Information Booklet cum Syllabus

of

'A' Level Course in Information Technology (IT)

Under DOEACC Scheme

Revision-V

January 2020

National Institute of Electronics and Information Technology

An Autonomous Scientific Society under

Ministry of Electronics and Information Technology, Government of India

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CONTENTS

Sl. No.	TITLE		PAGE NO.
Section 1: About NIELIT and 'A' Level Course in Information Technology under DOEACC Scheme			
1.1	About the Revised Syllabus		5
1.2	About NIELIT		5
1.3	DOEACC Scheme		6
1.4	Objective of Scheme		6
1.5	'A' Level Course in Information Technology under DOEACC Scheme		6
1.6	Practical		10
1.7	Improvement		10
1.8	Mini Project		11
1.9	Major Project		11
1.10	Credit Scheme For 'A' Level Course in Information Technology		14
1.11	Examination Pattern		15
1.12	Practical Examination Scheme		20
1.13	Hardware Requirement for Modules		21
1.14	Software Requirement for Modules		22
1.15	Hardware and Software Requirement for Specialized Area		22
1.16	Parity Between Revision IV and Revision V of 'A' Level		23
Section 2: Detailed Syllabus of Modules of 'A' Level Course			
2.1	A1-R5	Information Technology Tools and Network Basics	26
2.2	A2-R5	Web Designing and Publishing	33

2.3	A3-R5	Programming and Problem Solving Through Python	37
2.4	A4-R5	Internet of Things and Its Applications	42
2.5	A5-R5	Data Structure Through Object Oriented Programming Language	48
2.6	A6-R5	Computer Organization and Operating System	53
2.7	A7-R5	Database Technologies	59
2.8	A8-R5	Systems Analysis, Design and Testing	63
2.9	A9.1-R5	Big Data Analytics Using Hadoop	68
2.10	A10.1-R5	Data Science Using Python	73
2.11	A9.2-R5	Web Application Using PHP	78
2.12	A10.2-R5	Full Stack Web Development Using MVC Framework	84
2.13	A9.3-R5	Network Management	90
2.14	A10.3-R5	Information Security Management	95
2.15	A9.4-R5	Internet of Things (IoT): A Practical Approach	102
2.16	A10.4-R5	Internet of Things (IoT) Using Raspberry Pi	108
2.17	A9.5-R5	Artificial Intelligence Concepts and R Programming	113
2.18	A10.5-R5	Machine Learning Using Python	116
Section 3: Practical Assignments and Sample Question Papers			
3.1	A1-R5	Information Technology Tools and Network Basics	120
3.2	A2-R5	Web Designing and Publishing	138
3.3	A3-R5	Programming and Problem Solving Through Python	147
3.4	A4-R5	Internet of Things and Its Applications	157

3.5	A5-R5	Data Structure Through Object Oriented Programming Language	167
3.6	A6-R5	Computer Organization and Operating System	179
3.7	A7-R5	Database Technologies	191
3.8	A8-R5	Systems Analysis, Design and Testing	201
3.9	A9.1-R5	Big Data Analytics Using Hadoop	212
3.10	A10.1-R5	Data Science Using Python	221
3.11	A9.2-R5	Web Application Using PHP	232
3.12	A10.2-R5	Full Stack Web Development Using MVC Framework	245
3.13	A9.3-R5	Network Management	257
3.14	A10.3-R5	Information Security Management	262
3.15	A9.4-R5	Internet of Things(IoT): A Practical Approach	268
3.16	A10.4-R5	Internet of Things(IoT) Using Raspberry Pi	277
3.17	A9.5-R5	Artificial Intelligence Concepts and R Programming	285
3.18	A10.5-R5	Machine Learning Using Python	295

Section 1

About NIELIT and 'A' Level Course in Information Technology under DOEACC (Department of Electronics Accredited Computer Courses) Scheme

1.1. About the Revised Syllabus

The fourth revised version of 'A' Level course in Information Technology syllabus under DOEACC (Department of Electronics Accredited Computer Courses) Scheme came into effect in January 2010 examinations. Since then, much advancement has been observed in the area of Information Technology. The need of industry has also changed with the availability of new and advanced technologies and tools. With the advancement in technologies, the software development practices have also changed. This also has led to change in job profile. Different job roles require different skills. Moreover, the digital initiatives taken by Government have also changed the way the business is taking place these days. These factors have led to bringing the revision in syllabus of DOEACC 'A' Level (IT) course.

This document presents the **fifth revised version of DOEACC 'A' Level course** in Information Technology (IT) syllabus **(hereafter called as A Level)** which becomes effective for teaching from the date of its notification. The syllabus of 'A' Level has been designed to enhance the skills of students so as to enable them to solve problem using IT tools.

1.2. About NIELIT

National Institute of Electronics and Information Technology, NIELIT, (Erstwhile DOEACC Society) is an autonomous scientific society of the Ministry of Electronics& Information Technology (MeitY), Government of India. The Society is registered under the Societies Registration Act, 1860. NIELIT was set up to carry out Human Resource Development and related activities in the area of Information, Electronics &Communication Technology (IECT). NIELIT is engaged both in Formal & Non-Formal Education in the area of IECT besides development of industry-oriented quality education and training programmes in the state-of-the-art areas. NIELIT has endeavoured to establish standards to be the country's premier institution for Examination and Certification in the field of IECT. It is also one of the National Examination Body, which accredits institutes/organizations for conducting courses in IT and Electronics in the non-formal sector.

Over the last three decades, NIELIT has acquired very good expertise in IT training through its wide repertoire of courses. These courses are as under.

- 'O' Level (Foundation) –NSQF aligned course at Level 5
- 'A' Level (Advance Diploma) - NSQF aligned course at Level 6
- 'B' Level (MCA equivalent) - NSQF aligned course at Level 7
- 'C' Level (M-Tech level) - NSQF aligned course at Level 8
- Digital Literacy Courses
    - ACC (Awareness in Computer Concepts)
    - BCC (Basic Computer Course)
    - CCC (Course on Computer Concepts) –NSQF aligned at Level 3
    - CCC+ (Course on Computer Concepts Plus)

- ECC (Expert Computer Course)

At present, NIELIT is operating from offices located at Agartala, Aizawl, Ajmer, Aurangabad, Bhubaneswar, Calicut, Chandigarh, Chennai, Chuchuyimlang, Churachandpur, Delhi, Dibrugarh, Gangtok, Gorakhpur, Guwahati, Haridwar, Imphal, Itanagar, Jammu, Jorhat, Kohima, Kolkata, Kokrajhar, Kurukshetra, Leh, Lucknow, Lunglei, Mandi, Pasighat, Patna, Pali, Ranchi, Ropar, Senapati, Shillong, Shimla, Silchar, Srinagar, Tezpur, Tura, Tezu with its Headquarters at New Delhi. It is also well networked throughout India with the presence of about 900+ accredited institutes. The Headquarters is situated at NIELIT Bhawan, Plot No. 3, PSP Pocket, Institutional Area, Sector 8, Dwarka, New Delhi – 110 077.

1.3. DOEACC Scheme

DOEACC was a joint scheme of the then Department of Electronics (now MeitY) and All India Council for Technical Education (AICTE), Govt. of India.

1.4. Objective of Scheme

The objective of the Scheme is to generate skilled manpower in the area of Information Technology (IT) and Electronics at the national level by utilizing the facilities and infrastructure available with the institutions/organizations in the non-formal sector. NIELIT is managed and administered by a Governing Council chaired by the Hon'ble Minister of Electronics & Information Technology and eminent academicians, professionals from IT & Electronics industries. The Director General is the Chief Executive Officer of the Society and manages day to day affairs of the Society. Manifold activities under the DOEACC Scheme are:

i. Accreditation
ii. Registration
iii. Examination & Certification

1.5. 'A' Level under DOEACC Scheme

1.5.1. Objective of 'A' Level Course in Information Technology

The objective of the course is to equip a student with necessary skills as per following job role based on specialisation attained.

i. Freelancer (For 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

1.5.2. Structure of 'A' Level Course under DOEACC Scheme

The revised syllabus (Revision V) of 'A' Level course consists of eight compulsory theory modules. The first four modules are that of all four modules of 'O' Level (IT) Revision V, five specialized areas (students to pick one specialized area) each consisting of two modules, two practical papers and one project. The structure of the 'A' Level in Information Technology syllabus is indicated below: -

Structure of 'A' Level Course in Information Technology Revision V

1. A1-R5: Information Technology Tools and Network Basics
2. A2-R5: Web Designing & Publishing
3. A3-R5: Programming and Problem Solving through Python
4. A4-R5: Internet of Things and its Applications

} Four modules of 'O' Revision V (Mandatory)

5. A5-R5:Data Structure Though Object Oriented Programming Language
6. A6-R5: Computer Organization and Operating System
7. A7-R5: Database Technologies
8. A8-R5: Systems Analysis, Design and Testing

} Another set of four mandatory modules

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)

Note: Two practical papers, one mini project and one major project in specialized area are mandatory to qualify 'A' Level (IT)

Specialized Area: Data Analytics
A9.1-R5 : Big Data Analytics using Hadoop
A10.1-R5: Data Science using Python

Specialized Area: Web Application Development
A9.2-R5 : Web Application using PHP
A10.2-R5: Full Stack Web Application using MVC

Specialized Area: Information Security
A9.3-R5 : Network Management
A10.3-R5: Information Security Management

Specialized Area: Internet of Things
A9.4-R5 :Internet of Things (IoT):A Practical Approach
A10.4-R5: Internet of Things (IoT) using Raspberry Pi

Specialized Area: Artificial Intelligence
A9.5-R5 :Artificial Intelligence Concepts and R Programming
A10.5-R5: Machine Learning Using Python

1.5.3. Sequence of Modules Training

The suggestive sequence to cover all the modules of 'A' Level course in Information Technology along with learning hours is listed below.

Module Code	Module	Learning Hours (Theory)	Learning Hours (Practical/ Tutorials/ Project)	Total Learning Hours
Semester I				
A1-R5	Information Technology Tools and Network Basics	48	72	120
A2-R5	Web Designing & Publishing	48	72	120
A6-R5	Computer Organization and Operating System	48	72	120
A5-R5	Data Structure Though Object Oriented Programming Language	48	72	120
Semester II				
A3-R5	Programming and Problem Solving through Python	48	72	120
A4-R5	Internet of Things and its Applications	48	72	120
A7-R5	Database Technologies	48	72	120
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	120
PR-I	Practical based on A1-R5, A2-R5, A3-R5 and A4-R5			
PR-II	Practical based on A5-R5, A6-R5 and A7-R5			
PJ-I	Mini Project		40	
Semester III				
A8-R5	Systems Analysis, Design and Testing	48	72	120
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	120
PJ-II	Major Project (350 hours) based on specialized area.	0	350	350
	Total	**480**	**1110**	**1590**

1.5.4. Sequence of Modules Training After 'O' Level (IT)

The suggestive sequence to cover all the modules of 'A' Level course in Information Technology for those candidates who join 'A' level after passing 'O' Level (IT) course along with learning hours is listed below.

Module Code	Module	Learning Hours (Theory)	Learning Hours (Practical/ Tutorials/ Project)	Total Learning Hours
Semester I				
A5-R5	Data Structure Though Object Oriented Programming Language	48	72	120
A6-R5	Computer Organization and Operating System	48	72	120
A7-R5	Database Technologies	48	72	120
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	120
PR-II	Practical based on A5-R5, A6-R5 and A7-R5			
Semester II				
A8-R5	Systems Analysis, Design and Testing	48	72	120
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	120
PJ-II	Major Project (350 hours) based on specialized area.	0	350	350
	Total Learning hours of 'A' Level after 'O' Level (IT)	**288**	**782**	**1070**
	Learning hours for 'O' Level (IT)	**192**	**328**	**520**
	Total	**480**	**1110**	**1590**

List of Specialized Areas	
Data Analytics	
A9.1-R5	Big Data Analytics using Hadoop
A10.1-R5	Data Science using Python
Web Applications	
A9.2-R5	Web Application using PHP
A10.2-R5	Full Stack Web Development using MVC Framework
Information Security	
A9.3-R5	Network Management
A10.3-R5	Information Security Management
Internet of Things	
A9.4-R5	Internet of Things (IoT) a Practical Approach
A10.4-R5	Internet of Things (IoT)using Raspberry Pi
Artificial Intelligence	
A9.5-R5	Artificial Intelligence Concepts and R Programming
A10.5-R5	Machine Learning using Python

1.5.5. Duration of the Course

The duration of 'A' level Course in Information Technology is 1590 hours including 390 hours of projects. The minimum period to cover contents of 'A' Level Course in Information Technology is one and half years. The minimum period to cover contents of 'A' Level course in Information Technology is one year for those candidates who register themselves in 'A' Level course in Information Technology after passing 'O' Level (IT).

1.6. Practical

The students have to devote 60%of the total time allotted to each module of the course for the practical sessions. Practical assignments have been worked out for each theory module and given in this booklet.

1.7. Improvement

The candidates are allowed to improve his/her grade in one subject immediately after clearing all the theory papers (immediate to last examination where the candidate has cleared his/her last paper).

1.8. Mini Project

The candidate registered in 'A' Level in Information Technology (IT) under DOEACC Scheme is required to submit two projects, one mini project and second major project. Guidelines to submit the Mini project are given in Information Brochure cum Syllabus booklet of 'O' Level (IT) –Revision V under DOEACC Scheme.

1.9. Major Project

NIELIT curriculum has a Major project as an important component of 'A' Level course in Information Technology. The Project is carried out by the student under guidance and support of faculty and management of the respective institute. It is felt that such a project provides an opportunity to the student to apply his/her knowledge and skills to real life problems (including oral and written communication skills), and as such the project should be given utmost importance and priority both by the students as well as institution faculty / management in respect of its identification, planning and implementation.

1.9.1. Objective of the Major Project

The aim of the project is to give the students an integrated experience in solving a real-life problem by applying knowledge and skills gained on completion of theory papers in a course at a given Level. It provides an occasion for students to develop written and communication skills, Project also helps the students to realize the importance of resource and time management, ownership of task towards deliverables, innovation and efficiency in task management apart from presentation skills. It also provides a good opportunity for students to build, enhance and sustain high levels of professional conduct and performance and evolves a problem solver frame of mind in student. It is also felt that taking up the project by a student prepares him for a job in industry and elsewhere.

1.9.2. Who could be Guide

A Supervisor / Guide for 'A' Level (IT) should be a person with DOEACC 'B' level/MCA/B.Tech/ equivalent/higher qualification and adequate experience (minimum 3 years) in the area in which the student has chosen the Project. In case of a candidate is from an accredited institute, the institute concerned will render all help including the nomination of the Supervisor.

