

NSQF QUALIFICATION FILE

Approved in 2nd NSQC – NCVET, Dated: 22nd September, 2020

NSDA Code
2020/ITES/NIELIT/03884

CONTACT DETAILS OF THE BODY SUBMITTING THE QUALIFICATION FILE

Name and address of submitting body:

National Institute of Electronics and Information Technology (NIELIT), NIELIT Bhawan, Plot No 3, PSP Pocket, Sector-8, Dwarka, New Delhi-77

Name and contact details of individual dealing with the submission

Name: Shri J. Mohan Koli

Position in the organisation: Deputy Director

Address if different from above: Same as above

Tel number(s): 011 25308300 Ext 126

E-mail address: jmohan@nielit.gov.in

List of documents submitted in support of the Qualifications File

Annexure I - Detailed Curriculum

- i. Syllabus and Lesson Plan
- ii. Indicative list of hardware and software to conduct the training.
- iii. Sample Practical Assignments and Question papers
- iv. Practical & Project guidelines
- v. Credit system
- vi. Trainer's qualification

Model Curriculum to be added which will include the following:

- **Indicative list of tools/equipment to conduct the training**
- **Trainers qualification**
- **Lesson Plan**
- **Distribution of training duration into theory/practical/OJT component**
- **Distribution of training duration into theory/practical/Project component-**

Training duration			
Theory in Hours	Practical inHours	Project (Major + Minor) in Hours	Total in Hours
480	720	350+40	1590

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SUMMARY

1	Qualification Title	A Level
2	Qualification Code, if any	NIELIT/IT/L6/004
3	NCO code and occupation	2522.0201, 2412.0200, 2412.0300, 2421.0101, 2431.0100, 2434.0101
4	Nature and purpose of the qualification (Please specify whether qualification is short term or long term)	Long term The objective of the Scheme is to generate skilled manpower in the area of Information Technology (IT) at the national level by utilizing the facilities and infrastructure available with the institutions/organizations in the non-formal sector.
5	Body/bodies which will award the qualification	Examination Wing, NIELIT Headquarters, National Institute of Electronics and information Technology (NIELIT) NIELIT Bhawan, Plot No 3, PSP Pocket, Sector-8, Dwarka, New Delhi-77
6	Body which will accredit providers to offer courses leading to the qualification	Examination Wing, NIELIT Headquarters, National Institute of Electronics and information Technology (NIELIT) NIELIT Bhawan, Plot No 3, PSP Pocket, Sector-8, Dwarka, New Delhi-77
7	Whether accreditation/affiliation norms are already in place or not, if applicable (if yes, attach a copy)	Yes (Given in Annexure (V))
8	Occupation(s) to which the qualification gives access	i. Freelancer (self-employed) ii. Full Stack Developer iii. Data Scientist/ Data Analyst iv. IoT Architect v. IoT Developer vi. Business Intelligence Analyst vii. Information Security Analyst viii. Training Faculty
9	Job description of the occupation	After undergoing this qualification, candidate will be able to perform primarily following job roles. i. Freelancer (For self-employed)

		<ul style="list-style-type: none"> ii. Full Stack Developer iii. Data Scientist/Analyst iv. IoT Architect v. IoT Developer vi. Business Intelligence Analyst vii. Information Security Analyst <p>The Full Stack Developer is responsible to develop both client side and serverside scripting.</p> <p>The Data Scientist fetches information in different formats from the various sources & analyses it for the business purposes.</p> <p>The IoT Architect provides a mechanism to managedatareceivedfromvariousnetworks and devices like smart phones, cameras etc. IoT Architect designs IoT solution to organizations problems.</p> <p>The Business Intelligence Analysts are responsible to collect data from multiple sources and industry trends. They analysis datatofigureoutmarketandbusinessstrends for companies to increase profits and efficiency.Theygivepictureoforganization’s competitiveness compare to other player in the sameindustry.</p> <p>The Security analysts are responsible for ensuring protection of digital assets from unauthorized access. This includes securing both online and on-premise infrastructures, weedingthroughmetricsanddatatofilterout suspiciousactivity,andfindingandmitigating risks before breaches occur. Security analysts are also responsible for generating reports for IT administrators and business managers to evaluate the efficacy of the security policies inplace.</p> <p>The NIELIT A Level qualified person can also become Faculty at training/education institute.</p>
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10	Licensing requirements	-NA-
11	Statutory and Regulatory requirement of the relevant sector (documentary evidence to be provided)	-NA-
12	Level of the qualification in the NSQF	6
13	Anticipated volume of training/learning required to complete the qualification	1590 hours (one & half year) including 390 hours of projects (Major Project – 350 hours and Minor Project 40 hours) One year, if candidate register after passing ‘O’ Level (IT).
14	Indicative list of training tools required to deliver this qualification	Given in Annexure - I (B) enclosed with the curriculum
15	Entry requirements and/or recommendations and minimum age	<p>(i.) Students from Institutes conducting accredited courses: ‘O’ Level in Information Technology under DOEACC Scheme. Such candidates are required to register through NIELIT ‘A’ Level Accredited institute.</p> <p>Or</p> <p>A Government recognized polytechnic engineering diploma after 10+2/ Graduate (may be concurrent). Such candidates are required to register through NIELIT ‘A’ Level Accredited institute.</p> <p>Or</p> <p>10+2. Such candidates are required to register through NIELIT ‘A’ Level Accredited institute. Candidates can pursue graduation in parallel with ‘A’ level (IT) Course. The candidate will be eligible for getting O Level (IT) certificate after clearing required modules.</p> <p>In each of the above cases, the completion certificate of ‘A’ Level under DOEACC Scheme will be awarded only after successful completion of the academic stream i.e. polytechnic engineering diploma after 10+2 or degree (Graduation).</p> <p>(ii.) Direct Applicants ‘O’ Level in Information Technology under DOEACC Scheme followed by six months</p>

		<p>experience in IT. Relevant experience connotes job experience in IT, including teaching in a recognized institution as a faculty member, excludes coaching.</p> <p>Or</p> <p>A Government recognized polytechnic engineering diploma after 10+2/ Graduate followed by one and half year experience in IT. Relevant experience connotes job experience in IT, including teaching in a recognized institution as a faculty member, excludes coaching.</p> <p>In each of the above cases, the completion certificate of 'A' Level under DOEACC Scheme will be awarded only after successful completion of the academic stream i.e. polytechnic engineering diploma after 10+2 or degree (Graduation).</p> <p>Age: No bar</p>
16	<p>Progression from the qualification (Please show Professional and academic progression)</p>	<p>Academic: 'A' level->'B' Level</p> <p>Professional: -</p> <ul style="list-style-type: none"> - Freelancer (self-employed/Entrepreneur) - Full Stack Developer/ Full Stack Web Developer-> Sr Full Stack Web Developer-> Project Manager - Data Scientist/Analyst-> Big Data Analytics Architect-> Analytics Manager -IoT Developer/ Architect -> Sr. IoT Developer/ Architect-> Chief Internet of Things Officer (CIoTO). - Business Intelligence Analyst -> Business Intelligence Manager-> Business Intelligence Director - Information Security Analyst-> Information Security Engineer-> Security Architect, IT-> Director of IT Security -Training Faculty-> Sr Faculty-> Head of Dept
17	<p>Arrangements for the Recognition of Prior learning (RPL)</p>	<p>Yes, Given at Sr.no. 15.</p>

18	International comparability	Yes. Given in annexure III (A) A level course of NIELIT is equivalent to Fundamental Information Technology Engineer Examination of Information Technology Promotion Agency (IPA), Japan. (B) A Level course of NIELIT is equivalent to TQC Certification of Computer Skill Foundation (CSF) Standards, Taiwan.
19	Date of Planned review of the qualification	Normally 3 to 4 years.

