

QUALIFICATION FILE

Application Documentation: Version 1 /01 September, 2016

NSDA Reference

To be added by NSDA

CONTACT DETAILS OF SUBMITTING BODY

Name and address of submitting body:

C-DAC,ACTS

ACTS, Innovation Park, S. No. 34/B/1,

Panchvati, Pashan, Pune 411 008

Name and contact details of individual dealing with the submission

Name: Shri. Aditya Kumar Sinha

Position in the organisation: Joint Director

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List of documents submitted in support of the Qualifications File

1. Qualification File
2. Course Content

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SUMMARY

Qualification Title and Code:	Certificate Course in IoT
Body/bodies which will award the qualification:	Centre for Development of Advanced Computing (C-DAC) organization of the Ministry of Electronics and Information Technology (MeitY), Ministry of Communications & Information Technology
Body which will accredit providers to offer the qualification:	C-DAC
Body/bodies which will be responsible for assessment:	C-DAC
Occupation(s) to which the qualification gives access:	<p>Certificate Course in IoT aims to groom the students to enable them to work on current technology scenarios as well as prepare them to keep pace with the changing face of technology and the requirements of the growing IT industry.</p> <p>After the completion of the course, students can work as IoT Application developer.</p>
Proposed level of the qualification in the NSQF:	Level 7
Anticipated volume of training/learning required to complete the qualification:	320 hrs of classroom/lab learning
Entry requirements / recommendations:	Any Engineering /Science graduate with mathematics up to 10+2 level.
Progression from the qualification:	<p>The course aims to groom the students to enable them to work on current technology scenarios as well as prepare them to keep pace with the changing face of technology and the requirements of the growing IT industry. The course curriculum has been designed keeping in view the emerging trends in advanced computing as well as contemporary and futuristic human resource requirements of the ICT industry.</p> <p>Candidates will be trained in communication protocols, tolls like Node JS and python for development and embedded linux</p>

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Candidate can start from level 6 and lead to further levels.			
Planned arrangements for RPL:	NA		
International comparability where known:	There are many courses available on IoT but CDAC is providing knowledge of IoT concepts, Wireless Networks, Python Programming, Communication model, Embedded Linux and management development program in one course also implementation of learning can be evaluated under project.		
Formal structure of the qualification:			
Title of NOS/unit or other component (include any identification code used)	Mandatory/ Optional Enter M or O for each unit/ component	Estimated size (learning hours) The total should be the same as the entry under “anticipated volume” above	Level In the NSQF, individual units or components of qualifications can have outcomes which put them at levels which are higher or lower than the whole qualification.
Fundamentals of IoT	M	30	7
IoT prototyping using NodeJS	M	30	7
Python Programming	M	30	7
Embedded Linux	M	35	7
Wireless Network	M	30	7
Communication models and IoT Protocols	M	30	7
Cloud Platforms for IoT	M	35	7
Management Development Program	M	60	7
Project	M	40	7
Total		320	

Please attach any document giving further detail about the structure of the qualification – eg a Curriculum or Qualification Pack.

Give details of the document here:

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SECTION 1

ASSESSMENT

Body/Bodies which will carry out assessment:

C-DAC's Exam, Evaluation and Certification department will carry out assessment as per evaluation guideline finalized by Academic Council/ Academic Management Committee.

Will the assessment body be responsible for RPL assessment?

- Same will be finalised when the national RPL Policy will be finalised.
- Assessment is online through our e-Pariksha system or manually, depending on the strength of students.
- Issuance of qualification is centralized through C-DAC.

Describe the overall assessment strategy and specific arrangements which have been put in place to ensure that assessment is always valid, consistent and fair and show that these are in line with the requirements of the NSQF:

Assessment is a necessary and essential part of conducting the Certificate Course in IoT, as it provides important feedback and inputs to both the institute as well as the student. The institute gets an idea about the relative performance of each student, which also serves as feedback about the design and conduct of the course. The student gets a clear picture of his academic standing, individually and in comparison to his fellow students.