1.9.3. Type of Major Project

The student undergoing course 'A' level Course in Information Technology has to submit project in order to be 'A' Level certified. The project should be original and of real-life value. The project should not be copy of existing material from any other source.

The Learners (Students) are expected to carry out a project successfully and submit the project certificate in the prescribed format from the head of the institute running the accredited course or the organization of which the learner is an employee. Proforma of the Project Completion Certificate is given as follow.

Performa of the Project Completion Certificate

This is to certify that the Project entitled _____is a bonafide work done by Mr./Ms._____ (NIELIT Registration No._____) in partial fulfilment of 'A' Level Course in Information Technology under DOEACC Scheme Examination and has been carried out under my direct supervision and guidance.

This report has not been submitted for any other examination and does not form part of any other course undergone by the candidate.

Signature of Guide/Supervisor

Name:

Signature

Name:
(By Head of the Institution) with PROV No. /FULL No.)

Or

Signature
(Name of Head of the Organization / Division)

Division:
Organization Name:
Address:

Place

Date

.

Student can develop a project of any type like browser based, mobile based or client-server architecture base application. However, it should be based on specialized area which the student has opted. For example, if a student has opted Artificial Intelligence (AI), he/she has to develop a major project in the application areas of AI.

1.9.4. Time of Submission of Major Project for 'A' Level Course in Information Technology

'A' Level (IT) student can submit the project only after clearing 5 papers of the 'A' Level Course in Information Technology and appear in both the modules of specialized area which the student has opted. The project should be of minimum 350 man-hours and carries a total of 200 marks (80% for the project evaluation and 20% for the viva-voce).

1.9.5. Some Important Notes While Preparing the Project Proposal

The following suggested guidelines may be followed in preparing the Final Project Report:

Good quality white executive bond paper A4 size should be used for typing and duplication. Care should be taken to avoid smudging while duplicating the copies.

Page Specification: (Written paper and source code)

- Left margin 3.0 cms Right margin 3.0 cms
- Top margin 2.7 cms
- Bottom margin 2.7 cms
- Page numbers – All text pages as well as Program source code listing should be numbered at the bottom centre of the pages.

1.9.6. Submission of Project Report to NIELIT

The student will submit his/her project report in the prescribed format along with requisite fee. The Project Report should include:

- One hard copy of the Project Report.
- Soft copy of Project on Optical Drive
- The Project Report may be about 50 pages (excluding coding).

1.9.7. Fees

An applicable fee for submitting 'A' Level Project should be remitted to NIELIT in the prescribed mode only on the official website of NIELIT. The applicable fee is available on web site on NIELIT. The students are advised to check the applicable fee from official website of NIELIT before remitting the same to NIELIT.

1.10. Credit Scheme For 'A' Level Course in Information Technology

1.10.1. About Credit System

A credit system based on the AICTE norms has been introduced for indicating the efforts required to pass a specific level of course under the DOEACC Scheme. Award of credit to a student will facilitate measurement/comparison of study hours including Theory Lectures, Tutorials and Practical Assignments put in a given module/paper/subject under

the Scheme with similar course in IT in India and abroad. This will also facilitate other Universities/ Apex Accrediting bodies to consider academic and professional equivalence of NIELIT courses. This will also help students/organizations to transfer credits from NIELIT to other academic bodies and vice-versa for ensuring continuity in education. Following table gives the number of hours of theory lectures, tutorials and practical per week to be attended and the credits earned by the student: -

1.10.2. Calculation of Credits

Sr. No.	Module Code	Module Name	No. of Lecture Theory Hours	No. of Tutorial/ Practical /Project Hours	Theory Credits	Practical Credits	Total Credits
			(A)	(B)	(C=(A)/ 15)	(D= ((B) /2* 15)	(E= (C) + (D))
1.	A1-R5	Information Technology tools and Network Basics	48	72	3	2	5
2.	A2-R5	Web Designing & Publishing	48	72	3	2	5
3.	A3-R5	Programming and Problem Solving through Python	48	72	3	2	5
4.	A4-R5	Internet of Things and its Application	48	72	3	2	5
5.	A5-R5	Data Structure Though Object Oriented Programming Language	48	72	3	2	5
6.	A6-R5	Computer Organization and Operating System	48	72	3	2	5
7.	A7-R5	Database Technologies	48	72	3	2	5
8.	A8-R5	Systems Analysis, Design and Testing	48	72	3	2	5

9.	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	3	2	5
10.	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	3	2	5
11.	PR-I	Practical-1	-	-	-	-	-
12.	PR-II	Practical-2	-	-	-	-	-
13.	PJ-I	Mini Project		40		1	1
14.	PJ-II	Major Project		350		12	12
15.		**Total Credits**					**63**

Notes

1. One credit is defined as one hour of theory lecture and 2 hours of tutorials/ practical/project every week for one semester consisting of 15 weeks.

2. Total number of credits earned in a module is calculated using AICTE formula (as applicable to Under Graduate Courses in IT namely ,C=L + (T+P)/2 where L, T and P indicate number of hours per week for Lectures, Tutorials and Practical. Hours spent during Project development is considered under Tutorials and Practical.

3. The credit scheme has been implemented since July, 2003 examinations.

4. Fractions in Credits have been rounded to nearest integer.

1.11. Examination Pattern

The theory examination for each module under the fifth revised syllabus would be for duration of three hours and the total marks for each subject would be 100. Each Practical examination will be of three hours duration and would carry100 marks. The teaching and examination for 'A' Level modules in IT will start once the notification is issued by NIELIT.

Dates for the various activities related with examinations will be announced on NIELIT website, well in advance of the examinations.

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 student at large.

1.11.1. Pass Percentage

To qualify a module, a candidate must have obtained at least 50% in each theory and practical examination. A successful project complete certificate is mandatory for student to qualify 'A' Level course. Following table shows the marks distribution.

Module Code	Module	Maximum Marks
A1-R5	Information Technology tools and Network Basics	100
A2-R5	Web Designing & Publishing	100
A3-R5	Programming and Problem Solving through Python	100
A4-R5	Internet of Things and its Application	100
A5-R5	Data Structure Through Object Oriented Programming Language	100
A6-R5	Computer Organization and Operating System	100
A7-R5	Database Technologies	100
A8-R5	Systems Analysis, Design and Testing	100
A9.x-R5	One module out of A9.1-R5, A9.2-R5, A9.3-R5, A9.4-R5 and A9.5-R5.	100
A10.x-R5	One module out of A10.1-R5, A10.2-R5, A10.3-R5, A10.4-R5 and A10.5-R5.	100
PR-I	Practical-1 (Based on Modules A1-R5 to A4-R5)	100
PR-II	Practical-2 (Based on Modules A5-R5 to A7-R5)	100
PJ-I	Mini Project	100
PJ-II	Major Project based on Specialized Areas	200
	Total	1500

The marks will be translated into grades, while communicating results to the candidates. The gradation structure is as below: -

Pass Percentage	Grade

Failed (<50)	F
50%-54.99%	D
55%-64.99%	C
65%-74.99%	B
75%-84.99%	A
85% and over	S

1.11.2. Award of Certificates

The students would be eligible for the award of 'A' Level course in Information Technology under DOEACC Scheme certificate on successfully qualifying the eligibility criteria along with Theory Examinations of all modules, Practical Examination and the Projects. The 'A' Level Certificate was 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 10th April, 1996 issued by Ministry of Human Resources Development and is currently aligned at NSQF (National Skill Qualifications Framework) level 6.Further, in the certificate, the specialized area will also be mentioned.

If a student wants to change specialized area after clearing one of the modules, he/she will have to clear both the modules of newly opted specialized area.

Student after clearing all the 10 modules, two projects and two practical examinations has further option to appear in additional specialized area. The students interested in getting certificate of additional specialized area shall have to clear both the modules of additional specialized area. Such students are also required to submit a major project related to additional specialized area.

Student who is registered in 'A' Level and clears first four theory modules (A1-R5, A2-R5, A3-R5 and A4-R5), Practical (PR-1) and submits mini project certificate as per requirement of 'O' Level (IT) will be awarded 'O' Level (IT) certificate.

1.11.3. Registration

Registration is a pre-requisite for appearing in 'A' Level examinations. A candidate can register at only one level at a time to appear for the examination. Registration is only for candidates and not for institutes. Candidate has to register with NIELIT through online portal.

1.11.4. Eligibility Criteria

The eligibility criteria for registration at 'A' Level are as follows:

(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.

Or

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.

Or

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.

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).

(ii.) Direct Applicants

'O' Level in Information Technology under DOEACC Scheme followed by six months experience in IT. Relevant experience connotes job experience in IT, including teaching in a recognized institution as a faculty member, excludes coaching.

Or

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.

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).

1.11.5. Prior Knowledge for Selecting Specialized Area

In 'A' Level Course in Information Technology under DOEACC Scheme, five specialized areas are offered. The student has to select one. Each specialized area requires certain level of prior knowledge. The following table shows the recommended prior knowledge before selecting the specialized area. However, it is not essential.

Sr. No.	Specialized Area	Desirable Prior Knowledge
1	Data Analytics	Mathematics / Statistics
2	Web Application Development	HTML and/or any client-side scripting

3	Information Security Management	Computer Network Concepts
4	Artificial Intelligence	Mathematics/ Statistics/ Business Intelligence/ Data Mining
5	Internet of Things (IoT)	Science subjects

1.11.6. Schedule of Registration of 'A' Level Course in Information Technology

For getting registered, a candidate fulfilling the eligibility criteria should apply online through NIELIT portal. Registration fee is also to be paid online. Registration fee once paid is not reimbursable or adjustable against any other payment.

Registration Application can be submitted online throughout the year, however cut off dates are specified for submitting Registration Application for each examination for the convenience of processing and allotting Registration Numbers.

Cut off Dates for Registration			
January Examination		**July Examination**	
Direct Candidate	**Through Institute**	**Direct Candidate**	**Through Institute**
30th September of previous year	10th October of previous year	31st March of same year	10th April of same year

A notification with respect to change in cut off dates is issued from time to time and shall be applicable.

1.11.7. Auto-upgradation

The candidates successfully completing all papers (Theory, Practical and Project) of a particular Level in a particular Examination and wish to appear in the next Examination for immediate higher Level are exempted from the above cut off dates. Such candidates can fill up examinations Form and Registration Forms for higher Levels subject to following conditions: -

a) Registration fee and Examination fee is paid online.

b) The facility is available to the candidates appearing through Accredited Institutes and not for direct applicants. However, the facility is available to a candidate who might have completed lower level as a direct candidate and wishing to appear for immediate higher level through Accredited Institutes.

c) The facility is not available to those candidates who might be appearing through Accredited institute but have cleared lower level prior to the preceding exam (e.g. if a candidate has passed 'A' Level Exam in Jan, 2019, he would be eligible for this facility in case he wishes to appear for 'B' Level Examinations in July, 2019

through Accredited Institute. If, however, he had passed 'A' Level prior to Jan., 2019 Exams, this facility would not be available to him).

d) This facility would also not be available to the candidate opting for Level jumping (e.g. from 'O' to 'B' or 'A' to 'C' Levels).

Once registered at a particular level, the registration is valid for ten consecutive examinations for 'A' Level, reckoned from the specific examination as indicated in the Registration allocation letter issued to the candidates.

Registration, by itself, does not entitle a candidate to appear for an examination at the Level concerned, unless all conditions, stipulated in the examination application form, and in any other notification, relevant to the examination are fulfilled by the candidate.

1.11.8. Re-registration

Candidates who are not able to clear the level within the validity period of initial registration, are allowed to re-register for once, at the same level for another full term i.e. 5 years to clear the left over papers by submitting filled in Registration application and full Registration fee within one year of the expiry of the validity period of existing Registration.

1.12. Practical Examination Scheme

The Practical Examination will be conducted by the NIELIT in reputed Institutions for all candidates. The institutes are obliged to facilitate the conduct of Practical Examinations and arrange infrastructure, support of its faculty and staff for the conduct of Practical Examination at their Centre. The practical examination scheme is as follows.

Number of Practical Examinations	Two
Duration of each Practical Examination	Three-hour duration including viva-voce
Max. Marks	100 = 80(Practical) + 20(Viva Voce)
Grading	Marks obtained by the students will be translated into the Grades as per the structure given Section 1.11.1.
Date(s)	Date(s) for practical examination will be announced on NIELIT website.

The institutes are not allowed to charge any fee from the candidates for the practical examination.

1.13. Hardware Requirement

1.13.1. Minimum Computer Configuration Recommended

Desktop/Laptop/PC

Processor	:	1 GHz or higher
RAM	:	4 GB or higher
HDD	:	100 GB or higher free space
Monitor	:	SVGA or of latest technology
Mouse	:	Operating System compatible
Keyboard	:	Standard
NIC	:	Standard
Optical Drive	:	Standard
Speaker, Mic, Webcam	:	Standard
Printer	:	Standard
Projector	:	Standard
Modem/DSL	:	Standard
Scanner	:	Standard

Sufficient number of computers are standard networking are part of satisfying criteria for accreditation.

Networking

NIC	:	Standard
RJ-45 Connector	:	Standard
Crimping Tools	:	Standard
UTP/STP/Coaxial Fiber Optic	:	
Cables and their connectors	:	Standard
8/16 port Switch	:	Standard
Wi-Fi Router	:	Standard

Others

Arduino UNO or equivalent board sensors and motors

1.14. Software Requirement

Sr. No.	Particular/ Module	Software
1.	Operating System	Linux /Ubuntu 16 or higher
2.	NOS	Linux
3.	Software Package	Any relevant word processing/spreadsheet/ presentation like Libre Office 6.0
4.	Complier/Interpreter	Python, C, C++
5.	Antivirus	Standard
6.	Internet and Web Publishing Tools	Standard Browser and publishing tools
7.	IoT	Arduino IDE, Any open source Tool
8.	Databases	MariaDB, MySQL

1.15. Hardware and Software Requirement for Specialized Courses

The following table shows the hardware and software required to conduct modules of the specialized areas.