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20	Formal structure of the Qualification			
	Mandatory components			
	Title of Component and Identification Code/NOSs/Learning outcomes	Estimated size (learning hours)	Level	
Sem I				
		Theory Learning Hours	Practical Learning Hours	
1	A1-R5: Information Technology Tools and Network Basics	48	72	5
2	A2-R5: Web Designing & Publishing	48	72	5
3	A6-R5: Computer Organization and Operating System	48	72	6
4	A5-R5: Data Structure Though Object Oriented Programming Language	48	72	6
Sem II				
5	A3-R5: Programming and Problem Solving through Python	48	72	5
6	A4-R5: Internet of Things and its Applications	48	72	5
7	A7-R5: Database Technologies	48	72	6
8	A9.X-R5 One module out of A9.1-R5, A9.2-R5, A9.3-R5, A9.4-R5 and A9.5-R5	48	72	7
9	PR-I Practical based on A1-R5, A2-R5, A3-R5 and A4-R5			5
10	PR-II Practical based on A5-R5, A6-R5 and A7-R5			6
11	PJ-I Mini Project	40		5
Sem III				
12	A8-R5: Systems Analysis, Design and Testing	48	72	6
13	A10.X-R5 One module out of A10.1-R5, A10.2-R5, A10.3-R5, A10.4-R5	48	72	7

	and A10.5-R5			
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15	PJ-II Major Project (350 hours) based on specialized area.	350		7
	Sub Total (A)	1590		
	Optional Components			
	Title of Component and Identification Code/NOSs/Learning outcomes	Estimated size (learning hours)		Level
	For modules 9 and 10, student will have to select one specialized group out of five groups. Each specialized group consists of two modules. Both the modules within selected specialized group are mandatory to qualify 'A' Level (IT).			
I	Data Analytics			
	A9.1-R5: Big Data Analytics using Hadoop	48	72	7
	A10.1-R5: Data Science using Python	48	72	
II	Web Applications			
	A9.2-R5: Web Application using PHP	48	72	7
	A10.2-R5: Full Stack Web Development using MVC Framework	48	72	
III	Information Security			
	A9.3-R5: Network Management	48	72	7
	A10.3-R5: Information Security Management	48	72	
IV	Internet of Things			
	A9.4-R5: Internet of Things (IoT) a Practical Approach	48	72	7
	A10.4-R5: Internet of Things (IoT) using Raspberry Pi	48	72	
V	Artificial Intelligence			
	A9.5-R5: Artificial Intelligence Concepts and R Programming	48	72	

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	A10.5-R5: Machine Learning using Python	48	72	7
	Subtotal (B)	Optional (Electives are included in the Previous table)		
	Total (A+B)	1590		

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Formal structure of the Qualification- Sequence of Modules Training After 'O' Level (IT)				
Mandatory components				
Title of Component and Identification Code/NOSs/Learning outcomes		Estimated size (learning hours)		Level
Sem I				
		Theory Learning Hours	Practical Learning Hours	
1	A5-R5: Data Structure Though Object Oriented Programming Language	48	72	6
2	A6-R5: Computer Organization and Operating System	48	72	6
3	A7-R5: Database Technologies	48	72	6
4	A9.X-R5 One module out of A9.1-R5, A9.2-R5, A9.3-R5, A9.4-R5 and A9.5-R5	48	72	7
5	PR-II Practical based on A5-R5, A6-R5 and A7-R5			6
Sem II				
5	A8-R5: Systems Analysis, Design and Testing	48	72	6
6	A10.X-R5 One module out of A10.1-R5, A10.2-R5, A10.3-R5, A10.4-R5 and A10.5-R5	48	72	7
7	PJ-II Major Project (350 hours) based on specialized area.	350		7
Sub Total (A): Total Learning hours of 'A' Level after 'O' Level (IT)		1070		
Sub Total (B): Learning hours for 'O' Level (IT)		520		
Total (A+B)		1590		
Optional Components				
Title of Component and Identification Code/NOSs/Learning outcomes		Estimated size (learning hours)		Level

	For modules 9 and 10, student will have to select one specialized group out of five groups. Each specialized group consists of two modules. Both the modules within selected specialized group are mandatory to qualify 'A' Level (IT).			
I	Data Analytics			
	A9.1-R5: Big Data Analytics using Hadoop	48	72	7
	A10.1-R5: Data Science using Python	48	72	
II	Web Applications			
	A9.2-R5: Web Application using PHP	48	72	7
	A10.2-R5: Full Stack Web Development using MVC Framework	48	72	
III	Information Security			
	A9.3-R5: Network Management	48	72	7
	A10.3-R5: Information Security Management	48	72	
IV	Internet of Things			
	A9.4-R5: Internet of Things (IoT) a Practical Approach	48	72	7
	A10.4-R5: Internet of Things (IoT) using Raspberry Pi	48	72	
V	Artificial Intelligence			
	A9.5-R5: Artificial Intelligence Concepts and R Programming	48	72	7
	A10.5-R5: Machine Learning using Python	48	72	
	Sub total(B)	Given in the Previous table		-

<u>Total (A+B)</u>	1590	
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SECTION 1
ASSESSMENT

21	<p>Body/Bodies which will carry out assessment: Examination Wing, NIELIT Headquarters, National Institute of Electronics and Information Technology (NIELIT) NIELIT Bhawan, Plot No 3, PSP Pocket, Sector-8, Dwarka, New Delhi-77</p>
22	<p>How will RPL assessment be managed and who will carry it out?</p> <p>Yes, Given at Sr.no. 15.</p>
23	<p>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.</p> <p>Theory examination for each module under the fifth revised syllabus would be for a duration of three hours and the total marks for each subject would be 100. Dates for the various activities related with examinations will be announced on NIELIT website, well in advance of the examinations Candidate is required to pass in all OUTCOMES individually. Following assessment methodologies are used.</p> <p>A. All theory examinations will be conducted in the OFFLINE (PEN- Paper) mode. Each paper consists of two parts.</p> <ul style="list-style-type: none"> - Part I carries 40 marks and contains forty questions, which is a combination of Objective type -Multiple choice questions, Fill-in the blanks, True/ False and Match the Following. - Part II carries 60 marks and contains five subjective type questions. <p>B. Two Practical examination of three hours duration and 100 marks each would be conducted. The emphasis is on the practical demonstration of</p>

skills & knowledge based on the performance criteria. Each Practical exam carrying 100 marks, out of which 80 marks shall be for the Practical/Hands-on and 20 marks for Viva Voce.

- (i) Examination of Practical 1 (PR1) will be based on the syllabi of A1-R5 to A4-R5, modules of 'A' Level course.)
- (ii) Examination of Practical 2 (PR2) will be based on the syllabi of A5-R5 to A7-R5, modules of 'A' Level course.)

Laboratory/ Practical work will be conducted at Institutions / organizations, which are running the course. NIELIT will be responsible for holding the examination for theory and practical both for the students from Accredited Centres and direct candidates.

C. Project:

- (i) PJ-I Mini Project
- (ii) PJ-II Major Project based on Specialized Areas

- Projects are carried out by the student under guidance and support of faculty and management of the respective Institute/ Organization). A successful project completion certificate is mandatory for student to qualify mini Project of 'A' Level course.

- Major project exam will include a viva-voce examination. Project carries a total of 300 marks. 80% of the marks are earmarked for the project evaluation and 20% for the viva-voce. To qualify for a pass, a candidate must obtain at least 50% in the project evaluation and viva-voce.

I.

