook chapters and assigned reading materials to gain a better understanding prior to completing an assignment or exploring new resources to gain additional information. There shall be no restriction on the resources that the students are allowed to consult or any limit to the number of hours he/she choose to spend on the assignment. Since each student employs his/her own personal learning style, an individual assignment may actually be a fairer measure of the students learning. There are two assignments, one after 25% coverage of the total syllabus and the other after 75% of the total syllabus. Each shall be evaluated and assigned a score. The scores should be marked on the student's assignment sheets by the Skill Development Executive after evaluation. The scores shall be entered in the student profile twice. The first shall be made on completion of the initial 25% of the syllabus. It will be based on the average score up to that point. The second entry shall be made on completion of 75% of the syllabus. This will be based on the grades awarded for the assignment after the first entry. The average of the two shall be the final score for assignments. Questions for the assignments will be generated from a data bank created for the same**.** The data bank will have questions which will test the vital portions of the syllabus covered which have a direct bearing in the skill acquisition. The SDE can Access this though One Time Password (OTP) for each batch and each assignment

b) Internal Exam: there are two internal tests viz.one after completing 50% of the syllabus and the other after the end of the training course. These tests are conducted by the trainer based on the topics covered in the course. Questions are selected at random from a question bank already created. Of these for each test 50% of the questions are theoretical, in the form of objective type and the remaining 50% will be short descriptive questions oriented towards procedure/strategies/ways of doing/ ethics of doing, (Process of skill acquisition). The duration of the first test after 50% of the total session will be 1 hr and that of the second test after completion of the entire syllabus will be 3hrs. The grades shall be entered in the students profile twice. The first entry shall be made on completion of the initial 50% of the syllabus and the second entry shall be made on completion of the rest

of the syllabus. Total score for internal assessment will be the total of the average grade points secured in the internal tests and assignments.

3. **FINAL ASSESSMENT:** Final assessment will be conducted using a question bank. Questions will be randomly generated of which 40% will be meant to check trainee's professional knowledge, 50% is to check their professional skills and rest 10% for their soft skills.

4. **GENERATION OF QUESTION PAPER**: Each batch will have a unique user id and the trainer will be given access to question bank once for each category of test. They will be given access to the test only at the prescribed hour on the day of assessment. Question paper will be from the question bank at random based on the criteria specified for assessing each competency given in the session assessment evidence. Guidelines will be given to the trainers in terms of evaluation of assignments and internal tests.

5. **THE ASSESSMENT PLAN :** Outcome-based assessment to be followed in the skill courses by the Assessment Division will have the following design:

I. **Continuous and Comprehensive Skill Assessment (30% Weightage)**
- Knowledge and application tests carried out at four intervals during a skill course (20 Marks)
- Attendance and assignments (10Marks)

II. **End Assessment – Performance-based (70% Weightage)**
- Practical test/hands on experience/Skill test in an OJT Centre/SDC – (30 Marks)
- Skill Proficiency Test (40 Marks)

6. **REDRESSAL OF GRIEVANCES IN ASSESSMENT**: Any grievance regarding any of the assessment has to be addressed grievances cell of ASAP. based on the degree grievance ASAP head will choose any one or more of the following
- Deployment of a quality assurer for third party assessment
- Report from the Skill Development Centre Programme Manager
- Direct inspection by the concerned officials from ASAP Reassessment

The factual details will be submitted to the Chief Executive Officer whose decision will be final.

24. ASSESSMENT EVIDENCE

Module	Assessment Criteria for the outcomes	Total Marks	Mark Allocation			Viva
			Out of	Theory	Skills	

M1/U1 Foundationsfor Machine Learning Understanding of Linear Algebra, random processes, echniques, and to develop programming solutions in Python using scientific python libraries and optimization techniques needed for machine learning	PC 1: Implement list, tuples, and dictionaries using Python.	100	90	2	3	10
	PC 2: Implement loops, decision statements, functions, class, and file handling using Python			3	5	
	PC 3 : Read, manipulate datasets using Pandas and numpy			Nil	8	
	PC 4: Visualize data using matplotlib			Nil	6	
	PC5: Design and develop programming solutions using Python			Nil	8	
	PC 6 : Explain linear independence, span and basis			5	7	
	PC 7 : Compute determinants eigen values and eigen vectors of matrix			5	7	
	PC 8 : Apply matrix calculus in solving linear equations.			8	Nil	
	PC 9 : Model and Real world phenomena using probabilistic models.			6	8	
	PC 10 : Understanding of gradient descent, stochastic gradient descent techniques.			2	7	
M1/U2 MachineLearning Techniques **Outcome:** Proficienc in different categories of machine learning techniques such as	PC 1**:** Understand different categories of machine learning.	100	90	5	Nil	10
	PC 2: Develop predictive models using linear regression technique.			2	5	