Sr. No.	Specialized Area	Software	Hardware
1.	Data Analytics	HDFS, HIVE, Java, HBASE, PIG, JSQL, Linux/Ubuntu, RHIVE	Minimum RAM 8 GB (Desktop/Laptop/ PC)
2.	Web Application Development	Apache, PHP, MySql, NetBeans, CakePHP	Minimum RAM 4 GB (Desktop/Laptop/ PC)
3.	Information Security	CentOS/ Ubuntu, Oracle VirtualBox, Cryptotools, Snort, Squid Proxy Server Nessus, Network Minner, Kali Linux	Wireless Access Point, wireless card, Unmanaged Switches, routers

4.	Internet of Things	Arduino IDE, Linux, Apache server NOOBS, Raspbian or any Linux distribution for Raspberry Pi	NodeMCU or equivalent open hardware, WiFi Access points, Raspberry Pi with 8GB RAM, SD Card, Mouse, Keyboard and sensor kit
5.	Artificial Intelligence	R, Python, Anaconda,	Minimum RAM 8 GB (Desktop/Laptop/ PC)

1.16. Parity Table Between Revision IV and Revision V of 'A' Level

Previous Syllabus		**Revised Syllabus**	
Module Code (Revision IV)	**Revision IV (Module)**	**Module Code (Revision V)**	**Revision V (Module)**
M1/A1-R4	IT Tools and Business System	A1-R5	Information Technology tools and Network Basics
M2/A2-R4	Internet Technology and Web Design	A2-R5	Web Designing & Publishing
M3/A3-R4	Programming and Problem Solving Through 'C' Language	A3-R5	Programming and Problem Solving through Python
M4.1-R4	Application of .NET Technology	A4-R5	Internet of Things and its Applications
M4.2-R4	Introduction to Multimedia		
M4.3-R4	Introduction to ICT Resources		
A4-R4	Computer System Architecture		
A5-R4	Structured Systems Analysis and Design	A8-R5	Systems Analysis, Design and Testing

A6-R4	Data Structure through C Language	A5-R5	Data Structure Through Object Oriented Programming Language
A7-R4	Introduction to Database Management	A7-R5	Database Technologies
A8-R4	Basics of OS, Unix and Shell Programming	A6-R5	Computer Organization and Operating System
A9-R4	Data Communication and Network	No exemption will be given if exemption is already availed for eight mandatory papers (A1-R5 to A8-R5). However, any paper can be exempted against these papers for which exemption has not been availed. Total papers to be exempted shall remain 8.	
A10.1-R4	Introduction to Object Oriented Programming Through Java		
A10.2-R4	Software Testing and Quality Management		

1. The above table shows the equivalence between the modules of old syllabus and revised syllabus (Revision IV and V).

2. Candidates would not be allowed to appear in the equivalent papers of the Revision V (new syllabus), if they have already passed the relevant papers in earlier revision.

3. Candidates would have to pass 10theory papers, two projects and two practical papers in order to qualify 'A' Level (IT) in Revision V syllabus.
4. In case, the candidate has cleared examination as per Revision II and/or Revision III, the equivalency of Revision II with III and Revision III with IV will be done before the equivalency with Revision V.
5. Candidates would be allowed exemption in maximum eight papers which they have passed in Revision IV and below.
6. No exemption will be given in modules of any specialized area. Candidate will have to appear in examination of modules of specialized area in order to qualify for 'A' Level course in Information Technology.

Section 2

Detailed Syllabus of Modules of 'A' Level Course in Information Technology

2.1. Module: A1-R5-Information Technology Tools and Network Basics

2.1.1.Introduction

The module is designed to equip a student to use computers for professional as well as day to day use. It provides theoretical background as well as in depth knowledge of Software/ packages.

2.1.2.Objectives

After completing the module, the incumbent will be able to:

i. Acquire confidence in using computers in Office and General Life
ii. Identify the basic components of computers and terminology
iii. Understand file management
iv. Createdocumentsusingwordprocessor,spreadsheet&presentationsoftware
v. Understandcomputernetworks,andbrowsetheinternet,contentsearch,emailand collaborate with peers
vi. Use e-Governance applications and use computer to improve existing skills and learn new skills
vii. Understanding Social Networking platform
viii. Using Internet for Digital Financial services
ix. Develop knowledge about FutureSkills
x. Understand the various financial services and be aware of the various schemes started by Government.

2.1.3.Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.1.4.Outline of Module

Module Unit	Duration(Theory) in Hours	Duration (Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. Introduction to Computer	4	6	i. Identify computers, IT gadgets and explain their evolution and applications. ii. Get familiar with various input, output and hardware

			components of a computer along with storage devices. iii. Get familiar with various types of software, utilities used for computer and mobile apps.
2. Introduction to Operating System	4	6	i. Well acquainted with Operating System and its applications for both desktop and mobile devices. ii. Able to identify various desktop screen components and modify various properties, date, time etc. iii. Able to add and remove new program and features, manage files and folders. iv. Well versed with printing and know various types of file extensions.
3. Word Processing	6	9	i. Word Processing, their usage, details of word processing screen. ii. Opening, saving and printing a document including pdf files. iii. Document creation, formatting of text, paragraph and whole document. iv. Inserting Header and Footer on the document. v. Finding text on a word document and correcting spellings. vi. Inserting and manipulating tables, enhancing table using borders and shading features. vii. Preparing copies of a document labels etc. for

			sending various recipients using Mail Merge.
4. Spreadsheet	8	12	i. Basic Knowledge of Spreadsheet Processing, their usage, details of Spreadsheet screen. ii. Opening, saving and printing a Spreadsheet. iii. Spreadsheet creation, inserting and editing data in cells, sorting and filtering of data. iv. Inserting and deleting rows /columns. v. Applying basic formulas and functions. vi. Preparing chart to represent the information in a pictorial form.
5. Presentation	6	9	i. Basic Knowledge of PowerPoint presentations. ii. Opening/saving a presentation and printing of slides and handouts. iii. Manipulating slides to enhance the look of the slides as well as whole presentation by inserting a picture, objects, multimedia formatting etc. iv. Running a slide show with various transitions.
6. Introduction to Internet and WWW	6	9	i. Gather knowledge of various types of networks and topologies ii. Get an overview of Internet, its applications and various

			browsers available to access the Internet. iii. Connect to Internet using various modes of connections/devices available. iv. Get knowledge of device identification on local network as well as on Internet for both Desktop and Mobile Devices. v. Can search Information on the Internet on various topics. vi. Download and print web pages.
7. E-mail, Social Networking and e-Governance Services	6	9	i. Create an email account, compose an email, reply an email and send the email along with attachments ii. Get familiar with Social Networking, Instant Messaging and Blogs. iii. Get familiar with e-Governance Services, e-Commerce and Mobile Apps.
8. Digital Financial Tools and Applications	4	6	i. Know the Digital Financial Tools. ii. Get Knowledge of Internet Banking Modes. iii. Get familiar with e-Governance Services, e-Commerce and Mobile Apps. iv. Use the Digital Locker and will be able to store documents in Digital Locker.
9. Overview of FutureSkills & Cyber Security	4	6	i. Latest trends and technologies in upcoming fields in IECT.

			ii. Need of Cyber Security and will be able to secure their PC and Mobile devices by using basic security features.

2.1.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction to Computer, Introduction to Operating System	10
2. Word Processing	20
3. Spreadsheet	20
4. Presentation	20
5. Introduction to Internet and WWW, E-mail, Social Networking and e-Governance Services	20
6. Digital Financial Tools and Applications, Overview of FutureSkills & Cyber Security	10
7. Total	100

2.1.6.Detailed Syllabus

(i) Introduction to Computer

Computer and Latest IT gadgets, Evolution of Computers & its applications, IT gadgets and their applications, Basics of Hardware and Software, Central Processing Unit, Input devices, Output devices, Computer Memory & storage, Application Software, Systems Software, Utility Software, Open source and Proprietary Software, Mobile Apps.

(ii) Introduction to Operating System

Operating System, Basics of Operating system, Operating Systems for Desktop and Laptop, Operating Systems for Mobile Phone and Tablets, User Interface for Desktop and Laptop, Task Bar, Icons & shortcuts, Running an Application, Operating System Simple Setting, Using Mouse and Changing its Properties, Changing System Date and Time, Changing Display Properties, To Add or Remove Program and Features, Adding, Removing & Sharing Printers, File and Folder Management, Types of file Extensions.

(iii) Word Processing

Word Processing Basics, Opening Word Processing Package, Title Bar, Menu Bar, Toolbars & Sidebar, Creating a New Document, Opening and Closing Documents, Opening Documents, Save and Save As, Closing Document, Using The Help, Page Setup, Page Layout, Borders, Watermark, Print Preview, Printing of Documents, PDF file and Saving a Document as PDF file, Text Creation and manipulation, Document Creation, Editing Text, Text Selection, Cut, Copy and Paste, Font, Color, Style and Size selection, Alignment of Text, Undo & Redo, AutoCorrect, Spelling & Grammar, Find and Replace, Formatting the Text, Creating and using user defined Styles, Paragraph Indentation, Bullets and Numbering, Change case, Header & Footer, Table Manipulation, Insert & Draw Table, Changing cell width and height, Alignment of Text in cell, Delete / Insertion of Row, Column and Merging & Splitting of Cells, Border and Shading, Mail Merge, Table of Contents, Indexes, Adding Comments, Tracking changes, Macros

(iv) Spreadsheet

Elements of Spread Sheet, Creating of Spread Sheet, Concept of Cell Address [Row and Column] and selecting a Cell, Entering Data [text, number, date] in Cells, Page Setup, Printing of Sheet, Saving Spreadsheet, Opening and Closing, Manipulation of Cells & Sheet, Modifying / Editing Cell Content , Formatting Cell (Font, Alignment, Style), Cut, Copy, Paste & Paste Special, Changing Cell Height and Width, Inserting and Deleting Rows, Column, AutoFill, Sorting & Filtering, Freezing panes, Formulas, Functions and Charts, Using Formulas for Numbers (Addition, Subtraction, Multiplication & Division), AutoSum, Functions (Sum, Count, MAX, MIN, AVERAGE),Sort, Filter, Advanced Filter, Database Functions (DSUM, DMIN,DMAX, DCOUNT, DCOUNTA), What-if Analysis, Pivot table Charts (Bar, Column, Pie, Line), Data Validation.

(v) Presentation

Creation of Presentation, Creating a Presentation Using a Template, Creating a Blank Presentation, Inserting & Editing Text on Slides, Inserting and Deleting Slides in a Presentation, Saving a Presentation, Manipulating Slides, Inserting Table , Adding ClipArt Pictures, Inserting Other Objects, Resizing and Scaling an Object, Creating & using Master Slide, Presentation of Slides , Choosing a Set Up for Presentation, Running a Slide Show, Transition and Slide Timings, Automating a Slide Show, Providing Aesthetics to Slides & Printing, Enhancing Text Presentation, Working with Color and Line Style, Adding Movie and Sound, Adding Headers, Footers and Notes, Printing Slides and Handouts

(vi) Introduction to Internet and WWW

Basic of Computer Networks, Local Area Network (LAN), Wide Area Network (WAN), Network Topology , Internet, Concept of Internet & WWW, Applications of Internet, Website Address and URL, Introduction to IP Address, ISP and Role of ISP, Internet Protocol, Modes of Connecting Internet (HotSpot, Wifi, LAN Cable, Broad Band, USB Tethering), Identifying and uses of IP/MAC/IMEI of various devices, Popular Web Browsers (Internet Explorer/Edge, Chrome, Mozilla Firefox,

Opera etc.), Exploring the Internet , Surfing the web, Popular Search Engines, Searching on Internet, Downloading Web Pages, Printing Web Pages

(vii) E-mail, Social Networking and e-Governance Services

Structure of E-mail, Using E-mails, Opening Email account, Mailbox: Inbox and Outbox, Creating and Sending a new E-mail, Replying to an E-mail message, Forwarding an E-mail message, Searching emails, Attaching files with email, Email Signature, Social Networking & e-Commerce, Facebook, Twitter, Linkedin, Instagram, Instant Messaging (Whatsapp, Facebook Messenger, Telegram), Introduction to Blogs, Basics of E-commerce, Netiquettes, Overview of e-Governance Services like Railway Reservation, Passport, eHospital [ORS], Accessing e-Governance Services on Mobile Using "UMANG APP", Digital Locker

(viii) Digital Financial Tools and Applications

Digital Financial Tools, Understanding OTP [One Time Password]and QR [Quick Response] Code, UPI [Unified Payment Interface], AEPS [Aadhaar Enabled Payment System], USSD[Unstructured Supplementary Service Data], Card [Credit / Debit], eWallet, PoS [Point of Sale], Internet Banking, National Electronic Fund Transfer (NEFT), Real Time Gross Settlement (RTGS), Immediate Payment Service (IMPS), Online Bill Payment

(ix) Overview of Futureskills and Cyber Security

Introduction to Internet of Things (IoT), Big Data Analytics, Cloud Computing, Virtual Reality, Artificial Intelligence, Social & Mobile, Blockchain Technology, 3D Printing/ Additive Manufacturing, Robotics Process Automation, Cyber Security, Need of Cyber Security, Securing PC, Securing Smart Phone

2.1.7.Recommended Books/Study Material

1. LibreOffce, Getting Started Guide by LibreOffice Documentation Team
2. Microsoft Office for Dummies by Wallace Wang
3. Mastering MS Office by Bittu Kumar, V & S Publisher
4. Mastering Office 2016 by Lalit Mali, Notion Press
5. Computer Networking by Tittel Ed, McGRaw Hills Companies
6. OpenOffice.org for DUMMIES by Gurdy Leete, Ellen Finkelstein and Mary Leete

2.2. Module: A2-R5-Web Designing & Publishing

2.2.1.Introduction to Module

This module is designed to start web designing, irrespective of knowledge currently the students have in this area. The businesses, nowadays, are heavily relying on web based applications. The purpose of this module is to provide skill to students in designing layouts of web sites. By the end of this module, students will be able to describe the structure and functionality of the World Wide Web, create web pages using a combination of HTML, CSS, and JavaScript and Angular js. The students will also learn how to design and integrate multimedia objects in web site. Further, the student will learn how web sites are published.

2.2.2.Objective

After completing the module, the incumbent will be able to:

i. Design and create effective web pages
ii. Integrate graphics in web pages
iii. Integrate various tools and techniques like HTML, CSS, JavaScript etc.
iv. Design and edit images using tools
v. Embed the images in web pages

2.2.3.Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.2.4.Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives(Learner will learn after completion of unit)
1. Introduction to Web Design	2	3	i. Know the types of web site. ii. Know the role of front end and back end application. iii. Understand the concept of client side scripting and server side scripting

2. Editors	2	3	i. Use different editors available for writing code. ii. Understand working of editors.
3. HTML Basics	10	15	i. Develop static website using different HTML Controls.
4. Cascading Style Sheets (CSS)	10	15	ii. Purpose of CSS. iii. Role of CSS in web sites. iv. Roles of effects in Web site.
5. CSS Framework	6	9	i. Use CSS Framework to develop web site effectively.
6. JavaScript and Angular Js	10	15	i. Apply client side scripting. ii. Adding validations and checks on forms (web pages).
7. Photo Editor	6	9	i. Edit images and embed in web pages.
8. Web Publishing and Browsing	2	3	i. Publish the web sites.