S.No.	Title of Component and Identification	Maximum Marks	Pass Marks
1	A1-R5 Information Technology tools and Network Basics	100	50% in each Theory and Practical
2	A2-R5 Web Designing & Publishing	100	
3	A3-R5 Programming and Problem Solving through Python	100	
4	A4-R5 Internet of Things and its Application	100	
5	A5-R5 Data Structure Through Object Oriented Programming Language	100	
6	A6-R5 Computer Organization and Operating System	100	
7	A7-R5 Database Technologies	100	
8	A8-R5 Systems Analysis, Design and Testing	100	

9	A9.x-R5 - One module out of A9.1-R5, A9.2-R5, A9.3-R5, A9.4-R5 and A9.5-R5.	100	Examination
10	A10.x-R5 - One module out of A10.1-R5, A10.2-R5, A10.3-R5, A10.4-R5 and A10.5-R5.	100	
11	PR-I Practical-1 (Based on Modules A1- R5 to A4-R5)	100	Project completion certificate is required to qualify Mini Project
12	PR-II Practical-2 (Based on Modules A5- R5 to A7-R5)	100	
13	PJ-I Mini Project	300	
14	PJ-II Major Project based on Specialized Areas	300	
Total		1500	

II. Marks details of ‘A’ Level course in Information Technology after passing ‘O’ Level (IT) course-

Four theory papers, one Practical and Mini Project are exempted for the candidates who join ‘A’ level after passing ‘O’ Level (IT) course.

Title of the Component	Maximum Marks	Pass Marks
A5-R5 Data Structure Through Object Oriented Programming Language	100	50% in each theory and Practical Examination
A6-R-5 Computer Organization and Operating System	100	
A7-R-5 Database Technologies	100	
A9.- x-R-5 One module out of A9.1-R5, A9.2-R5, A9.3-R5, A9.4-R5 and A9.5-R5	100	
A8-R5 Systems Analysis, Design and Testing	100	
A10.x-R5 One module out of A 10.1-R5, A10.2-R5, A10.3-R-5, A10.4-R5 and A10-R5	100	
PJ-II Major Project based on Specialized Areas	100	
Total	1000	

Pass Percentage:-

- To qualify a module, a candidate must have obtained at least 50% in each theory and practical examination.
- Projects are carried out by the student under guidance and support of faculty and management of the respective Institute/ Organization). A successful project complete certificate is mandatory for student to qualify mini Project of 'A' Level course. Major project exam will include a viva-voce examination. Project carries a total of 300 marks. 80% of the marks are earmarked for the project evaluation and 20% for the viva-voce. To qualify for a pass, a candidate must obtain at least 50% in the project evaluation and viva-voce.

The marks will be translated into grades, while communicating results to the candidates. No rounding off takes place for the calculation of grades. The gradation structure is as given-

Pass Percentage	Grade
Failed (<50)	F
>= 50% to < 55%	D
>= 55% to < 65%	C
>= 65% to < 75%	B
>= 75% to < 85%	A
>=85%	S

ASSESSMENT EVIDENCE

1. Assessment evidences

(i) A1-R5: Information Technology Tools and Network Basics

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Introduction to Computer-	<ul style="list-style-type: none"> • Identify computers, IT gadgets • Their evolution and applications. • Identify various input, output and hardware components of a computer along with storage devices. • Familiar with various types of software, utilities used for computer and mobile apps.
Introduction to Operating System	<ul style="list-style-type: none"> • Use of Operating System for both desktop and mobile devices. • Identify various desktop screen components and modify various properties, date, time etc. • Add and remove new program and features, manage files and folders. • Well versed with printing Various types of file extensions.
Word Processing	<ul style="list-style-type: none"> • Usage of Word Processing, details of word processing screen. • Opening, saving and printing a document including pdf files. • Document creation, formatting of text • Inserting Header and Footer in the document. • Finding text in a word document and correcting spellings. • Inserting and manipulating tables, enhancing table using borders and shading features. • Preparing copies of a document labels etc. for sending various recipients using Mail Merge.
Spreadsheet	<ul style="list-style-type: none"> • Use of Spreadsheet Processing and details of Spreadsheet screen. • Opening, saving and printing a Spreadsheet. • Spreadsheet creation, inserting and editing data in cells, sorting and filtering of data. • Inserting and deleting rows/columns. • Use of basic formulas and functions.

	<ul style="list-style-type: none"> Preparation of chart to represent the information in a pictorial form.
Presentation	<ul style="list-style-type: none"> Create Presentation Opening/saving a presentation and printing of slides and handouts. Manipulating slides to enhance the look of the slides as well as whole presentation by inserting a picture, objects, multimedia formatting etc. Running a slide show with various transitions.
Introduction to Internet and WWW	<ul style="list-style-type: none"> Test of knowledge of various types of networks and topologies Use of the Internet and various browsers available to access the Internet. Connect to the Internet using various modes of connections/devices available.
E-mail, Social Networking and e-Governance Services	<ul style="list-style-type: none"> Creation of an email account, compose an email, reply an email and send the email along with attachments Familiar with Social Networking, Instant Messaging and Blogs. Get familiar with e-Governance Services, e-Commerce and Mobile Apps.
Digital Financial Tools and Applications	<ul style="list-style-type: none"> Use of Digital Financial Tools. Familiar with Internet Banking Modes. Use of the Digital Locker and will be able to store documents in Digital Locker.
Overview of Future Skills & Cyber Security	<ul style="list-style-type: none"> Latest trends and technologies in upcoming fields in ICT. Need of Cyber Security and will be able to secure their PC and Mobile devices by using basic security features.
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no 23.

A2-R5: Web Designing & Publishing

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
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Introduction to Web Design	<ul style="list-style-type: none"> • Types of website. • Role of front end and back end application. • Concept of client-side scripting and server side scripting
Editors	<ul style="list-style-type: none"> • Use of different editors available for writing code. • Working of editors.
HTML Basics	Develop static website using different HTML Controls.
Cascading Style Sheets (CSS)	<ul style="list-style-type: none"> • Purpose of CSS. • Role of CSS in websites. • Roles of effects in Website.
CSS Framework	<ul style="list-style-type: none"> • Use of CSS Framework to develop web site effectively.
JavaScript and Angular JS	<ul style="list-style-type: none"> • Apply client side scripting. • Addition of validations and check on forms (webpages).
Photo Editor	<ul style="list-style-type: none"> • Editing of images and embed in webpages.
Web Publishing and Browsing	<ul style="list-style-type: none"> • Publish the websites.
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no 23.

A3-R5: Programming and Problem Solving through Python

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
1. Introduction to Programming	<ul style="list-style-type: none"> • Concept of Programming. • History and evolution of Programming.
2. Algorithm and Flowcharts to solve problems	<ul style="list-style-type: none"> • Purposes & concepts of algorithm and flowchart. • Use of algorithm and flowchart to solve problem independent of language. • Different constructs of algorithm and flowchart.

3. Introduction to Python	<ul style="list-style-type: none"> • Why it one the most popular languages in the industry i.e., features of Python. • Structure of Python problem. Scope of Python.
4. Operators, Expressions and Python Statements	<ul style="list-style-type: none"> • Use of the basic operators and expressions available in Python in developing program. • Use of various Python statements like conditional constructs, looping constructs in writing Python program.
5. Sequence data types	<ul style="list-style-type: none"> • Work with various built-in Sequence data types and their use. • Use of mutable and immutable objects and their concepts.
6. Functions	<ul style="list-style-type: none"> • Apply the in-built functions available in Python in solving different problems. • Work with modular approach using user defined functions.
7. File Processing	<ul style="list-style-type: none"> • Work with files • Reading/ writing on files.
8. Modules	<ul style="list-style-type: none"> • Concept of modules • Modular Programming • Importing
9. NumPy Basics	<ul style="list-style-type: none"> • Work on NumPy array manipulation to access data and subarrays and to split, reshape, join array etc
•	
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no 23.