- A separate evaluation process is to be conducted for every module of the course.
- The evaluation for each module must be completed as per guidelines given below. The mid-module /surprise test evaluation is mandatory and can be taken after discussion with the concerned faculty.
- Students are evaluated on a continuous and throughout the duration of the course to make a fair assessment of the skills acquired by them. To have a very uniform and fair assessment. The evaluation process is divided into two parts:
 - Continuous Assessment - CA (150 marks)
 - Course End Examination - CCE (150 marks)

Continuous Assessment :This is being done primarily by the respective faculty in the form of Lab tests, assignments, quizzes, submission of term reports, presentations etc. conducted (with the help of respective course co-coordinators) at regular intervals and as and when the portions of the subjects are completed. These are basically internal exams and local to the centre. This process is further categorized into two parts.

- Lab test
- Internal test : Assignment/Case Studies /quiz and other valuation methods like case study, viva, group discussion depending on the subject and the faculty

It is recommended to conduct Management Development Program and Organisational Behaviour sessions and also conduct surprise test for the development of soft skills, logical, analytical capabilities and managerial skills for the benefit of the students and also give assignments and conduct some surprise test related to Management Development Program and Organisational Behaviour.

The figures shown below indicate the weightage of each module in the final performance statement. The examination(s) for each module must be conducted for at least that number of marks. However, the centre may conduct evaluation for a higher number of marks, in which case the marks will be scaled down. For example, if the examination for the Operating Systems Concepts module is

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conducted for 100 marks, the marks earned by the student will be scaled down to out of 40.

A student must score a minimum of 40 percent marks in each component of the evaluation, and also in the aggregate score, in order to successfully clear the module. If a student scores more than 40% on aggregate but has scored less than 40% in one component of the evaluation, he will not be declared as passed.

The weight age for each component will normally be:

Theory examination – (CCEE) 150 marks

Laboratory examination, Internal marks 150 marks

(Internal marks: Lab Assignment Evaluation, Surprise Tests, attendance, Viva, Seminars)

The question papers for the theory as well as the laboratory examinations at all the centres will be set by C-DAC, ACTS, Pune. The centres according to guidelines provided by, ACTS, Pune, will conduct the evaluation of the laboratory and assignments locally.

Minimum Pass marks:

The minimum marks to be obtained for declaring a student pass in any module is as follows:

For 40 mark QP : 16 marks

For 20 mark QP : 8 marks

For 60 mark QP : 24 marks

Assessment is through e-Pariksha system.

About e-Priksha System:

ePariksha is a web based application for the automation of the examination process. The system provides a great control on exams from preparing question paper to scheduling exam and from monitoring exam to generate results.

ePariksha has a strong administration which provides complete system status in one glance.

It's Results & Reports generations functionality provides system details in all standard and required formats.

An image based, LAN based, secure, fault tolerant and scalable system through which examinations can be delivered "on demand" basis in selected examination centres spread across the country.

System Support:

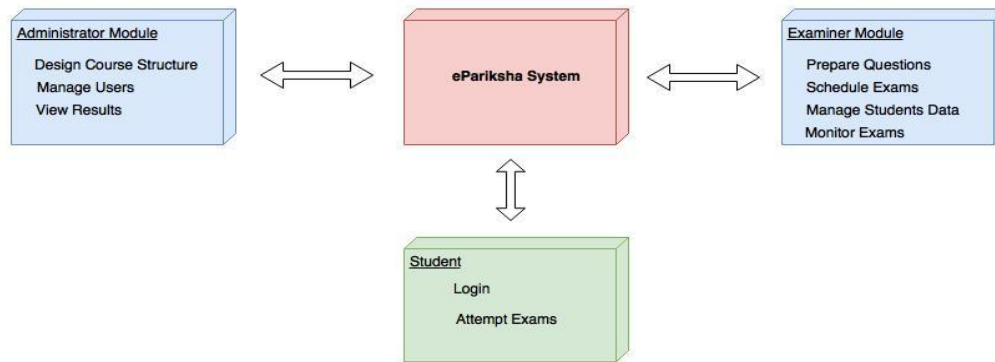
- Decentralized mode of operation(LAN based)
- Question Paper approach
- Multi lingual and multi subject support
- Browser based

Components of the e-Parikhsa System Includes:

- **Administration Module-** To design course structure, Manage users, view results.
- **ePariksha System** –Assessment of students through online system.
- **Examiner Module** -To manage the examination related activity and conduct- i.e Registration data and question paper uploading, conduct of examination, response generation

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- **Student Login** –Allows students to login and attempt exams.