2.2.5.Marks Distribution

Module Unit	Written Marks (Max.)
1 Introduction to Web Design and Editors, HTML Basics	25
2 Cascading Style Sheets (CSS)	20
3 CSS Framework	15
4 JavaScript and Angular Js	20
5 Photo Editor, Web Publishing and Browsing	20

6 Total	100

2.2.6.Detailed Syllabus

(i) Introduction to Web Design

Introduction of Internet, WWW, Website, Working of Websites, Web pages, Front End, Back End, Client and Server Scripting Languages, Responsive Web Designing, Types of Websites (Static and Dynamic Websites).

(ii)Editors

Downloading free Editors like Notepad++, Sublime Text Editor, Making use of Editors, File creation and editing, saving.

(iii)HTML Basics

HTML: Introduction, Basic Structure of HTML, Head Section and Elements of Head Section, Formatting Tags: Bold, Italic, Underline, Strikethrough, Div, Pre Tag Anchor links and Named Anchors Image Tag, Paragraphs, Comments, Tables: Attributes –(Border, Cellpadding, Cell spacing , height , width), TR, TH, TD, Rowspan, Colspan Lists : Ordered List , Unordered List , Definition List, Forms, Form Elements, Input types, Input Attributes, Text Input Text Area, Dropdown, Radio buttons , Check boxes, Submit and Reset Buttons Frames: Frameset, nested Frames.

HTML 5 Introduction, HTML5 New Elements: Section, Nav, Article, Aside, Audio Tag, Video Tag, HTML5 Form Validations: Require Attribute, Pattern Attribute, Autofocus Attribute, email, number type, date type , Range type, HTML embed multimedia, HTML Layout, HTML Iframe

(iv) CSS

Introduction to CSS, Types of CSS, CSS Selectors : Universal Selector ,ID selector, Tag Selector, Class Selector, Sub Selector, Attribute Selector, Group Selector, CSS Properties: Back Ground properties, Block Properties, Box properties, List properties, Border Properties, Positioning Properties, CSS Lists CSS Tables, CSS Menu Design CSS Image Gallery,

(v)CSS Framework

Web Site Development using W3.CSS Framework, W3.CSS Intro, W3.CSS Colors, W3.CSS Containers, W3.CSS Panels, W3.CSSBorders, W3.CSSFonts, W3.CSS Text, W3.CSS Tables, W3.CSS List, W3.CSSImages, W3.CSS Grid

(vi) JavaScript and Angular Js

Introduction to Client Side Scripting Language, Variables in Java Script, Operators in JS, Conditions Statements, JS Popup Boxes, JS Events, Basic Form Validations in JavaScript. Introduction to Angular JS: Expressions, Modules and Directives.

(vii) Photo Editor

Features of Photo Editing: Tools: Selection Tools, Paint Tools, Transform Tools, Text Tool, Layers, Brightness/ Contrast, Improve Colors and tone, Filters.

(viii) Web Publishing and Browsing

Overview, SGML (Standard Generalized Markup Language), Web hosting Basics, Documents Interchange Standards, Components of Web Publishing, Document management, Web Page Design Considerations and Principles, Search and Meta Search Engines, WWW, Browser, HTTP, Publishing Tools.

2.2.7.Recommended Books/Study Material

1. HTML5, Black Book, Kagent Learning Solution Inc, 2014
2. Mastering HTML, CSS &JavaScript Web Publishing by Lemay Laura, BPB publications
3. HTML & CSS: The Complete Reference by Thomas Powell
4. Web Design, McGraw -hill

2.3. Module: A3-R5-Programming and Problem Solving though Python Language

2.3.1.Introduction to Module

Python is easy to use, powerful and versatile programming language, making it a great choice for developers. Python is used widely in different areas likes building Raspberry Pi applications, writing script program for desktop applications, configuring servers, developing machine learning & data analytics applications and developing web applications.

2.3.2.Objectives

The objectives of this module are to make the learners understand the programming language concepts like Data Types, Loops, Functions; Python Lists, Strings, Tuples, Dictionaries, Elementary Data Handling using Pandas, NumPy etc.

After completion of this course, the learner is expected to analyze the real-life problem and write a program in Python to solve the problem. The main emphasis of the module will be on writing algorithm to solve problems and implement in Python. After completion of the module, the learner will be able to

i. Draw flow charts for solving different problems
ii. Develop efficient algorithms for solving a problem
iii. Use the various constructs of Python viz. conditional, iteration
iv. Write programs making judicious use of Lists, Strings, Tuples, Dictionaries wherever required
v. Manage data using NumPy
vi. Handle files and create Modules in Python

2.3.3.Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.3.4.Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives(Learner will learn after completion of unit)
1. Introduction to Programming	2	3	i. Understand the concept of Programming. ii. Understand evolution of Programming.

2. Algorithm and Flowcharts to solve problems	6	9	i. Understand the concepts and purposes of algorithm and flowchart. ii. Use algorithm and flowchart to solve problem independent of language. iii. Gain knowledge of different constructs of algorithm and flowchart.
3. Introduction to Python	2	3	i. Understand features of Python that make it one the most popular languages in the industry. ii. Understand structure of Python problem. iii. Understand the areas where Python is used.
4. Operators, Expressions and Python Statements	10	15	iv. Use the basic operators and expressions available in Python in developing program. v. Understand and use various Python statements like conditional constructs, looping constructs in writing Python program.
5. Sequence data types	6	9	i. Work with various built-in Sequence datatypes and their use ii. Understand the concept of mutable and immutable objects
6. Functions	10	15	i. Apply the in-built functions available in Python in solving different problems.

			ii. Work with modular approach using user defined functions.
7. File Processing	6	9	i. Work with files and reading /writing onto files.
8. Modules	2	3	i. Understand the concept of modules and importing, loading and reloading of modules in programs.
9. NumPy Basics	4	6	ii. Work on NumPy array manipulation to access data and sub-arrays and to split, reshape, join arrays etc
Total	48	72	

2.3.5.Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction to Programming, Algorithm and Flowcharts to solve problems	20
2. Introduction to Python, Operators, Expressions and Python Statements, Sequence data types	30
3. Functions, File Processing, Modules	40
4. NumPy Basics	10
5. Total	100

2.3.6.Detailed Syllabus

(i) Introduction to Programming

The basic Model of computation, algorithms, flowcharts, Programming Languages, compilation, testing &debugging and documentation.

(ii)Algorithms and Flowcharts to Solve Problems

Flow Chart Symbols, Basic algorithms/flowcharts for sequential processing, decision-based processing and iterative processing. Some examples like:

Exchanging values of two variables, summation of a set of numbers, Decimal Base to Binary Base conversion, Reversing digits of an integer, GCD (Greatest Common Division) of two numbers, Test whether a number is prime, factorial computation, Fibonacci sequence, Evaluate 'sin x' as sum of a series, Reverse order of elements of an array, Find largest number in an array, Print elements of upper triangular matrix, etc.

(iii) Introduction to Python

Python Introduction, Technical Strength of Python, Introduction to Python Interpreter and program execution, Using Comments, Literals, Constants, Python's Built-in Data types, Numbers (Integers, Floats, Complex Numbers, Real, Sets), Strings (Slicing, Indexing, Concatenation, other operations on Strings), Accepting input from Console, printing statements, Simple 'Python' programs.

(iv) Operators, Expressions and Python Statements

Assignment statement, expressions, Arithmetic, Relational, Logical, Bitwise operators and their precedence, Conditional statements: if, if-else, if-elif-else; simple programs, Notion of iterative computation and control flow –range function, While Statement, For loop, break statement, Continue Statement, Pass statement, else, assert.

(v) Sequence Data Types

Lists, tuples and dictionary, (Slicing, Indexing, Concatenation, other operations on Sequence data type), concept of mutability, Examples to include finding the maximum, minimum, mean; linear search on list/tuple of numbers, and counting the frequency of elements in a list using a dictionary.

(vi) Functions

Top-down approach of problem solving, Modular programming and functions, Function parameters, Local variables, the Return statement, DocStrings, global statement, Default argument values, keyword arguments, VarArgs parameters.

Library function-input(), eval(),print(), String Functions: count(), find(), rfind(), capitalize(), title(), lower(), upper(), swapcase(), islower(), isupper(), istitle(), replace(), strip(), lstrip(), rstrip(), aplit(), partition(), join(), isspace(), isalpha(), isdigit(), isalnum(), startswith(), endswith(), encode(), decode(), String: Slicing, Membership, Pattern Matching, Numeric Functions: eval(), max(), min(), pow(), round(), int(), random(), ceil(), floor(), sqrt(), Date & Time Functions, Recursion.

(vii) File Processing

Concept of Files, File opening in various modes and closing of a file, Reading from a file, Writing onto a file, File functions-open(), close(), read(), readline(), readlines(),write(), writelines(), tell(),seek(), Command Line arguments.

(viii) Scope and Modules

Scope of objects and Names, LEGB Rule Module Basics, Module Files as Namespaces, Import Model, Reloading Modules.

(ix) NumPy Basics

Introduction to NumPy, ndarray, datatypes, array attributes, array creation routines, Array From Existing Data, Array From Numerical Ranges, Indexing & Slicing.

2.3.7.Recommended Books/Study Material

1. Python Programming- A modular Approach (with Graphics, database, Mobil and Web Applications by Sheetal Taneja and Naveen Kumar, Pearson.
2. Python Network Programming Cookbook by Pradeeban Kathiravelu, Dr. M. O. Faruque Sarkar, PACKT.
3. Head First Python by Paul Berry, O'Reilly
4. Dive into Python by Mark Pilgrim, APress
5. Beginning Programming with Python Dummies by John Paul Meuller.

2.4. Module: A4-R5- Introduction to Internet of Things(IoT) and its Applications

2.4.1.Introduction

The module is designed to equip the students to understand the basics of connected world that is Internet of Things (IoT) and its applications. IoT primarily refers to the connected and smarter world having physical and virtual objects with some unique identities. IoT applications spans across domains of industrial control, retail, energy, agriculture, etc.

This module provides the theoretical and practical aspects of interfacing sensors and actuators, making informed world of Things speaking to each other. The different type of communication modes and models are discussed in detail. The in-depth knowledge of software and packages is provided to make applications in IoT paradigm.

2.4.2.Objective

After completing the module, the incumbent will be able to:

i. Understand how connected devices work together to update other applications.

ii. Acquire knowledge to interface sensors and actuator with microcontroller-based Arduino platform.

iii. Writing C programs in Arduino IDE.

iv. Understand the Communication between microcontroller and PC using serial communication.

v. Build IoT based applications and understand how data flows between things.

vi. Understand how electronic devices control electrical appliances working at 220v AC.

vii. Understand security aspect of IoT devices.

viii. Enhance skill set towards better personality development.

2.4.3.Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.4.4.Outline of Module

Module Unit	Duration(Theory) in Hours	Duration (Practical) in Hours	Learning Objectives(Learner will learn after completion of unit)
1. Introduction to IoT – Applications/Devices, ProtocolsandCo	4	6	i. Understand various IoT Applications, protocols, architecture, etc.

mmunication Model			ii. Understand the characteristics of IoT devices. iii. Know about Physical Design/Logical Design, Functional blocks of IoT and Communication Models.
2. Things and Connections	4	6	i. Closed loop/ feedback loop system. ii. The use of sensors, actuators and controllers in the IoT process flow. iii. TCP/IP Versus OSI models. iv. Wired and wireless connectivity.
3. Sensors, Actuators and Microcontrollers	8	12	i. The role of Sensors, transducers in measuring physical quantities. ii. Working and characteristics of actuators. iii. Role and use of microcontroller in building various electronic devices.
4. Building IoT Applications	20	30	i. Working of microcontroller and hardware prototyping Arduino platform. ii. The role of 'C' language in building IoT applications. iii. Built-in Data-type, operators-expressions iv. Conditional statements and loops. v. Arrays, functions. vi. Digital, analog pins of Arduino. vii. Interfacing sensors, actuator.

			viii. Using Ardublock GUI tool.
5. Security and Future of IoT Ecosystem	4	6	i. Need of security in IoT. ii. Various basic concept of security. iii. Security levels. iv. Need of powerful CPU for Future IoT eco system.
6. Soft skills-Personality Development	8	12	i. Role of positive personality and determinants of personality. ii. Self-esteem. iii. Communication and writing skills.

2.4.5.Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction to IoT – Applications/Devices, Protocols andCommunication Model	10
2. Things and Connections	10
3. Sensors, Actuators and Microcontrollers	15
4. Building IoT Applications	40
5. Security and Future of IoT Ecosystem	5
6. Soft skills-Personality Development	20
7. Total	100

2.4.6.Detailed Syllabus

(i) Introduction to Internet of Things – Applications/Devices, Protocols andCommunication Model

Introduction - Overview of Internet of Things(IoT), the characteristics of devices and applications in IoT ecosystem, building blocks of IoT, Various technologies making up IoT ecosystem, IoT levels, IoT design methodology, The Physical

Design/Logical Design of IoT, Functional blocks of IoT and Communication Models.

(ii) Things and Connections

Working of Controlled Systems, Real-time systems with feedback loop e.g. thermostat in refrigrator, AC, etc.Connectivity models – TCPIP versus OSI model, different type of modes using wired and wireless methodology, The process flow of an IoT application.

(iii) Sensors, Actuators and Microcontrollers

Sensor - Measuring physical quantities in digital world e.g. light sensor, moisture sensor, temperature sensor, etc.

Actuator – moving or controlling system e.g. DC motor, different type of actuators

Controller – Role of microcontroller as gateway to interfacing sensors and actuators, microcontroller vs microprocessor, different type of microcontrollers in embedded ecosystem.

(iv) Building IoT applications

Introduction to Arduino IDE – writing code in sketch, compiling-debugging, uploading the file to Arduino board, role of serial monitor.

Embedded 'C' Language basics - Variables and Identifiers, Built-in Data Types, Arithmetic operators and Expressions, Constants and Literals, assignment.

Conditional Statements and Loops - Decision making using Relational Operators, Logical Connectives - conditions, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement.