A4-R5: Internet of Things and its application

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
1. Introduction to IoT – Applications/ Devices, Protocols and Communication Model	<ul style="list-style-type: none"> • Applications, protocols, architecture, etc. of IoT • Characteristics of IoT devices.
	<ul style="list-style-type: none"> • Physical Design/Logical Design, Functional blocks of IoT and Communication Models.
2. Things and Connections	<ul style="list-style-type: none"> • Closed loop/ feedback loop system. • Use of sensors, actuators and controllers in the IoT process flow. • TCP/IP Versus OSI models. • Wired and wireless connectivity.
3. Sensors, Actuators and Microcontrollers	<ul style="list-style-type: none"> • The role of Sensors, transducers in measuring physical quantities. • Working and characteristics of actuators. • Role and use of microcontroller in building various electronic devices.
4. Building IoT Applications	<ul style="list-style-type: none"> • Working of microcontroller and hardware prototyping Arduino platform. • The role of ‘C’ language in building IoT applications. • Built-in Data-type, operators-expressions • Conditional statements and loops. • Arrays, functions. • Digital, Analog pins of Arduino. • Interfacing sensors, actuator. • Use of ArduBlock GUI tool.
5. Security and Future of IoT Ecosystem	<ul style="list-style-type: none"> • Need of security in IoT. • Various basic concept of security. • Security levels. • Need of powerful CPU for Future IoT eco system.
6. Soft skills- Personality Development	<ul style="list-style-type: none"> • Role of positive personality and determinants of personality. • Test of Communication and writing skills.
Means of assessment	Assessment details are given at Sr. no 23

Pass/Fail

Pass/Qualifying Criteria is also given at Sr. no23.

A5-R5- Data Structure Through Object Oriented Programming Language

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Object Oriented Concepts	Basic concepts of Object- Oriented approach of programming. Difference between traditional procedural approach and Object- Oriented approach
Basics of C++ and C++ classes and Objects	What are the C++ Data types, Operators, control structures? What is array. Use of Array in the program. Use of pointers. Program using Functions. Basic input/output and Solve simple problems in C++ Use of C++ language to create classes and Objects What is the concept of Operator Overloading
Analysis of Algorithm	Analysis of various algorithms in terms of space and time complexity Concept of Big-Notation.
Searching and Sorting	Various Searching techniques Comparison in various Searching techniques in terms of time complexity. Various sorting techniques Comparison in sorting techniques in terms of time complexity

Elementary Data Types- Arrays, Linked Lists and types	Implementation of 1-D and 2-D arrays. various operations that is to be performed on arrays
	<ul style="list-style-type: none"> • Creation of new structures like- Linked list, double Link List, Circular Link List and all the operations related to same.
Stacks and Queues	<ul style="list-style-type: none"> • Implementation of stacks and queues. • use of the two data structures.
Trees	<ul style="list-style-type: none"> • Nonlinear Data Structure- trees and different modes of traversals • Implementation of different types of trees-BST, Threaded Binary Tree, Btree. • Practical use of the above.
Graphs	<ul style="list-style-type: none"> • The concept of Graph. • Implementation of graph through Adjacency Matrix and various traversal techniques of graphs
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no 23.

A6-R5-Computer Organization and Operating System

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Basic Structure of Computers	<ul style="list-style-type: none"> • Identify various components of a computer and their function. • Concept of Von Neumann Architecture

Computer Arithmetic Operations	<ul style="list-style-type: none"> • Truth table of various logic gates • Theorems of Boolean algebra. • Concept of fixed and floating-point numbers in system • Binary Arithmetic.
Central Processing Unit and Instructions	<ul style="list-style-type: none"> • Register Organization • Types of Instructions, Instruction Formats. • Various Addressing Modes. • Data Transfer and Manipulation. • Instruction cycle.
Memory Organization	<ul style="list-style-type: none"> • Characteristics of Memory Systems. • Type of memories, Main memory, Static & Dynamic memories, Secondary Memory. • Performance Considerations - Cache Memory with mapping, Virtual Memory etc. • Page replacement, • Introduction to RAID.
I/O Organization	<ul style="list-style-type: none"> • peripheral devices, • Data transfer modes • Interrupt handling • Types of Interrupts. • What is Priority Interrupt and what are these? • What is Direct Memory Access and how it is implemented? • Synchronous and Asynchronous Data Transfer.
Operating Systems Overview	<ul style="list-style-type: none"> • Various types of operating systems • Various functions performed by OS • What is kernel and shell & Distributed Operating Systems, System Calls. • Scheduling of algorithms, • Memory management, threads.

Process Management and Shell Script	<ul style="list-style-type: none"> • What is Process, its Definition, Process Relationship, Process states, ProcessState transitions, Process ControlBlock. • Listing & Finding of Processes,Foreground and backgroundprocesses. • Interactive Process managementtools. • Context switching –Threads– Concept of multithreads • Sending signals toprocesses.
Users, Groups and Permissions	<ul style="list-style-type: none"> • Linux File security, examining, permissionsetc • Creation of a new user orgroup • Modification in the existinguser • Modification the ownership of afile. • Modification in the permission of a file-Symbolic Method, NumericMethod, /etc/passwd, /etc/shadow and /etc/group files, • Monitor the logins Default Permissions, Special Permissions unmask,passwd.
Standard I/O and Pipes	<ul style="list-style-type: none"> • Standard Input andOutput, • Redirecting Output to aFile, • Redirecting STDOUT to a Program (Piping), Combining Output andErrors, • Redirecting to Multiple Targets (tee), Redirecting STDIN from afile.
Finding and processing files	<ul style="list-style-type: none"> • Locate, find, Basic findExamples, • Logical Operators, find and Permissions,find and AccessTimes.
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no23.

A7-R5-Databases Technologies

An overview of DBMS	<ul style="list-style-type: none"> • Identify different types of Databases. • Difference between file- based system and database system
An Architecture of the Database System	<ul style="list-style-type: none"> • Explain three tier architecture. • Role of DBA • Explain E-R Model.
Relational Database Management System (RDBMS)	<ul style="list-style-type: none"> • Familiar with RDBMS terminology • What are the basic principles of Relational Model. • What is Basetables • What is the difference between primary key & foreign key. • What are relational constraints. • Explain Codd Rules
Database design	<ul style="list-style-type: none"> • What is database design diagram • What is normal form. • Explain E-R Diagram
Maria DB	<ul style="list-style-type: none"> • Introduction to Maria DB, Data Types, • Use of various SQL Commands like Create, insert, update, delete, drop, alter, • Use of various SQL functions (String functions, date functions), • Use of keys like indexing, key, primary key, foreign key • Difference between MariaDB and SQL.

<p>Manipulating Data with MariaDB</p>	<ul style="list-style-type: none"> • Manipulation of data using MariaDB database • Application of various SQL statements. • SQL Statements, Select, like clause, group by, order by, joins-left join, natural join, right join, union. Correlated and nested queries. • Backup and restore commands
<p>NoSQL Database Technologies</p>	<ul style="list-style-type: none"> • Difference between relational and NoSQL databases • Difference between centralized and distributed database and NoSQL Database • Advantages of distributed DB NoSQL Databases. • Distributed data storage, transaction and query processing techniques, JSON Object, Create & Access JSON Object • Features of NoSQL • Difference between NoSQL and SQL. • Different features of MongoDB • Architecture of MongoDB, Documents, Collections, Dynamic Schemes, Mongo Shell, Mongo Server and Client, Data Types, Embedded Documents, Creating Configuration file for Mongo,
<p>Selecting the Right Database</p>	<ul style="list-style-type: none"> • Select right database for different type applications.
<p>Means of assessment Assessment details are given at Sr. No. 23</p> <p>Pass/ Fail Pass/Qualifying Criteria is also given at Sr. No. 23</p>	

A8-R5-Systems Analysis, Design and Testing

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
System Concepts	<ul style="list-style-type: none"> • System Definition, their types. • Different stages of software development life cycle. • Role, Qualifications, responsibilities and Need of Systems Analyst.
Requirement Gathering and Feasibility Analysis	<ul style="list-style-type: none"> • Requirement Specification and its design • Requirements of system and role of its documentation • Requirement gathering techniques-interview, questionnaire, on-site observation, document observation, • Alternate solution effectively • Conduction of feasibility analysis of the proposed system. • Cost Benefit Analysis, quantifications of costs and benefits, payback period. • System proposal preparation for managements, parts and documentation of a proposal
Structured Analysis	<ul style="list-style-type: none"> • What are the tools of structured Analysis. • What is Data flow diagram • What are the symbols used in the DFD. • Case study for use of DFD, • What is Levelling of DFDs and what are the Levelling rules. • Logical and physical DFDs. • Software tools to create DFDs.