Salient Features:

- Exam Resume - Power Failure Handling
- Random Question Paper
- User friendly Interface
- Question Bank
- Instant Result
- Live Monitoring of Exams & Assignment
- Time bound exams
- Multilingual support
- Handheld devices Support
- Responsive Design

Feedback System: C-DAC's Advanced Computing Training School (ACTS) offers various courses and training programs through its own training centres and its network of Affiliated Training Centres (ATC) spread across the country. Each year, thousands of students and professionals are trained at these centres.

The purpose of the system i.e. Online Feedback System (OFS) is to develop a web application for getting the online faculty feedback by the students studying at centres and also at the various Authorized Training Centres (ATC) affiliated to for different training programs offered by C-DAC ACTS.

This system is for conducting "The Student Survey" for quality assurance of education. Students, Faculties and administrators can all benefit from survey. This is helpful in the continual improvements in teaching programs, processes as well as infrastructure and thereby enhancing the students' learning experience at C-DAC ACTS.

The Online Feedback System make the student feedback procedure centralized for all C-DAC centres as well as various Authorized Training Centres (ATCs) located across the country through which headquarter manager can manage student feedback of faculties as well as infrastructure studying at different training centres with different reports for feedback analysis.

Please attach any documents giving further information about assessment and/or RPL.
Give details of the document(s) here:

ASSESSMENT EVIDENCE

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There will be 150 questions to answer in 3 hours duration in Course End Exam as per the following distribution mentioned below.

Sr. No.	Module	Learning Outcome	Theory	Lab & IA	Total Marks
1.	Fundamentals of IoT	Students can demonstrate: <ul style="list-style-type: none"> The concept of open source hardware and get introduced to a variety of development boards. 	10	20	30
2.	IoT prototyping using NodeJS	<ul style="list-style-type: none"> How to create Smart Device 	20	20	40
3.	Python Programming	<ul style="list-style-type: none"> Show how high-level communications between different devices can be accomplished using web APIs, web sockets, and/or remote procedure calls. 	20	20	40
4.	Embedded Linux	<ul style="list-style-type: none"> Provide an understanding of essentials of embedded Linux Explain the essential components- tool chain, kernel, boot loader and root file system 	20	30	50
5.	Wireless Network	<ul style="list-style-type: none"> Students will be introduced to some existing applications of wireless sensor 	20	20	40

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		<p>actuator networks</p> <ul style="list-style-type: none"> • Students will understand what research problems sensor networks pose in disciplines such as signal processing, wireless communications and even control systems 			
6.	Communication models and IoT Protocols	<ul style="list-style-type: none"> • Effective communication between various layers of IoT Architecture. • Cloud Connectivity 	20	20	40
7.	Cloud Platforms for IoT	<ul style="list-style-type: none"> • Student will get exposure of concepts and internals of cloud. 	10	20	30
8.	Management Development Program	<p>Students can demonstrate:</p> <ul style="list-style-type: none"> • Good conversation skills • Writing effective emails /business letters • Acquire good communication skills/Interview skills /Mock Interview 	30	-	30
9.	Project	<ul style="list-style-type: none"> • Students will apply knowledge gained during term I for project work. • Design, implement and evaluate computer technologies, 	Grade		

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		<p>systems, processes, components and/or programs appropriate to a defined task, while analyzing the impact on existing systems and potential future applications.</p> <ul style="list-style-type: none"> • Think critically, relatively and analytically in technological solutions to simple and complex problems. • Apply formal frameworks, methods and management systems to the organization, storage and retrieval of data in ways that demonstrate an understanding of both the business enterprise and the relevant technology. • Implement effective business solutions across an organization that demonstrates appropriate consideration of alternative computer technologies, including networks, servers, programming languages and database systems. • Plan, analyze, design and construct information systems to identified specifications, using clear and efficient code in the relevant programming language(s). • Work effectively in a team to analyze the 	
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		requirements of a complex software system, and solve problems by creating appropriate designs that satisfies these requirements Communicate to others the progress of the system development and the content of the design by means of reports and presentations.			
Total			150	150	300

Complete a grid for each grouping of NOS, assessment unit or other component as listed in the entry on the structure of the qualification on page 1.