Arrays – Declaring and manipulating single dimension arrays

Functions - Standard Library of C functions in Arduino IDE, Prototype of a function: Formal parameter list, Return Type, Function call.

Interfacing sensors – The working of digital versus analog pins in Arduino platform, interfacing LED, Button, Sensors-DHT, LDR, MQ135. Display the data on Liquid Crystal Display (LCD), interfacing keypad

Serial communication – interfacing HC-05(Bluetooth module)

Control/handle 220v AC supply – interfacing relay module.

(v) Security and Future of IoT Ecosystem

Need of security in IoT - Why Security? Privacy for IoT enabled devices- IoT security for consumer devices- Security levels, protecting IoT devices

Future IoT eco system - Need of power full core for building secure algorithms, Examples for new trends - AI, ML penetration to IoT

(vi) Soft skills-Personality Development

Personality Development - Determinants of Personality- self-awareness, motivation, self-discipline, etc., building a positive personality, gestures.

Self-esteem - self-efficacy, self-motivation, time management, stress management, Etiquettes & manners.

Communication and writing skills- objective, attributes and categories of communication, Writing Skills – Resume, Letters, Report, Presentation, etc. Interview skills and body language.

2.4.7. Use-case for building IoT based Applications

A. Using Arduino and sensors/actuators

i. Interfacing Light Emitting Diode(LED)- Blinking LED :

This use case will be used for familiarizing the GPIO peripheral of atmega micro controller. The LED will be used as a device and GPIO will work as output mode.

ii. Interfacing Button and LED – LED blinking/glow when button is pressed

This use case will help to understand the GPIO in two different modes, Input - Button and LED - output mode.

iii. Interfacing Light Dependent Resistor (LDR) and LED, displaying automatic night lamp

This use case will help to understand ADC peripheral and how to read analog data from sensors.

iv. Interfacing Temperature Sensor (LM35) and/or humidity sensor (e.g. DHT11)

This use case will help to connect traditional environmental monitoring sensors (Temperature and humidity) to the Arduino development board. Also use the suitable libraries for implementing these case studies.

v. Interfacing Liquid Crystal Display (LCD) – display data generated by sensor on LCD

This case study will demonstrate how to provide local display unit with Arduino micro controller. Use suitable libraries for implementing these case studies.

vi. Interfacing Air Quality Sensor-pollution (e.g. MQ135) - display data on LCD, switch on LED when data sensed is higher than specified value.

This use case will help to understand how to use traditional smart pollution management sensors with Arduino platform for developing applications as a part of smart city projects.

vii. Interfacing Bluetooth module (e.g. HC05)- receiving data from mobile phone on Arduino and display on LCD

This use case will help to understand the connectivity solution to Arduino to a gadget like mobile phone. Bluetooth is used as connectivity solution in this application.

viii. Interfacing Relay module to demonstrate Bluetooth based home automation application. (using Bluetooth and relay).

This use case will enable the IoT node capability of Arduino development boards by integrating actuator (relay connected to GPIO) to Arduino board and remote connectivity (Using Bluetooth) using a mobile phone with the help of a readily available Bluetooth serial application.

2.4.8.Recommended Books/Study Material

1. Macro Schwartz, "Internet of Things with Arduino- Cookbook", Packt 2016
2. Arshdeep Bajga and Vijay Madisetti, "Internet of Things- A Hands-on Approach" Universities Press, 2014
3. Massimo Banzi, "Getting started with Arduino", 2nd Edition, Oreilly, 2011 [Make:Makezine.com]
4. Macro Schwartz, "Internet of Things with Arduino", Open Home Automation
5. Michael Margolis, "Arduino Cookbook", Oreilly, 2011

2.5. Module: A5-R5- Data Structure Through Object Oriented Programming Language

2.5.1.Introduction

Good knowledge of data structures and algorithms is the foundation of writing good code. Having good knowledge of essential Data structures like array, string, linked list, stack, queue, tree, graph etc makes one understand when to use which Data Structure and accordingly reduce the space and time complexity of the algorithm. Using the right data structure can drastically improve the performance of an algorithm.

In depth understanding of Data Structures, enables one to understand how computer gets things done. Everything from memory allocation in the depths of operating system, to the inner workings of an RDBMS, to how networking stack manages to send data from one place to another, all computers rely on fundamental data structures and algorithms, so understanding them better makes one understand the computer better.

In this course, the Data Structures and algorithms have been implemented using Object Oriented Approach with C++.Object-oriented programming (OOP) is a programming language model in which programs are organized around data, or objects, rather than functions and logic. An object can be defined as a data field that has unique attributes and behaviour. OOP approach enables a programmer to deal with real world entities. This opposes the historical approach to programming where emphasis was placed on how the logic was written rather than how to define the data within the logic.

2.5.2.Objective

The course is designed to impart knowledge and develop skills required to solve real world problems using Object Oriented Approach, Python constructs. The focus will also be on fundamentals of Data Structures, Abstract concepts and how these are useful in problem solving.

After completing the module, the student will be able to understand:

i. Basics of Object-oriented Programming

ii. Understand the OOP concepts- Abstraction, Objects, Classes, Polymorphism, Inheritance

iii. Implementation of Object-Oriented concepts using C++ classes

iv. Analyze step by step and develop algorithms to solve real world problems

v. Implementation of Data Structures like Linked List, Stack, queue, Trees, Graphs

vi. Sorting and Searching Techniques with focus on space and time complexity of algorithms

2.5.3.Duration

120 Hours - (Theory: 48hrs + Practical: 72 hrs)

2.5.4.Outline of Module

Module Unit	Duration(Theory) in Hours	Duration (Practical/ Tutorial) in Hours	Learning Objectives(Learner will learn after completion of unit)
1. Object Oriented Concepts	2	3	i. Have an understanding of Basic concepts of Object-Oriented approach of programming and how it is different from traditional procedural approach
2. Bsics of C++ and C++ classes nd Objects	10	15	i. Basics of C++, Data types, Operators,control structures, arrays, pointers, Functions, Basic input/output and will be able to solve simple problems in C++ ii. Use of C++ language to create classes and objects iii. Implementation of all OOPs concepts-Polymorphism, Data Abstraction, Inheritance iv. Understand the concept of Operator Overloading
3. Analysis of Algorithm	2	3	i. Analysis of various algorithms in terms of space and time complexity ii. Concept of Big- O notation.
4. Searchin and Sorting	8	12	iii. Various Searching techniques and their

			comparison in terms of time complexity iv. Various sorting techniques and their comparison in terms of time complexity
5. Elementary Data Types- Arrays, Linked Lists and Types	8	12	i. Implementation of 1-D and 2-D arrays and various operations to be performed on arrays ii. Creation of new structures like- Linked list, double Link List, Circular Link List and all the operations related to same
6. Stacks and Queues	6	9	i. Implementation of stacks and queues ii. Understand the use of the two data structures.
7. Trees	8	12	i. Nonlinear Data Structure-trees and different modes of traversals ii. Implement different types of trees-BST, Threaded Binary Tree, B tree and practical use of the same
8. Graphs	4	6	i. The concept of Graph and its implementation through Adjacency Matrix and various traversal techniques of graphs

2.5.5.Marks Distribution

Module Unit	Written Marks (Max.)
1. Object Oriented Concepts	5
2. Basics of C++, classes and objects	20
3. Analysis of algorithms	8
4. Sorting and Searching	12
5. Elementary Data Structures- Arrays, Linked Lists	15
6. Stack and Queue	15
7. Trees	15
8. Graphs	10
Total	100

2.5.6.Detailed Syllabus

(i) Object Oriented Concepts

Object Oriented Programming- a new paradigm, Abstraction, forms of Abstraction, OOP concepts- Classes, Objects, Polymorphism, Data Encapsulation, Data Hiding, Inheritance,

(ii)Basics of C++, Classes and Objects

Features of C++, Tokens, keywords, Data types, Operators, Manipulators, Console input, output, Control statements (conditional and loops), Functions, Classes, Instantiation, Destructor, constructor, Polymorphism - Operator Overloading, Function Overloading, Inheritance-Single, Multiple, Multilevel, Pointers

(iii) Analysis of Algorithm

Introduction to algorithm design and Data structures, Comparison of Algorithms, Complexity in terms of space and time, Calculation of O- notation. Abstract Data type and its implementation with a Rational number example

(iv) Searching and Sorting

Searching- Linear and Binary Search, Sorting- Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Comparison of various searching and sorting techniques in terms of time complexity

(v) Elementary Data Structures: Arrays, Linked Lists

Representation of arrays-single and multidimensional, Address calculation using row major ordering, Various operations on arrays, Linked Lists-Singly Linked List, Double linked List, Circular Linked List- traversing, deleting, inserting, searching, counting, reversing, printing of nodes.

(vi) Stacks and Queues

Stack ADT, Implementation of stack using array and linked list, Application of Stack- Evaluation of postfix/prefix expression, Queue ADT, Implementation of queue using Array and Linked List

(vii) Trees

Definition and notations, Binary Search Trees Implementation. Traversals using stacks and recursion - In-order, post-order, pre-order techniques, Threaded binary tree, B-trees with implementation of 2-3 trees.

(viii) Graphs

Definition and notations, Components of Graphs, Types of Graphs, Graph Implementation using Adjacency Matrix and Adjacency List algorithms and programs, Graph Traversal Methods: Depth First Search and Breadth First Search.

2.5.7.Reference Books/Study Material

1. Object Oriented Programming with C++ by Robert Lafore
2. Object Oriented Programming with C++ by E Balaguruswamy
3. Data Structures through C++ by Yashwant Kanetkar
4. Schaum's Outlines Data Structures Seymour Lipschutz

2.6. Module: A6-R5-Computer Organization and Operating System

2.6.1.Introduction

Operating System is an intermediate software layer between user and computer hardware. The program which is executed on computer requires difference resources like memory, hardware, CPU etc. On the other hand, computer consists of various blocks memory, ALU, control unit, input/output devices and other peripherals. This module provides information on both the topics, Computer Organization and Operating System. The functions of Operating System help user to interact with all components of computers.

2.6.2.Objective

The objectives of this module are:

i. To have a thorough understanding of the basic structure and operation of a digital computer.

ii. To discuss in detail the operation of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point addition, subtraction, multiplication & division.

iii. To study the communication with I/O devices and standard I/O interfaces.

iv. To study the hierarchal memory system including cache memories and virtual memory.

v. To gain knowledge of functions of operating system like memory management, scheduling, file system and interface, distributed systems, security and deadlocks.

vi. To understand how an Operating System handles multiple processes.

2.6.3.Duration

120 Hours - (Theory: 70 hrs + Practical: 50 hrs)

2.6.4.Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. Basic Structure of Computers	6	9	i. Get familiar with various components of a computer and their function. ii. Get familiar with Von Neumann Architecture.

2. Computer Arithmetic Operations	10	15	i. Well acquainted with logic gates and Boolean algebra. ii. Get familiar with representation of fixed and floating-point numbers in system iii. Get familiar with binary arithmetic.
3. Central Processing Unit and Instructions	10	15	i. General registers ii. Types of instructions iii. Addressing modes iv. PCB.
4. Memory Organization	8	12	i. Primary memory, Secondary memory, Cache memory, Virtual memory ii. RAID
5. I/O Organization	6	9	i. peripheral devices, ii. Data transfer modes iii. Interrupt handling iv. DMA
6. Operating Systems Overview	3	3	i. Gather knowledge of various types of operating systems ii. Get an overview of various functions performed by OS iii. Get an overview about kernel and shell iv. Get an overview of system calls
7. Linux Basics	8	12	i. Use Linux operating system ii. Get familiar with basic Linux shell commands like who, whoami, echo, date

			iii. Get familiar with navigating manual pages and getting help for a command. iv. List contents of a directory v. Create and remove files and directories. vi. Check Inode no of a file vii. Copy or move files or directories viii. Work with large text files using commands like more, less, head, tail, cut ix. Search text within a file using grep command
8. Process Management and Shell Script	10	15	i. Get familiar with process and its states ii. Know about Inode structure iii. Know the various scheduling techniques iv. Start a task in background and move it to foreground v. Write shell scripts.
9. Users, Groups and Permissions	4	6	i. View security permissions of a file ii. Create a new user or group iii. Modify existing user iv. Modify the ownership of a file. v. Modify the permission of a file vi. Monitor the logins
10. Standard I/O and Pipes	3	9	i. to redirect output to a file ii. to redirect input from a file

			iii. take the output of one command and send it into another command as input
11. Finding and processing files	2	3	i. locate files based on various criteria such as filename, size, date, type and permission

2.6.5.Marks Distribution

Module Unit	Written Marks (Max.)
1. Basic Structure of Computers	5
2. Computer Arithmetic Operations	10
3. Central Processing Unit and Instructions	8
4. Memory Organization	8
5. I/O Organization	9
6. Operating Systems Overview	8
7. Linux Basics	16
8. Process Management and Shell Script	13
9. Users, Groups and Permissions	10
10. Standard I/O and Pipes	8
11. Finding and processing files	5
Total	100

2.6.6.Detailed Syllabus

Part 1 – Computer Organization

(i) Basic Structure of Computers

Structure of a Computer System, Arithmetic Logic Unit, Control Unit, Bus Structure, Von Neumann Architecture.

(ii) Computer Arithmetic Operations

Introduction to logic gates, Boolean algebra, Data Representation-Number system, Fixed and Floating point numbers, Floating point representation, Signed numbers, Binary Arithmetic, 1's and 2's Complements Arithmetic, Binary adder, 2's Complement method for multiplication, Map Simplification.

(iii) Central Processing Unit and Instructions:

General Register Organization, Types of Instructions, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Instruction cycle.

(iv) Memory Organization:

Characteristics of Memory Systems, Type of memories, Main memory, Static & Dynamic memories, Secondary Memory, Performance Considerations, Cache Memory with mapping, Virtual Memory, Address memory used pages, page replacement, Introduction to RAID.

(v) I/O Organization

Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Interrupt handling, Types of Interrupts, Priority Interrupt, Direct Memory Access, Input-Output Processor (IOP), Synchronous and Asynchronous Data Transfer.

Part 2 – Operating System

(vi) Operating Systems Overview:

Overview of Computer Operating Systems, Types of OS, Functions of OS, Protection and Security, Distributed Operating Systems, System Calls, Scheduling algorithms, memory management, threads.