	<ul style="list-style-type: none"> • Preparation of
Structured Designs	<ul style="list-style-type: none"> • What is entity relationship model and E-R diagrams. • What is cardinality ratio. • What is participation constraint. • Specify the cardinality ratio & participation constraint of various relationship types. • What is Normalization process. • What are data input methods, designing outputs, output devices. • Application Architecture, server-based architecture, client-based architecture, n-tier architecture, • Program design- structured chart. Preparation of Design Specification Document,
Object Oriented Modelling Using UML	<ul style="list-style-type: none"> • What is Object Oriented (OO) Development Life Cycle and Modelling. • What is Static and dynamic modelling. • Comparison of OO and Module-oriented Approach. What is Object Oriented Modelling in UML; • What are the UML diagrams. Explain its types.
Testing	<ul style="list-style-type: none"> • Need for software testing. • Types of testing like Functional Testing-unit testing, integration testing, user acceptance. Non-functional Testing- performance, stress testing, peak load testing, Maintenance Testing-Regression Testing
System Implementation and Maintenance	<ul style="list-style-type: none"> • Processes involved in deploying the software.

	<ul style="list-style-type: none"> • Testing and Validation • Preparation of User Manual, • Activities related to Maintenance of the software once it is made operational.
Other Software Development Approaches	<ul style="list-style-type: none"> • Different software development approaches • Distributed System, centralized versus distributed system, • What are the components of distributed system-process. • What are the different Layers of distributed system. • Design and layers of Internet Based applications.
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no 23.

A9.1-R5-Big Data Analytics Using Hadoop

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Analyze and Define Business Requirement	<ul style="list-style-type: none"> • Difference between traditional tools and • Analysis of business requirement through database
Operating System (Ubuntu/Linux)	<ul style="list-style-type: none"> • What is the Operating System and its functions. Management of files and folders. • Various types of file extensions and their purposes • Basic commands used in Operating System.
Java Programming	<ul style="list-style-type: none"> • Write programs using Java Programming Language and its main constructs. • Handle exception situations. • Write graphical programs using Java. • Integrate Java with any database. • Integration of any external Java API i
Hadoop Framework and Map Reduce Programming Technique	<ul style="list-style-type: none"> • Use of Hadoop framework for managing voluminous data. • Write programming using MAP

	Reduce techniques.
Analysing Data using HIVE	<ul style="list-style-type: none"> • CanProcessandanalyzelargevolumeofdata usingHIVE
Basics of R Programming and RHIVE	<ul style="list-style-type: none"> • Need of R in analysing voluminousdata. • Integration of R withHIVE
HIVE-Java Connectivity	<ul style="list-style-type: none"> • Connection of HIVE withJAVA • Developmentof GUI using JAVA, HIVE andR
HBASE, PIG and JAQL	<ul style="list-style-type: none"> • What are the purposes of other Big Data tools like JAQL, HBASE andPIG
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no23.

A9.2-R5-Web Application Development Using PHP

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Introduction to the Website Development	<ul style="list-style-type: none"> • Concept of Webpages andWebsite • Types ofwebsites. • Open SourceTechnologies • Platforms for PHP WebsiteDevelopment • Server-Side Scripting language and Client- Side Scriptinglanguage
Introduction to Linux Operating System	<ul style="list-style-type: none"> • What is Linux and why it isused? • What are the basic concepts of Linuxoperating system? • Execution of basic LinuxCommands. • Installation and ConfiguringNetBeans • ConfigureIDEfor webdevelopment. • Install and configure webserver. • Configure PHP and MySQL in Linuxenvironment
Review of Designing Web pages	<ul style="list-style-type: none"> • Design a web page • Create and implementCSS • HTML basics, Attributes, heading, Paragraph, Formatting, lists, blocks, classes, Iframesetc. • HTML Forms, elementsetc. • What is CSS? CSS Types, CSS Padding, CSS Id & Class,

<p>Review of Client Side Validations using various techniques</p>	<ul style="list-style-type: none"> • Java Script, Variable declaration, Operators, Control Statements, ErrorHandling. • Use of arrays, use of Built in Functions, User definedFunction. • HTML Forms and Java Script, HTML DOM, Validations using JavaScript • AJAX- XML Http Request Object, Response Handling, AJAX Components, AJAX Framework, HTML in AJAX, XML andAJAX, Validations usingAJAX. • JQUERY library, JQuery Selectors, JQuery Filters, • Working with JQuery Events, JQuery and HTML Forms, Validations usingJQuery. • ApplyingClient-sidevalidationsusingJava Script andAJAX • Applying Client-sidevalidationsusing JQuery
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<p>Implementation of a server side programming language PHP</p>	<ul style="list-style-type: none"> • Acquiring skills on programmingconcepts • Acquiring skills on architecture of front-end application • Acquiring skills on implementation of basic conceptsinPHPprogramming.
	<ul style="list-style-type: none"> • Acquiring skills on implementation of object-oriented concepts inPHP.
	<ul style="list-style-type: none"> • Acquiringskillstounderstandtheparadigmfordealing with form-baseddata
	<ul style="list-style-type: none"> • Acquiring Skills on filehandling
	<ul style="list-style-type: none"> • Attaining skills on integrating application with back enddatabase
	<ul style="list-style-type: none"> • Attaining skills on server-sidevalidations Attaining skills on implementation of security features.

Database connectivity with PHP and MySQL	<ul style="list-style-type: none"> • DatabaseConnectivity • Can handle Datamanipulations • CRUD (Create, Read, Update andDelete) Operations inMySQL-PHP • Database server configuration using IPv4 andIPv6, • Fetching Data from Databaseserver. • User Authentication andauthorization • Websitedevelopment
Web Services & security vulnerabilities	ImplementationWeb Services. Web Security and SecurityVulnerabilities
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no 23.

A9.3-R5-Network Management

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Introduction to Computer Networks.	<ul style="list-style-type: none"> • Understand the concept of networking, various terminologies used inNetworking • Understand various types of Networks, Networktopologies • Various modesofcommunication
Introduction: Network layers/Models	<ul style="list-style-type: none"> • Concept of Networklayers • What are the Design issues for thelayers? • Merits and De-merits of LayeredArchitecture. • Comparison of the OSI Reference Model &the TCP/IP Protocol Models • What does TCP IP protocolmean? • What is TCP IP protocol and how does itwork? • What protocols are part of the TCP IPsuite?