Title of NOS/Unit/Component:

Assessable outcomes	Assessment criteria for the outcome
Enter the learning outcomes /elements of competence which will be assessed.	List all the criteria applying to this element/outcome.
Certificate Course in Network Administration	A+ >= 85%, A >= 70% to < 85% B >= 60% to < 70 % C >= 50% to < 60% D >= 40% to < 50% F < 40%
Means of assessment 1 Theory portion Assessment will be done through LAN based online system. Paper will be Objective question based. Lab evaluation will be done under project evaluation.	
Means of assessment 2 Re-examinations: The following conditions will be applicable for the course end re-exam: <ul style="list-style-type: none"> Students who do not appear for an exam on the scheduled date will not have an automatic right to re-examination. Only those students who, in the opinion of the 	

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centre/course coordinator have a genuine reason for being absent may be allowed to appear for a re-exam.

- Students who have failed an exam may be allowed to appear for a re-exam.
- The re-exam should be conducted following the same process as the regular examination.
- Students, who failed/remained absent in the Course End Examination conducted by , shall be allowed to appear in the re-examination only once.
- Students who remain absent or fail in the re-examination will not get any further chance for appearing for the re-examination. In such case the candidate can receive the Performance Statement and the certificate of participation without any grade.
- On evaluation of their answer sheets 20% of the marks obtained by the students will be deducted (towards de-rating for re-examination) for arriving at the final score, i.e. in order to clear the module test the student has to score a minimum of 48% marks instead of 40%.
- There will be no re-exam for the re-exam

Pass/Fail:

If Candidate scored below 40% in any of the component like Theory, lab or Internal will be consider as FAIL.

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SECTION 2

SUMMARY EVIDENCE OF LEVEL

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
7	Requires a command of wide-ranging specialised theoretical and practical skills, involving variable routine and non-routine contexts.	Wide-ranging factual and theoretical knowledge in broad contexts within a field of work or study.	Wide range of cognitive and practical skills required to generate solutions to specific problems in a field of work of study.	Good logical and mathematical skill understanding of social political and natural environment and organising information, communication and presentation skill.	Full responsibility for output of group and development

Assessed outcome	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
1. Fundamentals of IoT	Person may carry out a job as Developer for IoT Applications. This job demands a command of wide-ranging specialised theoretical and practical skills, involving variable routine and non-routine contexts.	Learning IoT Concepts, Wireless Networks, concepts, Embedded Linux will help to learner to get employment as IoT Application developer/ Tester.	Candidate can setup smart devices and create IoT Environment based on practical knowledge.	Candidate will be learning effective communications. Language to communicate written and oral. Aptitude, basic understanding of social political and natural environment.	Candidate can perform well and responsible for output of group and development
2. IoT prototyping using NodeJS					
3. Python Programming					
4. Embedded Linux					
5. Wireless Network					
6. Communication models and IoT Protocols					
7. Cloud Platforms for IoT					
8. Management Development Program					
9. Project					

SECTION 3

EVIDENCE OF NEED

What evidence is there that the qualification is needed?

Set up the Advanced Computing Training School (ACTS) in 1993 to meet the ever-increasing skilled

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manpower requirements of the Information Communication Technologies (ICT) industry as well as supplement its intellectual resource base for cutting-edge research and development. Over the years has designed and delivered various postgraduate and undergraduate degree and diploma programmes. In addition, imparts ICT training to state and national governments and agencies, strategic sectors, corporate and industries, foreign countries and international students, based on specific requirements.

What is the estimated uptake of this qualification and what is the basis of this estimate?

The Internet of Things (IoT) is in the midst of an explosion, as more connected devices proliferate. But there's not enough talent with the right skills to manage and execute on IoT projects. In fact, insufficient staffing and lack of expertise is the top-cited barrier for organizations currently looking to implement and benefit from IoT, according to research from Gartner.

What steps were taken to ensure that the qualification(s) does/do not duplicate already existing or planned qualifications in the NSQF?

NA

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?

Effective course design begins with understanding who your students are, deciding what you want them to learn; determining how you will measure student learning; and planning activities, assignments and materials that support student learning.

Our courses are specialized and market driven.

There is a dedicated team in CDAC to design and develop courses. There is a set process of reviewing and updating the by taking feedback from industry and domain experts .We are in touch with more than 500 companies and we design and updated courses with their interventions as per market demand.