(vii) Linux Basics

Open source, Overview of Linux, Basic Linux commands, structure of kernel and shell, Getting help, Linux File System, Some Important Directories, Inodes, Current Working Directory, File and Directory Names, Absolute and Relative Pathnames, Creating and Removing Directories, Changing Directories, Listing Directory Contents, Creating and Removing Files, Copying Files and Directories, Moving and Renaming Files and Directories, fundamental file types, Hard Links, Symbolic (or soft) Links, Viewing and working with large Text files – cat, more, less, head, tail, cut commands, search text within a file, grep.

(viii) Process Management and Shell Script

Processes: Definition, Process Relationship, Process states, Process State transitions, Process Control Block, Context switching – Threads – Concept of multithreads, Listing Processes, Finding Processes, Foreground and background processes, Interactive Process management tools, Sending signals to processes.

Shell Script, shell variables, control structure using variables in shell script.

(ix) Users, Groups and Permissions

Users, Groups, Linux File Security, Examining Permissions, accessing root user, creating user and groups, Changing File Ownership, Changing Permissions – Symbolic Method, Numeric Method, /etc/passwd, /etc/shadow and /etc/group files, Monitoring Logins, Default Permissions, Special Permissions umask, passwd.

(x) Standard I/O and Pipes

Standard Input and Output, Redirecting Output to a File, Redirecting STDOUT to a Program(Piping), Combining Output and Errors, Redirecting to Multiple Targets (tee), Redirecting STDIN from a file.

(xi) Finding and Processing Files

Locate, find, Basic find Examples, find and Logical Operators, find and Permissions, find and Access Times.

2.6.7.Reference Books/Study Material

1. Operating System Concepts by Peter B. Galvin, Greg Gagne and Abraham Silberschatz
2. Computer System Architecture by Morris Mano
3. Operating Systems: Internals and Design Principles by William Stallings, Peasons
4. Operating Systems: A Concept-Based Approach, by D. M. Dhamdhere, McGraw Hills
5. Computer Organization by John L. Hennessy, McGraw Hills
6. Computer Organization and Architecture by V. Rajaraman, T Radhakrishnan, PHI

2.7. Module: A7-R5-Databases Technologies

2.7.1.Introduction

Application software requires data to be stored permanently. Databases provide the facility to store data permanently. Further, databases provide functionality to maintain and retrieve data. Depending upon different types of data storage, retrieval and processing, different types of databases are required. This module is designed with view to equip learner with two types of databases, RDBMS and NoSQL databases.

2.7.2.Objective

The module is designed to equip a learner to acquire knowledge of the current trend and technologies of Databases. It provides theoretical background as well as in depth knowledge of Software/ packages. After completing the module, the incumbent will be able to:

i. Understand Database design using Normalization and E-R modelling
ii. Use Standard Query Language and its various versions.
iii. Understand importance of backup and recovery techniques.
iv. Develop Database System to handle real world problem.
v. Understand to use Maria DB
vi. Learn concept of JSON Object & NoSQL Database

2.7.3.Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.7.4.Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. An overview of DBMS	2	3	i. Identify different types of Databases ii. Difference between file-based system and database system
2. An Architecture of the Database System	4	6	i. Able to understand three tier architecture. ii. Able to understand the role of DBA

			iii. Gaining knowledge of E-R Model.
3. Relational Database Management System(RDBMS)	4	6	iv. RDBMS terminology v. Relational Model, Base tables and keys
4. Database design	8	12	i. Understand normal forms ii. E-R Diagram
5. Maria DB	8	12	i. Maria DB
6. Manipulating Data with MariaDB	10	15	i. Manipulate data using MariaDB database ii. Apply various SQL statements.
7. NoSQL Database Technologies	10	15	i. Know the difference between centralized and distributed database and NoSQL Database ii. Understand the advantages of distributed DB NoSQL Databases. iii. Get familiar with distributed data storage, transaction and query processing techniques. iv. JSON Object, Create & Access JSON Object v. Know different features of NoSQL vi. Understand NoSQL Database types vii. Get familiar with the benefits of NoSQL. viii. Differentiate between NoSQL and SQL. ix. Know different features of MongoDB

8. Selecting the Right Database	2	3	i. Select right database for different types of applications

2.7.5.Marks Distribution

Module Unit	Written Marks (Max.)
1. An Overview of the Database Management System	4
2. Architecture of Database System	6
3. Relational Database Management System(RDBMS)	6
4. Database Design	14
5. Maria DB	20
6. Manipulating Data with MariaDB	20
7. NoSQL Database Technologies	20
8. Selecting Right Database	10
9 Total	**100**

2.7.6.Detailed Syllabus

(i) An Overview of the Database Management System

What is database? Why database? Database system, database management system (DBMS), advantages of DBMS.

(ii) An Architecture of the Database system

Three levels of architecture, Logical View, Physical View, Conceptual View, Logical data independence, Physical Data Independence

(iii) Relational Database Management System (RDBMS)

Introduction, RDBMS terminology, relational model, base tables, keys, primary key, foreign key, constraints, Codd Rules

(iv) Database Design

Normalization, Normal forms-1NF, 2NF, 3NF, BCNF 4NF and 5NF, E-R Diagram. Mapping ER-diagram to database tables.

(v) Maria DB

Introduction to Maria DB, Data Types, SQL Commands, Create, insert, update, delete, drop, alter, SQL functions (String functions, date functions), indexing, key, primary key, foreign key

(vi) Manipulating Data with Maria DB

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

(vii) NoSQL Database Technology

Introduction to NoSQL Databases, Difference between relational and NoSQL databases. NoSQL features, types, advantages, Architecture of MongoDB, Documents, Collections, Dynamic Schemas, Mongo Shell, Mongo Server and Client, Data Types, Embedded Documents, Creating Configuration file for Mongo,

JSON File format for storing documents, Inserting and Saving Documents, Batch Insert, Insert Validation, Removing Documents, Updating Documents, Document Replacement, Using Modifiers, Updating Multiple Documents, Returning Updated Documents,

Introduction to Indexing, Introduction to Compound Indexes, Using Compound Indexes, Indexing Objects and Arrays, Aggregation Framework, Pipeline Operations- $match, $project, $group, $unwind, $sort, $limit, $skip, Using Pipelines, MongoDB and MapReduce, Aggregation Commands, Introduction to Replication, configuring a Replica Set, Member Configuration Options

(viii) Selecting the Right Database

Selection of right databases, RDBMS or NoSQL, selection of database based on performance, data size, type of data, frequency of accessing data, business needs, type of application.

2.7.7.Reference Books/Study Material

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2011.
2. C.J.Date, A.Kannan and S. Swamynathan,"An Introduction to Database Systems", Pearson Education
3. Emilien Kenler and Federico Razzoli, "MariaDB Essentials", Packt Publishing, 2015
4. Kristina Chodorow, "MongoDB: The Definitive Guide", 2nd Edition, O'REILLY
5. Saeed K. Rahimi and Frank S. Haug, "Distributed Database Management Systems- A Practical Approach", WILEY Publication
6. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison Wesley.
7. Alex Giamas, "Mastering MongoDB", Packt Publisher.

2.8. Module: A8-R5-Systems Analysis, Design and Testing

2.8.1.Introduction

The module is designed to equip a person to understand System Analysis and Design aspects. It provides theoretical background as well as in depth knowledge through case studies. This module covers both structured and Object-oriented techniques to analyse and design software.

2.8.2.Objective

After completing the module, the incumbent will be able to:

i. Under the need of system analysis and design in software development
ii. Understand complete life cycle of System analysis and Design
iii. Do the feasibility analysis and design of the proposed system
iv. Use various analysis and design tools and techniques
v. Get familiar with Object oriented System Design
vi. Understand the role of testing in software development

2.8.3. Duration

120 Hours - (Theory: 48 hrs + Tutorial/Tutorial/Case Studies: 72hrs)

2.8.4.Outline of Module

Module Unit	Duration(Theory) in Hours	Duration (Tutorial) in Hours	Learning Objectives(Learner will learn after completion of unit)
1. Introduction	6	12	i. Understand the concepts of system, their types ii. Understand the different stages of software development life cycle.
2. Requirement Gathering and Feasibility Analysis	8	12	i. System Requirement Specification and its design ii. Requirements of system and role of its documentation iii. Alternate solutions effectively

			iv. Conduction of feasibility analysis of the proposed system.
3. Structured Analysis	8	12	v. Tools used during in analysis of system vi. Role System Requirement Specification and its design vii. Understanding requirements of system and its documentation viii. Will be able to examine alternate solutions effectively ix. Will be able to do the feasibility analysis of the proposed system Requirement Specification and its design x. Understanding requirements of system and its documentation xi. Will be able to examine alternate solutions effectively xii. Will be able to do the feasibility analysis of the proposed system of tools in documentation. xiii. Technical Documentation of analysis.
4. Structured Designs	8	12	i. Tools used during software design ii. Writing technical design document.
5. Object Oriented Modelling Using UML	8	12	i. Design object-oriented software ii. Use of UML during documentation of object-oriented software.

6. Testing	4	6	i. Know the testing techniques available to test the developed software
7. System Implementation and Maintenance	2	3	i. Know the processes involved in deploying the software ii. Know the activities related to maintenance of the software once it is made operational.
8. Other Software Development Approaches	2	3	i. Different software development approaches

2.8.5.Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction	10
2. Requirement Gathering and Feasibility Analysis	10
3. Structured Analysis	20
4. Structured Design	20
5. Object-Oriented Modelling Using UML	20
6. Testing, System Implementation and Maintenance, Other Software Development Approaches	20
7. Total	100

2.8.6.Detailed Syllabus

(i) Introduction

System Definition and concepts, types of systems, systems user, designers, analysts, introduction to simple system development process- initiation, analysis, design, coding, testing, implementation and maintenance. Basic principles of successful

systems, Role and Need of Systems Analyst. Qualifications and responsibilities, System Analysis as a Profession.

(ii) Requirement Gathering and Feasibility Analysis

System requirements specification, Classification of requirements as strategic, tactical, operational and statutory, Requirement gathering techniques- interview, questionnaire, on-site observation, document observation, selecting appropriate technique, Feasibility analysis, deciding project goals, examining alternative solutions, Cost Benefit Analysis, quantifications of costs and benefits, payback period, system proposal preparation for managements, parts and documentation of a proposal

(iii) Structured Analysis

Data flow diagrams, case study for use of DFD, good conventions, Levelling of DFDs, Levelling rules, Logical and physical DFDs, Software tools to create DFDs. Preparation of Software Requirement Specification

(iv) Structured Design

Entity relationship model, E-R diagrams, Relationships cardinality and participation, Normalizing relations, various normal forms and their need, Some examples of relational data base design. Data input methods, designing outputs, output devices, designing output reports, screen design, graphical user interfaces, interactive I/O on terminals.

Application Architecture, server-based architecture, client-based architecture, n-tier architecture,

Program design- structured chart. Preparation of Design Specification Document,

(v) Object Oriented Modelling using UML

Object Oriented (OO) Development Life Cycle and Modelling. Static and dynamic modelling. Comparison of OO and Module-oriented Approach. Modelling using UML; class diagram, use case diagram, object diagram, package diagram, activity diagram, interaction diagrams, sequence diagram, state transition diagram. Deployment diagram, component Diagram.

(vi) Testing

Software Testing, need for software testing, types of testing, Functional Testing-unit testing, integration testing, user acceptance. Non-functional Testing-performance, stress testing, peak load testing, Maintenance Testing-Regression Testing.

(vii) System Implementation and Maintenance

Planning considerations, Conversion methods, procedures and controls, System acceptance criteria, System Evaluation and Performance, Testing and Validation. Preparing, User Manual, Maintenance Activities and Issues.

(viii) Other Software Development Approaches

Different Software Development approaches-waterfall model, prototype, rapid application development, spiral, agile development, DevOps development methodology.

Distributed System, centralized versus distributed system, components of distributed system-processes, interfaces and data. Layers of distributed system-presentation layers, application logic layer, data manipulation layer and data layer. Design and layers of Internet Based applications.

2.8.7.Reference Books/Study Material

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2011.
2. System Analysis and Design Methods by Jeffrey L Whitten and Lonnie D Bentley, Mc-GRaw Hill
3. System Analysis and Design by Alan Dennis, Barbara Haley Wixom, Roboerta M Roth, Publisher-Wiley
4. Modern Systems Analysis and Design-6th Edition by Hoffer, George, valacich; Published by Pearson Education India
5. System Analysis and Design by Dr.Brijendra Singh, Published by New Age International Private Limited
6. Software Engineering by K. K. Aggarwal and Yogesh Singh, New Age International Publisher

2.9. Module: A9.1-R5-Big Data Analytics Using Hadoop

2.9.1. Introduction

The purpose of this module is to provide skills to students to analyze and process large volume of data using tools and techniques. It provides theoretical background as well as in-depth knowledge of Software/ packages that are used in analyzing the voluminous data.

2.9.2. Objective

After completing the module, the incumbent will be able to:

i. Collect and combine data recovered from different sources and in different format into uniform format that will help in analyzing data.

ii. Understand the basics of data, database and requirement to analyze data, analyzing data using mathematical and statistical techniques, representation of data in tabular and graphical modes.

iii. The concept and usefulness of cluster environment for processing voluminous data.

iv. Analyze data using Hadoop framework and its sub-project of HIVE

2.9.3. Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.9.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. Analyze and Define Business Requirement	4	6	i. Differentiate between traditional tools and modern tools to analyze data. ii. Analyze business requirement through database
2. Introduction to Operating System (Ubuntu/Linux)	4	6	i. Understand Operating System and its functions. ii. Manage files and folders.

			iii. Know various types of file extensions and their purposes iv. Learn basic commands used in Operating System.
3. Java Programming	10	15	i. Write programs using Java Programming Language and its main constructs. ii. Handle exception situations. iii. Write graphical programs using Java. iv. Integrate Java with any database. v. Integrate any external Java API in application
4. Hadoop Framework and Map Reduce Programming Technique	8	12	i. Use Hadoop framework for managing voluminous data. ii. Write programming using MAP Reduce techniques.
5. Anaylzing Data using HIVE	10	15	i. Process and analyze large volume of data using HIVE
6. Basics of R Programming and RHIVE	4	6	i. Understand the need of R in analyzing voluminous data. ii. Integrate R with HIVE
7. HIVE-Java Connectivity	6	9	i. Connect HIVE with JAVA ii. Develop GUI using JAVA, HIVE and R

8. Introduction to HBASE, PIG and JAQL	2	3	i. Understand the purposes of other Big Data tools like JAQL, HBASE and PIG.

2.9.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Analyzing and Defining Business Requirement and Introduction to Operating System (Ubuntu)	10
2. Java Programming	30
3. Hadoop Framework and Map Reduce Programming Techniques	10
4. Analysing Data using HIVE, R, RHIVE, HIVE – JDBC	40
5. Introduction to HBASE, PIG and JAQL	10
6. Total	100

2.9.6. Detailed Syllabus

(i) Analyze and Define Business Requirement

Introduction to Business Intelligence, Business Analytics, Data, Information, how information hierarchy can be improved/introduced, understanding Business Analytics, Introduction to OLAP, OLTP, data mining and data warehouse. Difference between OLAP and OLTP.