Physical Layer	<ul style="list-style-type: none"> • What is physical layer in networking? • What is the protocol used in the Physical layer? • How data travels physically? • What are digital signals? Compare it with Analog Signal. • Define Bit rate, Bit length. • What is the relationship between bit rate and bandwidth? • What is Nyquist signaling rate for noiseless channel • What are the transmission modes and switching techniques? • Various transmission media. • What are different types of Multiplexing? • What are the advantages of multiplexing? • What FDM and TDM? • What is guided and unguided media? • What are the categories of transmission media?
Data Link Layer	<ul style="list-style-type: none"> • What are the functions of Data Link Layer • What is framing in the data link layer? • What are the error detection methods? • How is CRC used in the error detection? • What is checksum in error detection method? • Difference between CSMA / CA, CSMA/CD and their functions. • Which IEEE standard is developed for CSMA/CD
Network layer	<ul style="list-style-type: none"> • What is IPv4 CIDR? • What is IPv4 addressing? • What is CIDR in subnetting? • What is IPv6? • What is the difference between IPv4 and IPv6? • How does IPv4 communicate with IPv6? • What is DHCP? Steps to perform DHCP. • What is link state vector routing protocol? • What is the difference between distance vector and link state routing protocols?
Transport Layer	<ul style="list-style-type: none"> • What are the functions of Transport Layer? How does it work? • How does client/server communication take place? • What is socket in transport layer? • What are the advantages and disadvantages between TCP and UDP? • What is the main difference between TCP and UDP? • What features make TCP a reliable transport layer protocol? • Which of the transport layer protocols is

	connectionless?
Congestion Control	<ul style="list-style-type: none"> • What is CongestionControl. • How can we control congestion in a network? What are the congestion controltechniques? • What is the difference between open loop congestion control and closed loopcongestion control? • Which algorithm is used for congestion control? • Why congestion control is an importantactivity ofnetworking?
Application Layer	<ul style="list-style-type: none"> • What are the function of ApplicationLayer? • What are application levelprotocols? • How DNS server works step bystep? • What is a DNSnamespace? • What are the three domains ofDNS? • What is FTP HTTPSMTP? • Which protocol is used to sendemails? • What is SNMP protocol and how itworks? • What information does SNMPprovide? • What are the different protocols fornework management?
Networking devices	<ul style="list-style-type: none"> • Workingofvariousnetworkingdevicesusedin all Networklayers- <ul style="list-style-type: none"> • Repeaters and theiruse, • Hubs, • Bridges, • ManagedvsNon-Manageable switches, • L-2Switches,L-3Switches, StackableSwitches, • What are the differences between a hub anda switch? • What's the difference between a collision and broadcastdomain? • Which internetworking device can separate broadcastdomains? • How many collision and broadcast domains are there in Hub? • Drawbacks ofRouters, • Advantages of Gateways and itsFunctionality • What is the difference between a router and a wireless accesspoint? • What parameters to be considered to configure a wireless accesspoint?

Fundamentals of Mobile communication	<ul style="list-style-type: none"> • What is 1g 2g 3g 4g 5g technology? • What are the frequencies of 2g 3g and 4g networks? • What is generation of wireless communication? • Which type of antenna is used in wireless communication? • What is Spread Spectrum in wireless communication? Explain its benefit and types. • What are the main benefits of spread spectrum system?
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no 23.

A9.4-R5-Internet of Things: A Practical Approach

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Hardware platform for Prototyping IoT applications	<ul style="list-style-type: none"> • What is NodeMCU esp8266 used for? • How many pins are in NodeMCU? Draw and Explain its Pin Diagram. • What is NodeMCU in IoT? • Connect of esp8266 to Arduino? • What is difference between NodeMCU and esp8266? Programming esp8266 with Arduino IDE? <ul style="list-style-type: none"> • Connection of NodeMCU esp8266 to Arduino IDE? • Programming of NodeMCU Arduino IDE?
Sensors, Actuators and its interfacing	<ul style="list-style-type: none"> • What is operating principle of sensor & Actuator? • Interfacing principles of ADC and DACs. • Interfacing digital and analog sensors with NodeMCU. • Interfacing Actuators with NodeMCU • The Embedded bus protocols • How I2C works? • How SPI works?

IoT - Networking & Protocols	<ul style="list-style-type: none"> • <u>What are the protocols used inIoT?</u> • <u>What is IoTapplications?</u> • <u>What is CoAP protocol inIoT?</u> • <u>What is MQTT protocol inIoT?</u> • <u>What is Zigbee protocol inIoT?</u>
Webserver basics for IoT	<ul style="list-style-type: none"> • What is a Web Socketsserver? • What are Web Sockets how is it differentfrom HTTP? • What is Web serverconfiguration? • Installation ofApache? • What is Web scripting? How does it work in a Webpage? • What is difference between GET andPOST method in RESTAPI?
	<ul style="list-style-type: none"> • What is the difference between GETand POST method inPHP? • What is difference between an Internet and intranet? • What is an intranetserver? • How does NodeMCUwork? • What is a broker inMQTT? • Create a MQTTconnection?
The IoT database management & Cloud connectivity	<ul style="list-style-type: none"> • Which database is best forIoT? • Creation of a new database inMySQL? • What are the examples of database managementsoftware? • What are the types ofdatabase? • What is databasetool? • What are the fundamentals ofcloud computing and itsarchitecture? • What are the services of cloudcomputing? • What is the role of cloud solutionarchitect? • What is difference between public and private cloud? • What is the difference between public/private and hybridclouds? • What is private cloudcomputing? • What is difference between IoT andcloud? • What is the role of cloud inIoT? • Which cloud is best forIoT? • What is ThingSpeak inIoT?
Security for next Generation IoT, IIoT	<ul style="list-style-type: none"> • What are the security concerns related toIoT? • What is IoTsecurity? • What are the main challenges ofIoT? • Why IoT security is important? • What Should Be the Action Plan forEnsuring

	IoTSafety
Means of assessment	<ul style="list-style-type: none"> • Assessment details are given at Sr. no 23
Pass/Fail	<ul style="list-style-type: none"> • Pass/Qualifying Criteria is also given at Sr. no23.

A10.1-R5-Data Science Using Python

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Python Language, Structures, Programming Constructs	<ul style="list-style-type: none"> • Write programs in the Python language. • Use of conditional statements, loops and various data structures of Python.
Data Science Concepts	<ul style="list-style-type: none"> • What is Data Science and Analytics? • What is Exploratory Data Analysis? • How to perform Exploratory Data Analysis?
NumPy	<ul style="list-style-type: none"> • What is NumPy? Where it is used? • Scientific computing and data analysis by understanding large, multi-dimensional arrays and matrices • Operations on arrays • work on high-level mathematical functions to operate on these arrays
Pandas	<ul style="list-style-type: none"> • Data Analysis after importing data from various sources. • Understand the Series and DataFrame as the central data structures for data analysis. • Learn various functions, grouping, merging and querying large sets of data
Statistical Concepts and Functions	<ul style="list-style-type: none"> • The statistical tool of python having ability to manipulate some statistical data and calculate results of various statistical operations • Understand functions like mean, median, mode and standard deviation • Understand the concept of Correlation and Regression
Matplotlib	<ul style="list-style-type: none"> • What Is Data Visualization. • Create graphs and plots using Matplotlib. • Plotting histograms, bar charts, scatter graphs, line graphs etc.

GUI - Tkinter	<ul style="list-style-type: none"> • What isTkinter • Creation of various widgets like button, canvas, label, entry, frame, check button, label etc. Geometry Management: pack, grid, place, organizing layouts and widgets, binding functions, mouse clicking eventsetc.
Machine Learning	<ul style="list-style-type: none"> • Overview of Machine Learning and itsconcepts.
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	<ul style="list-style-type: none"> • Pass/Qualifying Criteria is also given at Sr. no23.