regression, classification, kNN, decision trees, dimensionality reduction, and clustering. Also,ability to apply different performance metrics, and select the best performing model.	PC 3: Apply ridge and lasso regression techniques for handling over-fitting.			2	5	
	PC 4 : Apply multivariate regression model on real data			2	5	
	PC 5 : Develop machine learning classifiers such as Logistic Regression, perception			2	4	
	PC 6 : Develop machine learning classifiers such as Support Vector Machine, Naïve Bayes.			2	4	
	PC 7 : Apply non parametric models such as kNN and decision trees			2	5	
	PC 8 : Develop ensemble methods such as Bagging, Boosting and Random Forest.			3	5	
	PC 9 : Implement unsupervised techniques such as Principal component analysis, Fischer Discriminant Analysis			3	5	
	PC 10 : Develop unsupervised models based on partitional and hierarchial clustering.			2	4	
	PC 11 : Evaluate machine learning models using various evaluation measures, ROC curves, precision and recall			2	4	
	PC 12 : Evaluate machine learning			1	2	

	model using significance tests.					
	PC 13 : Understand Bias - Variance trade - off			1	3	
	PC 14 : Handling under fitting - overfitting using regularization techniques			1	2	
	PC 15 : Follow best strategies for developing machine learning solutions			2	5	
M2/U1 Probabilistic and Statistical Methods for Learning Apply various Bayesian and Mixture models, apply various bayesian inference algorithms and perform text mining and information retrieval.	PC 1: Explain sum rule and product rule in probability theory.	100	90	5	Nil	10
	PC 2: Diagrammatic representations of probability distributions - probabilistic graphical models.			5	Nil	
	PC 3: Explain about joint probability and conditional independence.			5	Nil	
	PC 4: Distinguish between Bayesian Network and Markov Random Field.			Nil	10	
	PC 5: Explain Bayesian version of common algorithms such as k-means.			Nil	10	
	PC 6: What is factor graph for inference problem.			2	Nil	
	PC 7: Explain bipartite property of factor graphs.			3	Nil	
	PC 8: Distinguish between sum-product and max- sum algorithms.			5	Nil	

	PC 9: Use inference techniques to derive conclusions about model parameters.			5	10	
	PC 10: Ability to generate topic models and extract topics for text mining.			Nil	10	
	PC 11: Tools for information retrieval and extraction.			5	Nil	
	PC 12: Apply various evaluation measures for information retrieval and extraction.			Nil	15	
M2/U2 Deep Learning Proficiency in building deep learning models for both visual and text/sequence processing problems and generative models, and also develop deep reinforcement models for automation.	PC 1 : Acquire basic understanding of artificial neurons and linear thresholding units.	100	90	2	Nil	10
	PC 2 : Understand how Perceptrons and Multilayer perceptrons are constructed.			2	Nil	
	PC 3 : Ability to explain perceptron learning algorithm and compare it with gradient descentapproach.			3	Nil	
	PC 4 : Implement various gradient descent algorithms as such batch and stochastic mini batch using Python Numpy.			Nil	7.5	
	PC 5 : Ability to handle deep learning libraries such Tensorflow/ Keras or Pytorch			Nil	7.5	
	PC 6 : Understand the building of Deep blocks Neural Networks (DNN)			3	Nil	

	PC 7 : Define various activation functions and random initializations in deep learning networks.			2	Nil	
	PC 8 : Explain about vanishing gradient problem			3	Nil	
	PC 9 : How to resolve the issue of vanishing gradient problem in DNN.			3	Nil	
	PC 10 : Describe the limitations of DNN			2	Nil	
	PC 11 : Significance of Convolutional Neural Networks as compared to Deep Neural Networks.			2	Nil	
	PC 12 : Explain and implement various building blocks of Convolutional Neural Networks.			Nil	10	
	PC 13 : List out and implement various Convolutional Neural Network models.			Nil	7.5	
	PC 14 : Explain and implement sequence modelling using Recurrent Neural Networks and LSTM.			Nil	10	
	PC 15 : Ability to describe various building blocks of Deep Belief Networks (DBN).			2	Nil	
	PC 16 : Explain about deep encoders and decoders in the context of auto encoders.			2	Nil	
	PC 17 : Relationship between the depth of neural network and amount			2	Nil	