Introduction to database, characteristics of data in database, DBMS, advantages of DBMS, file-oriented approach versus Database-oriented approach to Data Management, disadvantages of file- oriented approach. A brief overview of relational model. Definition of relation, properties of relational model, Concept of keys: candidate key, primary key, alternate key, foreign key, Fundamental integrity rules: entity integrity, referential integrity. SQL statements: Insert, delete, update and select. Join, union.

(ii) Introduction to Operating System

Introduction to Ubuntu Operating System, Managing files and folder through command line and Desktop. Basic Ubuntu commands like ls, mkdir, clear, rm. Creating users and groups in Ubuntu. User priviledges and roles (chown and chmod

commands),gedit editor. Secure shell configuration, configuring. bashrc and environment files.

(iii) Java Programming

OOPS Principles, an Overview of Java Object-Oriented Programming, Data Types, Variables, and Arrays, Operators-Arithmetic Operators, The Bitwise Operators ,Relational Operators, Boolean ,Logical Operators, Programming Constructs, Methods and Inheritance, The basic Java I/O Classes and String Handling

Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch , Displaying a Description of an Exception ,Multiple catch Clauses , Nested try Statements , Throw throws finally Java's Built-in Exceptions Packages, Access Protection, Importing Packages and Interfaces

Java Swing and its controls like JTextField, JLabel, JComboBox, JTable, JButton, JScrollBar, JOptionPane and JMenu.

Java Database Connectivity JDBC-ODBC Bridge JDBC Drivers Creating DSN Driver Manager, Connection, Statement, Result Set. Connecting Java with Database.

(iv) Hadoop Framework and Map-Reduce Programming Technique

Big Data Concepts, Need for analyzing Big Data, its roles in Business Intelligence and decision making.

Big Data, Hadoop Architecture, Hadoop ecosystem components, storage, Hadoop Distributed File System (HDFS), Single node installation. Multi node installations. Cluster Architecture, Cluster configuration files Hadoop commands, Hadoop Server Role, name Node, secondary node, data node, file write and read.

Shell commands, Accessing files on HDFS and local machine, Map Reduce Framework, Developing Map Reduce Programs, structure of Map Reduce program,

(v) Analysing Data Using HIVE

Introduction to HIVE, installing HIVE, Data types, HIVE shell, HIVE commands, HIVE SQL, creating database and tables, bulk loading of data, SQL DML statements, SQL Join, HIVE Functions, Complex Data types, UDF in Hive using Java

(vi) Basics of R Programming and RHIVE

R Overview, Basic Syntax, Data types, R Control constructs like loop and conditional, R Function. Connecting R with Hive.

(vii) HIVE JDBC Connectivity

Starting HIVE in client-server mode, beeline, mapping HIVE datatype with Java datatypes, Connecting Java with HIVE. Integrating Java Swing, HIVE and JDBC for developing front end application.

(viii) Introduction to HBASE, PIG and JAQL

HBASE introduction, integration with Hadoop, HBase Shell, introduction to JAQL data model, JAQL shell, introduction to JSON files and accessing JSON files through JAQL. Introduction to PIG.

2.9.7.Reference Books/Study Material

1. Java - The Complete Reference by H. Schildt, Tata McGraw-Hill.
2. Head First Java by Kathy Sierra & Bert Bates, O'Reilly.
3. Programming with Java A Primer by E Balagurusamy, Tata McGraw-Hill.
4. Hadoop, The Definite Guide by Tom White, O'REILLY
5. Hadoop Operation by Eric Sammer, O'REILLY
6. Big Data by DT Editorial Services, Black Book
7. Apache HIVE Essential, Dayong Du, Packt Publisher
8. HBASE Essentials by Nishant Garg, Packt Publisher

2.10. Module: A10.1-R5-Data Science Using Python

2.10.1. Introduction

Data science is an interdisciplinary field that uses scientific processes and various algorithms to extract knowledge and insights from data which may be structured and unstructured.

Python has gathered a lot of interest recently as a choice of language for data analysis/science. Python is a free and open source and a general-purpose programming language which is easy to learn. Python, due to its versatility, is ideal for implementing the steps involved in data science processes. Python is being used for web development, data analysis, artificial intelligence, and scientific computing.

The three best and most important Python libraries for data science are NumPy, Pandas, and Matplotlib. NumPy and Pandas are used for analyzing and exploring with data. Matplotlib is a data visualization library used for making various types of graphs depicting the analysis.

2.10.2. Objective

With the growth in the IT industry, there is a booming demand for skilled Data Scientists and Python has evolved as the most preferred programming language for the same. This course will focus on fundamental python programming techniques, reading and manipulating csv files, and the various libraries for data science.

After completing the module, the student will be able to:

i. Take tabular data and clean it
ii. Manipulate the data
iii. Run basic inferential statistical analyses.
iv. Perform Data Analysis
v. Perform Visualization of analysis
vi. Built a Front end GUI

2.10.3. Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.10.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)

1. Python Language, Structures, Programming Constructs	6	9	i. Write programs in the Python language. ii. Extensively use conditional statements, loops and various data structures of python.
2. Data Science Concepts	2	3	i. The concept of Data Science and Analytics and various steps to achieve analysis.
3. Numpy	8	12	i. Scientific computing and data analysis by understanding large, multi-dimensional arrays and matrices ii. Run efficient operations on arrays iii. work on high-level mathematical functions to operate on these arrays.
4. Pandas	14	21	i. Data Analysis after importing data from various sources. ii. Understand the Series and DataFrame as the central data structures for data analysis. iii. Learn various functions, grouping, merging and querying large sets of data.
5. Statistical Concepts and Functions	6	9	i. The statistical tool of python having ability to manipulate some statistical data and calculate results of various statistical operations. ii. Understand functions like mean, median, mode and standard deviation.

			iii. Understand the concept of Correlation and Regression.
6. Matplotlib	6	9	i. Learn the python library used to create graphs and plots with just a few commands ii. Understand pyplot and its features of line styles, font properties, formatting axes etc. iii. Understand all aspects of the programmatical control of all the figures.
7. GUI - Tkinter	4	6	i. The standard python interface to the Tk GUI toolkit for creating quick and intuitive GUI. ii. The various widgets for input and their event handling. iii. Integrating the data analysis and graphs in Tkinter.
8. Machine Learning	2	3	i. Overview of Machine Learning and its concepts.

2.10.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Python Language, Structures, Programming Constructs	14
2. Data Science Concepts	6
3. Numpy	20
4. Pandas	24
5. Statistical Concepts and Functions	10
6. Matplotlib	10
7. GUI –Tkinter	12
8. Machine Learning – The Next Step	4

Total	100

2.10.6. Detailed Syllabus

(i) Python Language, Structures, Programming Constructs

Review of Python Language, Data types, variables, assignments, immutable variables, Strings, String Methods, Functions and Printing, Lists and its operations, Tuples and Dictionaries programs, Slicing strings,lists, tuples.

(ii) Data Science and Analytics Concepts

What is Data Science and Analytics? The Data Science Process, Framing the problem, Collecting, Processing, Cleaning and Munging Data, Exploratory Data Analysis, Visualizing results.

(iii) Introduction to NumPy Library

Numpy : Array Processing Package, Array types, Array slicing, Computation on NumPy Arrays – Universal functions ,Aggregations: Min, Max, etc., N-Dimensional arrays, Broadcasting, Fancy indexing, sorting arrays, loading data in Numpy from various formats.

(iv) Data Analysis Tool : Pandas

Introduction to the Data Analysis Library Pandas, Pandas objects – Series and Data frames, Data indexing and selection, Nan objects, Manipulating Data Frames, Grouping, filtering, Slicing, Sorting, Ufunc, Combining Datasets- Merge and join. Query Data Frame structures for cleaning and processing, lambdas. Aggregation functions and applying user defined functions for manipulations.

(iv) Statistical Concepts and Functions

Statistics module, manipulating statistical data, calculating results of statistical operations. Python Probability Distribution, Functions like mean, median, mode and standard deviation. Concept of Correlation and Regression.

(v) Matplotlib

Visualization with Matplotlib, Simple line plots, scatter plots, Density and Contour plots – visualizing functions, Multiple subplots, Plotting histograms, bar charts, scatter graphs and line graphs.

(vi) GUI – Tkinter

Tk as Inbuilt Python module creating GUI applications in Python. Creating 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 events. Building the complete interface of a project.

(vii) Machine Learning : The Next Step

What is Machine Learning? Types of Machine Learning Algorithms, Training the data and Introduction to Various Learning Algorithms. Applications of Machine Learning.

2.10.7. Reference Books/Study Material

1. Python for Data Analysis by OReilly
2. Getting started with Python Data Analysis
3. Python Data Science Handbook: Essential Tools for Working with Data By O'Reilly
4. Python for Data Science for Dummies

2.11. Module: A9.2-R5-Web Application Development Using PHP

2.11.1. Introduction

The combination of PHP and MySQL is the most convenient approach to dynamic, database-driven web design. Flexible, scalable, extensible, stable, open—PHP is all of these and more, which is why it's one of the most popular programming toolkits in the world. Today, more than 20 million domains use PHP, including Facebook and Yahoo. PHP is easily embedded with HTML, and is used to manage dynamic content and the databases of websites or, we can say, Web applications. We can use PHP with many popular databases like MySQL, PostgreSQL, Oracle, Sybase, Informix and Microsoft SQL Server.

So, using PHP is also good economics for organizations: it allows them to save on licensing fees and expensive server hardware, while simultaneously producing higher-quality products in shorter time frames. Any would-be developer on a Unix/Linux or even a Windows/Apache platform will need to master these technologies. At the same time, JavaScript is important, as it provides in-browser dynamic functionality and, through Ajax, hidden communication with the web server to create seamless interfaces. In conjunction with CSS, these technologies integrate to provide a formidable array of powerful web-development tools.

2.11.2. Objective

The module is designed to equip a person with skills of web application development using PHP & MySQL under Linux environment. The module will cover aspects of how to use PHP, MySQL and client-side validations like AJAX and JQUERY to create powerful and easy to maintain database driven web-based applications. It provides depth knowledge of web application development using open source tools like Linux, Apache, MySQL and Php. After completing the module, the incumbent will be able to:

i. Work on Linux operating System.
ii. Designing of Web Pages
iii. Configure and implement security features on Apache.
iv. Design a Database in MySQL
v. Perform MySQL Administration
vi. Work in programming language PHP
vii. Develop a Website using Open Source Technologies

2.11.3. Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.11.4. Outline of Module

Module Unit	Duration (Theory) in Hours	(Duration Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. Introduction to the Website Development	02	3	i. the concept of Webpages and Website ii. Open Source Technologies iii. Platforms for PHP Website Development iv. Server-Side Scripting language and Client-Side Scripting language
2. Introduction to Linux Operating System	04	06	i. Execute basic Linux Commands. ii. Configure IDE for web development. iii. Install and configure web server. iv. Configure PHP and MySQL in Linux environment.
3. Review of Designing Web pages	04	06	i. Design a web page ii. Create and implement CSS
4. Review of Client Side Validations using various techniques	04	06	i. Applying Client-side validations using Java Script and AJAX ii. Applying Client-side validations using JQuery
5. Implementation of a server side programming language PHP	16	24	i. Acquiring skills on programming concepts ii. Acquiring skills on architecture of front-end application

			iii. Acquiring skills on implementation of basic concepts in PHP programming. iv. Acquiring skills on implementation of object-oriented concepts in PHP. v. Acquiring skills to understand the paradigm for dealing with form-based data vi. Acquiring Skills on file handling vii. Attaining skills on integrating application with back end database viii. Attaining skills on server-side validations ix. Attaining skills on implementation of security features.
7. Database connectivity with PHP and MySQL	16	24	i. Database Connectivity ii. Can handle Data manipulations iii. CRUD (Create, Read, Update and Delete)Operations in MySQL-PHP iv. User Authentication and authorization v. Website development
8. Web Services & security vulnerabilities	04	06	i. Implementation Web Services. ii. Web Security and Security Vulnerabilities.

2.11.5. Marks Distribution

Module Unit	Written Marks (Max.) (100)
1. Introduction to the Website Development and Introduction to Linux Operating System	10
2. Review of designing of Web pages	10
3. Review of Client Side Validations using various techniques	10
4. Server side programming language PHP	30
5. Database connectivity with PHP and MySQL	30
6. Web Services & security vulnerabilities	10
7. Total	100

2.11.6. Detailed Syllabus

(i) Introduction to the Website Development

Introduction of Web Site: Concept of Website and Web Pages, types of Websites

Introduction to Open source Technologies: Operating system, Web Server, Database, Scripting Languages

Platforms for website development: LAMP,WAMP and MAMP, Scripting language

(ii) Introduction to Linux Operating System

Linux Operating System: Topics- Introduction, Installation, Linux Architecture, Boot Process, Kernel, System Initialization. Different flavours of Linux, Review of Basic Commands and Editors: Topics – Introduction to NetBeans, Installation and Configuring NetBeans, gedit, Notepad++, Configuring Servers: Installation of PHP and MySQL on Linux Operating System, Installation of Net Beans IDE and its configuration, Configuration of Apache Server

(iii) Design of Web Pages

Basic HTML:HTML Basics, HTML Elements, HTML Attributes, HTML Headings, HTML Paragraphs, HTML Styles, HTML Formatting, HTML Quotations, HTML Links, HTML Table, HTML Lists, HTML Blocks, HTML Classes, HTML IFrames etc.

HTML Forms: HTML Form Elements, Input Types, Input Attributes.

CSS: CSS Introduction, CSS Types, CSS Padding, CSS Id & Class, Styling Backgrounds Fonts, Links, CSS Border, HTML5

(iv) Client Side Validations using Various Techniques

Java Script: Java Script Introduction, Variable declaration, Operators, Control Statements, Error Handling, understanding arrays, Built in Functions, User defined Function, HTML Forms and Java Script, HTML DOM, Validations using Java Script

AJAX: Introduction to AJAX, XML Http Request Object, Response Handling, AJAX Components, AJAX Framework, HTML in AJAX, XML and AJAX, Validations using AJAX

JQUERY: JQUERY Introduction, JQUERY library, JQuery Selectors, JQuery Filters, Working with JQuery Events, JQuery and HTML Forms, Validations using JQuery

(v) Server side programming language PHP

Introduction of Php: Programming Concepts, Architecture of web application, PHP Data Types and basics

Control Structures: Conditional statement, if, else, case, for, while loops

Arrays in PHP: Types of Arrays, Array attributes, Associative arrays, Array functions.