SECTION 4

EVIDENCE OF RECOGNITION AND PROGRESSION

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?

- This qualification has been designed in consultation with industry and domain expert keeping in mind today's need. Evaluation criteria have been added to ensure progression to related path ways identified as per career path.

Please attach any documents giving further information about any of the topics above.

Give details of the document(s) here:

1. Course Content

Course Name: Certificate Course in IoT

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Course Modules:

Sr. No.	Module Name	Hours
1.	Fundamentals of IoT	30
2.	IoT prototyping using NodeJS	30
3.	Python Programming	30
4.	Embedded Linux	35
5.	Wireless Network	30
6.	Communication models and IoT Protocols	30
7.	Cloud Platforms for IoT	35
8.	Management Development Program	60
9.	Project	40
	Total	320

Module content:

Fundamentals of IoT (30 Hrs)

IOT Architecture, building blocks

Things in IOT, Terminology

- end nodes/sensor nodes
- gateways
- servers/cloud platforms

Applications of IOT

standards, history

IOT-A Reference model, architecture

Enabling technologies

talking to environments -- available sensors,actuators

sensor nodes

connectivity solutions

gateway solutions

cloud platforms

Challenges in IOT -- power optimization, mobility, connectivity, security

IoT prototyping using NodeJS (30 Hrs)

Nodejs:-

Setting up Nodejs

Simple scripts, console operations

variables, data types, operators

control structures, functions

arrays, string handling

classes & objects

event handling

error handling

package management, importing libraries

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NodeRED:-

- Setting up nodered on target machine
- Available nodes, Inject, Debug, significant function nodes
- Creating simple flows, sub flows
- Writing functions
- Importing, Exporting flows
- Context management, Storing Data
- Adding additional nodes
- UI development using NodeRED

Python Programming (30 Hrs)

- Setting up python interpreter
- Simple programs, console i/o operations
- Data types, variables, literals, operators
- Conditional branching, loops
- Arrays & Strings
- Functions, Modules
- Package management
- Regular expressions, pattern matching
- Error handling
- Standard Library

Embedded Linux (35 Hrs)

- Architecture of embedded linux – kernel, system calls, libraries
- Internals – Process, Thread, File Handling
- Getting familiar with Linux command line
- Environment Variables
- Basic Administration
- Deploying Linux on target board
- rootfs image, File System Hierarchy
- Understanding boot loaders for target boards.
- System Monitoring & Tracing techniques – procfs, sysfs
- Package management on Linux
- Understanding cross tools, Cross compiling applications
- Peripheral interfacing using libraries
 - ADC
 - GPIO, PWM
 - UART

Wireless Network (30 Hrs)

- Network layer model for IOT
- Physical channels for communication (wired/wireless)
- IPv4 concepts
- TCP, UDP Protocols, Socket Programming
- IEEE 802.11(WLAN)
- Bluetooth, Bluetooth Low Energy (BLE) – protocols, profiles
- RFID concepts

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IoT Protocols and Communication models (30 Hrs)

- M2M vs IOT
- Communication models
 - Request Response
 - Publish Subscribe
 - Push Pull
 - Exclusive Pair
- Communication Protocols
 - MQTT
 - CoAP
 - Websockets
 - HTTP REST (GET,POST,PUT,DELETE)
- Available tools & libraries for above protocols
- Protocol Bridging, Interoperability

Cloud Platforms for IoT (35 Hrs=17 T + 18 L)

- Virtualization concepts
- Cloud Architecture
- Cloud services -- SaaS, PaaS, IaaS
- Study of IOT Cloud platforms
- Supporting protocols and connectivity
- Data Visualization, Dashboards

Management Development Program

Introduction to communication, Barriers to communication, Kind of communication, Confidence building Non-verbal Communication, Fluency and vocabulary, Synonyms, Antonyms, Grammar, Noun Pronoun, Verb, Adjective, Preposition, Conjunction, Words of Idioms & phrases, Sentence Construction, Fill up the blanks, Pronunciation, Conversation practice, Polite Conversation, Greeting, Logical reasoning, General Aptitude, Writing: Covering letter, Resume, Email, Presentation Skill, group discussion, Interview skills, Mock interview

Project