	of training data required.					
	PC 18 : Compariso n between supervised learning, unsupervised learning and reinforcement learning.			2	Nil	
	PC 19 : Understand the concept behind policy gradients.			Nil	7.5	
	PC 20 : Explain about Deep Q- Network and Markov Decision Process.			Nil	10	
M3/U1 Project Conceptualization, design, development, and evaluation of an Artificial Intelligent model using classical or deep machine learning framework.	PC 1: Data pre-processing	100	90	Nil	10	10
	PC 2: Considering Different Optimization techniques			Nil	10	
	PC 3: Handling bias-variance trade- off			Nil	10	
	PC 4: Resolving overfitting- under fitting issues using regularization.			Nil	10	
	PC5: Applying proper model evaluation strategy for model selection.			Nil	20	
	PC6: Following project/product development Cycle			Nil	10	
	PC7: Following best practices in implementing machine learning model			Nil	20	

Means of assessment1 Internal Assignmentand Internal Assessment
Means of assessment 2 Final Assessment
Means of assessment 3 Practical
Means of assessment 4 Viva
Pass/Fail 80-100% - A 60-80% - B 40-60 % - C 20-40% - D Below 20 % - E (Not eligible)

SECTION 2

EVIDENCE OF LEVEL

Option B

Title/Name of qualification/component : Business Analyst			
NSQF Domain	**Key Requirements of Job Role**	**How job role relates to the NSQF level descriptors**	**NSQF Level**

Process	• Develop proficiency in the domain of artificial intelligence and machine learning through solid foundations in both theoretical aspects and practical skills. • Ability to understand various AI problems, and analyze the data available for given problems. • Perform appropriate data pre- processing which is essential to handle any machine learning based problems. • Ability to choose an appropriate Machine learning framework and model by performing exhaustive analysis. • Develop software and optimize them for performance. • Document and validate the code by exhausting testing and analysis.	The individual in this role must have the ability towork in a group and in a constantly changing environment. He/she needs to beinvolved with the work byactively engaging with the other stakeholders withinthe company such as data architects, quality and test analysts, etc. The individual needs to combine a knowledge ofthe processes along with a solid understanding of their contexts. To perform his/her role and to collaborate with otherstakeholders effectively, the individual requires avast understanding of the processes used to build software.	5
Professional knowledge	• Possess comprehensive problem solving skills by applying both practical and theoretical knowledge within the domain of artificial intelligence and machine learning. • Knowledge of various machine learning frameworks and ability to pick the appropriate one for solving the problem. • Understanding of various algorithms in the field of classical machine learning and deep learning techniques. • Different important algorithms in machine learning for solving problems under regression, classification, clustering and dimensionality reduction.	The individual in the role must have a vastamount of knowledge across the different aspects of machine learning challenges and appropriate problem solving skills. This knowledge across various challenges and its solution must be accompanied with an in-depth understanding of each discipline to perform this role effectively. Briefly, the individual should be proficient with various machine learning algorithms, different frameworks and appropriate data handling skills.	5

	• Work on multiple platforms such as Linux, Windows and MacOS. • Proficiency with handling organizational policies, evaluate the performance of various machine learning models and documenting them for further references.		
Professional skill	• Ability to understand the problem and appropriate cognitive and practical skills to devise a solution for the given problem. • Point out the challenges and limitations in developing the solution for a give machine learning based problem. • Perform rigorous model evaluation and select the appropriate best performing model. • Chart out the technical specifications and limitations in the development of the solution.	The role demands a skillset that allows the individual to build softwarecode for a machine learning based problem. This requires a wide range of skills. The individual therefore needs to be proficient at using several machine learning frameworks and algorithms, and also have the analytical ability to integrate them towards building an optimal solution.	5
Core Skill	• Good logical and mathematical skill understanding of social political and natural environment and organizing information, communication and presentation skill. • Develop software code using a range of code generations tools and unit testing tools. • Create, review and execute unit test cases. • Optimize software code performance and improve future designs by using corrective actions. • Identify and interpret the technical specifications and limitations of a system. • Evaluate the speed, runtime and memory dependencies of algorithmic model	The individual must apply his/her software development skills along with a sound understand larger business, technological and regulatory trends. This would enable him/her to build code effectively in line with industry best practices.	5
Responsibility	• Full responsibility for output of group and development.	The role demands working in a team to deploy algorithmic models. This may involve	