A10.2-R5-Full Stack Web Development using MVC Framework

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
MVC Infrastructure Basics, Frameworks & Introduction to CakePHP	<ul style="list-style-type: none"> • What areModel-View-Controller, • Why use framework in the project (conventional vs. MVCproject). • Advantages ofMVC • What isCakePHP? • Why use CakePHPframework. • Configuration and Installation ofCakePHP • How does MVC work inCakePHP? • CakePHP folder structure & File naming conventions. • Disadvantages of using theCakeframework.
Models	<ul style="list-style-type: none"> • What are the different models ofdatabases and how to interact betweendatabase. • Creation ofdatabase • Accessing and manipulating table data using find, save, update methods of the model, DeletingData.

3. Controller and Views	<ul style="list-style-type: none"> • CreateControllers • CreateViews • Controllers and Views Interaction and exchange data between them.
4. PHP Basics and Conditional Logic	<ul style="list-style-type: none"> • PHP and MYSQLBasics • Setup in different platform. • How to declare variable and data types, Constants, Arrays, Strings, Web concepts, Decision making statements, loop types, operators.
5. Functions and Error Handling	<ul style="list-style-type: none"> • What isFunction? • CanCreatePHPfunctions,PHPfunctionswith parameters, Argument by reference, setting default values for function parameters, dynamic function calls, regular expressions, Date and timefunctions • Able to create user definedfunctions. • Can work with Built-infunctions.
6. Object Oriented Programming	<ul style="list-style-type: none"> • Object OrientedConcepts • Classes, creation of Objects forClass. • Methods andfunctions • Objectorientedfunctionalitiesi.e.Inheritance, Method Overriding,Interfaces • ConstantsAccess Specifiers andAbstract Classes.
MySQL Installation and Basics	<ul style="list-style-type: none"> • Database and DatabaseTerminology • MySQL installation on variousplatforms • MySQL connection, Database creation, Database Manipulations- Add, Edit, Retrieve and Delete. Database manipulations like add, edit anddelete • Table creation and tablemanipulations-

Advance Queries and Data Manipulation using PHP and MySQL	<ul style="list-style-type: none"> • AdvancedQueries. • SQLInjection • Sorting andIndexing • Joins • Retrieving and manipulating Data usingPHP. • Creation of Login and Registration form for userauthentication • Searching, Updation, Deletion of dataand users
Creating Dynamic Forms using CakePHP HTML Helpers	<ul style="list-style-type: none"> • Generate forms usingCakePHP • Validate forms using modeldefinitions. • Difference between get and postmethods • Sessions andcookies • Form validation using Modelvalidation definitions • File handling in CakePHP • Use of CakePHP globalvariables.
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no23.

A10.3-R5-Information Security Management

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Network Fundamentals	<ul style="list-style-type: none"> • Identify differentcomponentsof network devices. • Identify the different types of network, topologies and the most common networktechnologies • Able to explain various properties and functions of network protocols and network protocolstacks • How networkswork? • What is a switch,router? • What is the difference between switch andhub? • What is VLAN used for? Why it isimportant?

<p>Introduction to cyber security and Attacks</p>	<ul style="list-style-type: none"> • Able to acquaint with various Information security threat and controls for it. • Principle of Least Privilege and Confidentiality, Integrity, Availability(CIA) • Conversant in the fundamentals of risk management, security policy and authentication/authorization/accountability. • What are the types of cyberattacks? • What is authentication and how does it work explain its types. • What is Web application attack? • How do you ensure data security in cloud computing? • What are the security aspects in mobile cloud computing?
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<p>Cryptography</p>	<ul style="list-style-type: none"> • Explain the concepts used in early substitution and translation ciphers • Mathematical concepts underpinning cryptography • Demonstrate the use of hashing in maintaining data integrity • Use encryption methods that ensure both confidentiality and integrity • Algorithms used to protect users online & design choices behind these algorithms. • What algorithms are used in asymmetric encryption?
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	<ul style="list-style-type: none"> • Which encryption algorithm uses a variable length symmetric key? • What is the best symmetric encryption algorithm? • What is RSA algorithm in network security? • Applications of cryptography.
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<p>Network Security and countermeasures</p>	<ul style="list-style-type: none"> • What are the different types of topologies and the inherent security risks they create • Identify the common types of attacks against networks • Explain properties and functions of network protocols and the network protocol stacks • What is the aspect of deploying and utilizing wireless networks and technologies • What is IDS? • Configure firewalls, IDS, HIDS, NIDS, NIPS on all platforms for all types of attack scenarios.
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<p>Web Server and Application Security</p>	<ul style="list-style-type: none"> • What is a Web application vulnerability? • What are some examples of vulnerabilities? • Identify vulnerabilities in web applications, find a way in which the problems could be fixed or avoided. • Learn Mitigation strategies from an infrastructure, architecture, and coding perspective • Application coding errors like SQL injection and cross-site scripting • OWASP top 10 vulnerabilities and mitigation techniques. • What is Nessus?
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<p>Security Auditing</p>	<ul style="list-style-type: none"> • Identifies the phases of IT audit, and how to ensure that an audit provides value to the organization. • explain management models exist for implementing a deeper risk management program in their organization. • What are the elements of risk assessment and the data necessary for performing an effective risk assessment using Microsoft Security Assessment Tool • Perform Risk Assessment based on ISO27001 using ISO27001 security toolkit
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	<ul style="list-style-type: none"> • Preparation of Audit Questionnaire & Performing Audit for ISO27001 Standard • What is the purpose of Microsoft Baseline Security Analyzer? • Use of Microsoft Baseline Security Analyzer.
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<p>Cyber Law and IT Act 2000</p>	<ul style="list-style-type: none"> • What is cyber crime under Information Technology Act 2000? • What are the major objectives of Information Technology Act 2000 (as amended in 2008) explain in brief? • What is the maximum punishment for cyber terrorism under IT Act 2000? • What is Digital Signature in cyber law? • How does domain name dispute arise?
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Cyber Forensics	<ul style="list-style-type: none"> • Identify source of digitalevidence • What are the different types of digital analysis that can be performed on the captured forensic evidence? • What is digital forensics and how is it used in investigations? • What does a digital forensic investigator do? • What is the cyber forensics procedure identification, preserving, analysis, authentication? • Perform collection, imaging and analysis of the digitalevidence • Perform volatile data collection and analysis • What is the importance of report, maintaining chain of custody?
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no23.

A10.4-R5-Internet of Things using Raspberry Pi

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Introduction to Single Board Computer – Raspberry Pi and other target platforms	Need and use of Single Board Computer- Raspberry Pi <ul style="list-style-type: none"> • Uses of Raspberry Pi in IoTecosystem • Architecture, Working and characteristics of SBC • Programming through Python- Variable types Operators Program in Python like sorting an array Use of various inbuilt functions
Configuring and Managing Raspberry Pi	<ul style="list-style-type: none"> • Selection of appropriate Raspberry Pi and its accessories • Operating System distribution- NOOBS, Raspbian • Uses of raspi-config command • Configuring Network-wired & wireless

Linux Operating System Basics	<ul style="list-style-type: none"> • Use of Terminal to access File system,creating, moving, deleting files/folders, Privileges/file permissions, ownershipetc • Writing shellscripts • Use of pipes,redirection
Hardware interfacing - GPIO programming	<ul style="list-style-type: none"> • What are the GPIO pins on RaspberryPi? • Pin configuration including GPIOpins • Functions of the GIPOpins. • Wiring Pi, BCMpinout • Interfacing of various devices like DC motor, LED, switches, sensorsetc. • Programming digital I/O's using WiringPi (C language)library • Web request fromPython • Running various Linux cmds frompython
Raspberry Pi based IoT application use- cases	<ul style="list-style-type: none"> • Configuring web server on RaspberryPi • Controlling GPIO pins from webbrowser • Display sensor valueson • webpage

	<ul style="list-style-type: none"> • Configure Apache- • MySQL-PHP • Pushing data topublic • and/or private web • server. • Programmingwith • Node-RED
Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no23.