	• Listen effectively and orally communicate information accurately with attention to details. • Check your work is complete and free from errors. • Make decisions on suitable courses of action. • Apply balanced judgements to different situations. • Ask for clarification and advice from appropriate people. • Build and maintain positive and effective relationships with clients • Check that your own and/or your peers" work meets customer requirements • Plan and organize your own work to achieve targets and deadlines. • Work with colleagues to deliver shared goals	helping peers with their work from time to time and providing feedback and advice to help improve the quality of their work. Since this role is likely to have people reporting to it, the individual performing this role is supposed to take responsibility for the output and the development of the entire team.	5

SECTION 3 EVIDENCE OF NEED

26	**What evidence is there that the qualification is needed? What is the estimated uptake of this qualification and what is the basis of this estimate ?** **Need of the qualification:** Artificial intelligence, the next rated 37 trend is expected to generate US$100-US$120 billion business for IT-BPM industry globally. Changing demands of global customers are driving Indian IT-BPM players to develop relevant competencies around these technologies. IT-BPM firms have already started rapid reskilling initiatives and are beginning to derive RoI for these efforts. An analysis of the skilling/reskilling programs of IT-BPM firms by NASSCOM in 2017 indicates that >50% of the workforce of large-sized firms (revenue >US$1 billion) has already been trained in digital technologies; for medium firms, it is 33%-35% and for small 35 firms, 38% of workforce has been reskilled. The revenue share of the Indian IT-BPM industry 35 from digital technologies as of FY2017 is estimated at >14% as per the report https://www.ey.com/Publication/vwLUAssets/ey-future-of-jobs-in-india/%24FILE/ey- future-of-jobs-in-india.pdf . As per the reports by research firm Gartner and economic times 2.3 million New jobs will be created by Artificial Intelligence. Starting in 2020, AI-related job creation will cross into positive territory, reaching two million net-new jobs in 2025 https://economictimes.indiatimes.com/jobs/by-2020-artificial-intelligence- will-create-more-jobs- than-it-eliminates- gartner/articleshow/62053363.cms. Machines and algorithms in the workplace are expected to create 133 million new roles, but cause 75 million jobs to be displaced by 2022 according to a new report from the World Economic Forum (WEF) called “The Future of Jobs 2018.” The growth of artificial intelligence could create 58 million net new jobs in the next few years https://www.forbes.com/sites/amitchowdhry/2018/09/18/artificial-intelligence- to-create-58-million- new-jobs-by-2022-says-report/#60728aa24d4b
27	**Recommendation from the concerned Line Ministry of the Government/Regulatory Body. To be supported by documentary evidences.**

	Industry recommendation received from the R& D Organisation of the Ministry of Electronics and Information Technology, Government Of India
28	**What steps were taken to ensure that the qualification(s) does (do) not duplicate already existing or planned qualifications in the NSQF? Give justification for presenting a duplicate qualification** This course is not registered in NQR.
29	**What arrangements are in place to monitor and review the qualification(s)? What data will be used and at what point will the qualification(s) be revised or updated? Specify the review process here** ASAP has a quality management system to monitor all its courses through regular feedback from students, Program Managers and Quality assures. Student feedback will be collected at regular intervals starting from the end of 1st to 30th session and there after every 15 sessions. Similar feedback will be collected from Program Managers who manage the courses in Skill Development Centers. These feedbacks are categorized into 3 groups mainly: Acceptable, Requires Improvement and Not Acceptable. Quality assures empanelled by ASAP are people with minimum 5 years' experience and standing in industry. Quality assures are deployed to these places and based on the feedback collected from students and Program Managers on learning outcomes. Corrective actions are suggested by Quality division to Program Managers through Sector heads and Sector Program Managers to effect the required changes. The planned date for review of qualification is 2025 August.

SECTION 4

EVIDENCE OF PROGRESSION

30	**What steps have been taken in the design of this or other qualifications to ensure that there is a clear path to other qualifications in this sector?** ***Show the career map here to reflect the clear progression*** The Career /Occupational Map reflects horizontal and vertical mobility emanating across experience levels. The candidate who successfully completes the course can join as IT industry as a AI-Machine Learning Developer, a trainer after completing the Training of Trainers and can turn up as an Entrepreneur/Freelancer in AI and Machine learning. Job Progression has been attached as Annexure 3