A10.5-R5-Machine Learning Using Python

Outcomes to be assessed/NOSs to be assessed	Assessment criteria for the outcome
Advanced Python	<ul style="list-style-type: none"> • Scientific computinganddata analysis using multi- dimensional arrays, data frames and analysisfunctions. • What is the difference between a listand tuple?

	<ul style="list-style-type: none"> • What is the difference between a dictionary and a list. • Use of various inbuilt functions. • Make various types of Graphs and Plots using Python Graphical libraries. • What is the use of NumPy in Python? • Can import CSV file into Pandas. • What is the difference between Matplotlib and Seaborn?
Machine Learning	<ul style="list-style-type: none"> • Solve problems through machine learning implementations. • Algorithms for evaluation and accuracy • What is supervised and unsupervised classification? • What are the supervised learning techniques? • How do you evaluate the accuracy of a classifier? • What is ensemble technique? • What is model evaluation in machine learning?
Computer Vision	<ul style="list-style-type: none"> • Write programs using machine learning algorithms in OpenCV for detection and recognition of images. • What is the best algorithm for face recognition?
Deep Learning	<ul style="list-style-type: none"> • What is artificial neural network with example? • What is a neural model? • What are the main components of artificial neural networks? • What is a neuron in a CNN? • What is back propagation algorithm in neural network? • What is the neural network model? • What are the types of neural processing? • What is Perceptron learning algorithm? • What is back propagation algorithm in machine learning? • How does artificial neural network algorithm work?
Natural Language Processing	<ul style="list-style-type: none"> • What are the steps in NLP? • What is semantic analysis in natural language processing? • What are the applications of NLP? • What is the difference between NLU and NLP? • What are natural language processing techniques? • What is natural language processing in artificial intelligence?

Means of assessment	Assessment details are given at Sr. no 23
Pass/Fail	Pass/Qualifying Criteria is also given at Sr. no23.

Complete a grid for each component as listed in “Formal structure of the the qualification” in the Summary.

NOTE: this grid can be replaced by any part of the qualification documentation which shows the same information – ie Learning Outcomes to be assessed, assessment criteria and the means of assessment.

SECTION 2

25. EVIDENCE OF LEVEL

Title / NameofQualification/Components:		A Level	
NSQF Domain	Outcomes of the Qualification/Component	How the outcomes relates to the NSQF level descriptors	NSQF Level
Process	Job that requires well developed skill, with clear choice of procedures in familiarcontext. Requires wide range of specialized theoretical & Practical skills involvingvariable routine and non-routine context. Assess how different area of IT in the organization work together. Develop, maintain and upgrade software. Monitor performance and usage of available resources.	Demands a wide range of specialized technical skill, clarity of knowledge and practice in broad range of activities involving standard and non- standard practices. The individual in this role needs to have thorough understanding of IT processesandhowtosatisfytherequirementof the organization’s clients /customers. Individuals will be expected to guide team members to carry out all assigned tasks safely andsecurely.	6
Professional Knowledge	Individual will have factual and theoretical knowledge in broad contexts within a fieldof work. Full resource utilization, skill Development and skill to updateKnowledge time to time. Explain and Demonstrate Professional knowledge includes software setup, system recovery, back-up, upgradation & creating deploymentplans.	Individual will carry out a broad range of work which requires wide ranging specialized theoretical and practical skills within a field of work or study. The individual will have in-depth knowledge of the different fields of IT and be able to guide junior associate to achieve the same.	6

Professional Skills	They plan tests, prepare test cases, generate test data and perform testing on test data to generate solutions to specific problems. They have good communication	The individual should have the ability to use various s/w in different platform & to monitor the performance and usage of resources. They should also know how to generate	6
	Skill and creative ideas for unique design of product.	solutions to specific problem in the field of work. Individual is also expected to monitor and guide/ aid staff to complete their task in more effective manner and will be responsible for resolving day to day operational problems.	
Core Skills	They should be good in communication, understanding, collecting information and logical skills. They can give new ideas for developments. They can identify system performance metrics and guide processes that track and measure performance of deployed systems.	Individual is expected to be able to communicate clearly in speech and writing and may be required to apply mathematical processes & expected to understand capability of team member and accordingly allocate work and check on the progress of the same, they should be able to guide/lead team on work within their capability.	6
Responsibility	They have full responsibility for output of group and self-development. They can design/ upgrade/maintain websites, database, software and provide solution in a conducive & Non-Conductive environment. Check-up procedures to ensure that project objectives are finished within specified time frames. Apply balanced judgments to different situations, Follow rule-based decision-making processes & complete accurate well written work. Make decisions on suitable courses, convey relevant information to teams Manage performance of teams and motivate them to their full potential.	Individuals will be responsible for the completion of their own work and they will have some responsibility for other's work & the team learning process. Individual will be able to make choices about the best procedure to adopt to address problems where the choices are clear and they will require well developed practical and cognitive skills to complete their work.	6

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?	
	Basis	In case of other Awarding Bodies (Institutes under Central Ministries and states departments)
	Need of the qualification	This Qualification is designed to meet the increasing manpower requirements in computers after discussion with various ministries- MHRD, Industries etc. The 'A' Level of NIELIT is recognized as equivalent to Advance Diploma Level Course by the Government of India for the purpose of employment vide Notification No.F.18-23/92-TD.V/TS dated 1st March, 1995 and F.18-23/92-TD.V/TS-IV dated 10 th April, 1996 issued by Ministry of Human Resources Development.
	Industry Relevance	The job role defined for the qualification is as per the National Qualification of Occupation 2015 which is developed by Employment Directorate under the ministry of Labour and Employment in collaboration with different industry partners and as per ILO guidelines. This justifies the qualification is very much relevant for industry.
	Usage of the qualification	With this qualification, candidates will be equipped with required knowledge to develop software. Candidates can be employed as Full Stack Developer/ Data Scientist/ Analyst/ IoT Architect/ IoT Developer/ Business Intelligence depending on the specialization.
	Estimated uptake	NIELIT is having 43 Centres and 140+ accredited Centres spread all over India and approximate 1000 candidates per year are expected to register in this course.
27	Recommendation from the concerned Line Ministry of the Government/Regulatory Body. To be supported by documentary evidences	
	This qualification is run by National Institute of Electronics & Information Technology (NIELIT). It is an Autonomous Scientific Society under the administrative control of Ministry of Electronics & Information Technology (MoE&IT), Government of India.	

28	<p>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.</p> <p>As the understanding and adoption model of QP evolve in the industry and across its sub-sectors, we foresee consolidation of qualification packs as a natural progression. The Qualification does not exist as per information available in public domain.</p>
29	<p>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</p> <p>The Qualification is monitored and reviewed normally in 3-4 years. The following data will be used</p> <ol style="list-style-type: none"> 1. Results of assessments 2. Employer feedback will be sought post-placement 3. Student feedbacks 4. Workshops and seminar for reviewing the qualifications 5. Industry Requirements 6. Consultation/ Tie-up with Industries or Expert for review of the Curriculum

SECTION 4

EVIDENCE OF PROGRESSION

30	<p>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? <i>Show the career map here to reflect the clear progression</i></p> <p>This qualification consists of both technical and analytical skills and designed in such a way that it will provide core concepts of IT Skills and leading various programming techniques. The candidate can choose a field of his interest from the list of electives and proceed further in that particular field to pursue advance course or one can work in the specialized field.</p> <p>This course gives link to higher qualification which is existing like B level of NIELIT. A successful candidate will get a certificate from NIELIT, which gives the following options of progression to the candidate</p> <ol style="list-style-type: none"> i. Freelancer (self-employed) ii. Full Stack Developer iii. Data Scientist/Analyst iv. IoT Architect v. IoT Developer vi. Business Intelligence Analyst vii. Information Security Analyst viii. Training Faculty
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