PHP Functions: String and other functions in PHP, Super global, PHP Functions, Types of Function: User Defined Function and Inbuilt Functions, PHP Email Function etc.

Object Oriented Concepts: Classes, defining a class and its usage, Constructor, Inheritance, Exception Handling, Use of include and require.

PHP Forms methods: GET, POST & REQUEST, creating user forms.

File handling in PHP: Uploading files and images, Using file system in PHP.

(vi) Database Connectivity with PHP and MySQL

Creation of Database Connection file, Database connectivity, using MySQL functions in PHP. Server-side validations. Inserting, Updating, deleting data using PHP and MySQL through forms, Bind Parameters for Database Queries, Using MySQL Store procedures in PHP, Database server configuration using IPv4 and IPv6, Fetching Data from Database server.

(vii) Web Services &Security Vulnerabilities

Web service architecture & Introduction, Session and cookies, Authentication and Authorization, storing hashed passwords in the database, Login and Logout operation, Access Control Filter, Session based and cookie-based login, Using security features etc. SQL Injection, Cross Site Scripting, Broken Authentication and Session Management, Insecure Direct Object References, Cross Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to restrict URL Access.

2.11.7. Reference Books/Study Material

1. PHP and MySQL® Web Development: Publisher: Addison-Wesley Professional Author: Laura Thomson, Luke Welling
2. Beginning PHP6, Apache, MySQL Web Development Publisher: Wrox Author: Elizabeth Naramore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Michael K.Glass Timothy Boronczyk
3. PHP: The Complete Reference by Steven Holzner, McGraw Hills
4. PHP and MySQL Web Development, Luke Welling, Laura Thomson, Pearson

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

2.12.1. Objective

The module is designed to equip learner to use PHP & MySQL with MVC framework. The module will cover aspects of how to use PHP, MySQL along with CakePHP MVC framework to create powerful and easy to maintain database driven websites.PHP, MySQL and CakePHP are also platform independent i.e. You can easily port a website developed on a windows machine to a Linux based apache web server with minimal to no changes.

After completing the module, the incumbent will be able to:

i. Understand the basics of the Web Technology
ii. Learn all major concepts of PHP and MySQL that beginner developers need to master.
iii. Learn all major concepts of MVC architecture in general and it advantages over conventional web development methods.
iv. Round off your application development skills by understanding how to implement PHP on a website using MVC framework.
v. Gain the PHP programming skills needed to successfully build interactive, data-driven sites
vi. Create forms easily using helper functions and work with form data
vii. Object oriented concepts
viii. Able to architect, write, debug, and run complete web applications
ix. Test and debug a PHP application

2.12.2. Duration

120 Hours - (Theory: 48hrs + Practical: 72 hrs)

2.12.3. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. MVC Infrastructure Basics, Frameworks& Introduction to CakePHP	4	8	i. Gather knowledge MVC Terminology ii. Advantages of MVC iii. Brief Information about MVC Frameworks of PHP

			iv. Installation of CakePHP v. Configurations required for Framework
2. Models	6	6	i. Models in detail ii. Defining Models iii. Use it for database access and manipulation iv. How to use basic SQL queries in models
3. Controller and Views	6	8	i. Create Controllers ii. Create Views iii. Controllers and Views Interaction and exchange data between them
4. PHP Basics and Conditional Logic	4	6	i. PHP and MYSQL Basics ii. Installation Setup,Data Types. iii. Get familiar with Arrays and Decision-Making Statement.
5. Functions and Error Handling	3	6	i. Well acquainted with functions and its uses. ii. Able to understand various types of Functions. iii. Able to create user defined functions. iv. Well versed with Regular Expressions.
6. Object Oriented Programming	8	12	i. Object Oriented Concepts ii. Classes, creation of Objects for Class. iii. Methods and functions iv. Object oriented functionalities i.e.

			Inheritance, Method Overriding, Interfaces v. Constants vi. Access Specifiers and Abstract Classes.
7.MySQL Installation and Basics	3	6	i. Database and Database Terminology ii. Database creation and Connection iii. Database manipulations like add, edit and delete
8. Advance Queries and Data Manipulation using PHPand MySQL	6	10	i. Advanced Queries. ii. SQL Injection iii. Sorting and Indexing iv. Joins v. Retrieving and manipulating Data using PHP. vi. Creation of Login and Registration form for user authentication vii. Searching, Updation, Deletion of data and users
9. Creating Dynamic Forms using CakePHP HTML Helpers	8	10	i. Generate forms using CakePHP ii. Validate forms using model definitions. iii. Difference between get and post methods iv. Sessions and cookies v. File uploading

2.12.4. Marks Distribution

Module Unit	Written Marks (Max.)
1. MVC Infrastructure Basics, PHP Frameworks & Introduction to CakePHP	14
2. Models	11
3. Controller and Views	12
4. PHP Basics and Conditional Logic	10
5. Functions and Error Handling	10
6. Object Oriented Programming	13
7. MySQL Installation and Basics	7
8. Advance Queries and Data Manipulation using PHP and MySQL	13
9. Creating Dynamic Forms using CakePHP Html Helpers	10
Total	100

2.12.5. Detailed Syllabus

(i) MVC Infrastructure Basics. PHP Frameworks& Introduction to CakePHP

Introduction to MVC, What are Model-View-Controller, Why use framework in the project (conventional vs. MVC project), Introduction to PHP Frameworks i.e Zend, CodeIgniter, Laravel. Installation of CakePHP, CakePHP folder structure, File naming conventions, Important config file (core.php, database.php)

(ii) Models

Models: Different models of databases and interaction between databases. Creating up model for a database, Accessing and manipulating table data using find, save, update methods of the model, Deleting Data, User defined functions in model, data validations.

(iii) Controller and Views

Application flow –Creating Controller Function, How Controller interact with model, how controller interact with views. CakePHPhelpers, Most commonly used helpers like Form, HTML, Session, Cookie etc, Create views and custom layouts

(iv) Php Basics and Conditional Logic

PHP introduction, Environment setup in different platforms, concept of Server-side scripting language and client side scripting language, Script syntax, How to declare variable and data types, Constants, Arrays, Strings, Web concepts, Decision making statements, loop types, operators

(v) Functionsand Error handling

What is Functions, Creating PHP functions, PHP functions with parameters, Argument by reference, setting default values for function parameters, dynamic function calls, regular expressions, Date and time functions ,Built-in functions, file inclusion, file manipulations

(vi) Object Oriented Programming

What is Object Oriented Concepts, Defining classes, Creating Objects, Member functions, The new keyword and Constructor ,Destructor, Access method and properties using $this variable, Inheritance& code reusability, Function overriding, Access Specifies- private, public and protected members, Static properties and method, Class constants, Polymorphism, Parent:: &self :: keyword, Instance of operator, Abstract method and class, Interface , Final, Exceptional handling.

(vii) MySQL Installation and Basics

Database Introduction, MySQL installation on various platforms, MySQL connection, Database creation, Database Manipulations- Add, Edit, Retrieve and Delete. Table creation and table manipulations- Add Edit, Retrieve and Delete, Like clause, Sorting, Group Functions with having clause

(viii) Advance Queries and Data Manipulation using PHPand MySQL

Joins, Handling NULL Values, Regular Expressions, , ALTER Command, Indexes, Temporary Tables, Database Handling Duplicates, SQL Injections. Creating user login form, Registration Form using database, User Authentication, Search, Update, Delete Users and Data. Fetching the data from database

(ix) Creating Dynamic Forms using CakePHP Html Helpers:

Introduction to basic html form, get, post methods, Generate form elements like input boxes, dropdowns, radio buttons, and links using CakePHP html helper, Form validation using Model validation definitions, Create, retrieve and delete cookies, Create, retrieve and delete session variables, File handling in CakePHP (create, delete, read files), CakePHP Global variables and their use

2.12.6. Reference Books/Study Material

1. PHP and MySQLWeb Development: Publisher: Addison-Wesley Professional Author: Laura Thomson, Luke Welling
2. PHP and MySQL Web Development: Publisher: Addison-Wesley Professional Author: Laura Thomson, Luke Welling
3. Beginning PHP6, Apache, MySQL Web Development Publisher: Wrox Author: Elizabeth Naramore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Michael K. Glass Timothy Boronczyk
4. Learn CakePHP Publisher: Apress Author: Radharadhya Dasa
5. Practical CakePHP Projects Publisher: Apress Author : Miller Cheryl

2.13. Module: A9.3-R5-Network Management

2.13.1. Introduction

This course will allow students to develop background knowledge as well as core expertise in networking and data communication technologies, which is one of the fastest growing industries in today's world. It forms an integral part of the modern Information and Communications Technology (ICT) in any organizations. Starting from intranet/extranet in small offices to the World Wide Web, principles of networking and data communication technologies DCN play an important role in designing any modern telecom infrastructure.

A major ramification of the fantastic growth of telecommunications and networking is a dramatic increase in the number of professions, where an understanding of Computer Networking is essential for success. This course is designed with this new mix of students in mind. The course, being the first one on telecommunication and Computer networking in the NIELIT hierarchy, starts from the very basics of communication technology and goes up to the Internet, spanning all the five layers of TCP/IP model. The students will be exposed to communication principles, different types of media, modulation techniques, multiplexing, switched networks, the Internet, TCP/IP suite, network security, mobile wireless communication, fibre-optic communications and the state-of-art networking applications.

2.13.2. Objective

At the end of the course the students would know:

i. Strategies for securing network applications in enterprises

ii. Emerging technologies, such mobile telephony etc. Acquire confidence in using computers Networks, Various transmission media, their comparative study, fibre optics and wireless media

iii. Categories and topologies of networks (LAN and WAN)

iv. Layered architecture (OSI and TCP/IP) and protocol suites

v. Channel error detection and correction, MAC protocols, Ethernet and WLAN

vi. Details of IP operations in the INTERNET and associated routing principles

vii. Operations of TCP/UDP, FTP, HTTP, SMTP, SNMP, etc.

2.13.3. Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.13.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical/ Tutorials) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. Introduction to Computer Networks	2	3	i. Understand the concept of networking, various terminologies used in Networking ii. Understand various types of Networks, Network topologies iii. Various modes of communication
2. Introduction: Network layers/Models	4	6	i. Network layers concepts and its merits and de-merits ii. Basics of OSI model and TCP-IP protocol suite
3. Physical Layer	2	3	i. Understand how data travels physically and understand concepts of signals, transmission modes, switching techniques, various transmission media etc.
4. Data Link Layer	6	9	ii. Understand function of physical layer, data framing, error detecting codes iii. DLL-sublayers, Physical layer protocols iv. Wireless LAN IEEE standards
5. Network layer	6	9	i. Understand IP addressing (IPV4,IPV6) ii. Understand Network layer protocols

6. Transport Layer	6	9	i. Understand function of transport layer and port addressing
7. Congestion Control	4	6	i. Understand basics of congestion in network and various congestion control techniques
8. Application Layer	6	9	i. Understand function of application layer and various protocols of this layer
9. Networking devices	4	6	i. Understand the working of various networking devices used in all Network layers
10. Fundamentals of Mobile communication	6	9	i. Overview of Mobile communication and evolution of its generations
Total	48	72	

2.13.5. Marks Distribution

Module Unit	**Written Marks (Max.)**
1. Introduction to Computer Networks	8
2. Introduction: Networks layers/Models	8
3. Physical Layer	10
4. Data Link	10
5. Network Layer	14
6. Transport Layer	14
7. Congestion control	10
8. Application Layer	12
9. Networking Devices	10
10. Fundamentals of Mobile Communication	4

Total	100

2.13.6. Detailed Syllabus

(i) Introduction To Computer Networks

Introduction: Definition of a Computer Network; What is a Network?, Components of a computer network: Use of Computer networks; Networks for companies, Networks for people, Social Issues: Classification of networks; Based on transmission technology, Based on the their scale, Local Area Networks(LANs), Metropolitan Area Networks (MANs), Wide Area Networks(WANs), Computer topologies: Physical vs Logical Topology, Types of topologies: Linear Bus Topology, Ring Topology, Star Topology, Hierarchical or Tree Topology, Topology Comparison, Considerations when choosing a Topology, Modes of communication: Simplex, Half Duplex, Full Duplex, Concept of Channel, Sender and receiver with Communication process

(ii) Introduction: Networks Layers / Models

Protocol hierarchy, Design issues for the layers, Merits and De-merits of Layered Architecture, Service Primitives: Reference models; The OSI Reference Model, The TCP/IP Protocol Model, Comparison of the OSI Reference Model & the TCP/IP Protocol Models: Network standardization; Who's who in the telecommunication world?, Who's who in the standards world, Who's who in the Internet standards world?, TCIP/IP Protocol Suite.

(iii) Physical Layer

Introduction: Basic Functions of Physical Layer, Digital Signals: Bit rate, Bit length, Transmission of digital Signals, Analog Signals: Amplitude, Phase, Frequency, Wavelength, Transmission Impairments, Data Rate limits: Noiseless Channel: Nuyquist Bit Rate, Noisy Channel: Shannon capacity, Performance: Bandwidth, Throughput, Goodput, Latency (delay), Jitter. Concept of Serial and Parallel transmission, Switching; Circuit switching, Message switching, Packet switching, Virtual Switching, Multiplexing; FDM – Frequency division multiplexing, WDM – Wavelength division multiplexing, TDM – Time Division Multiplexing: Synchronous and Statistical, Transmission Media: Guided Media, Unguided Media, PSTN, Modems, DSL and other standards, Cable Networks: HFC,CM,CMTS.

(iv) Data Link Layer

Introduction, Basic functions of Data Link Layer (LLC and MAC Sublayers): Framinng, CRC, Checksum, Protocols:Stop andWait, Go- Back-N, Selective Repeat, Piggybacking, HDLC, Point to Point, Multiple Access: Random Access :CSMA / CA, CSMA / CD, Controlled Access: Reservation, Polling, Token Passing,Wired LANS: IEEE Standards,Wireless LANs: IEEE Standards.

(v) Network Layer

IPv4 Addressing, IPv4 Subnetting: CIDR, VLSM, NAT, NAT Types, IPv6 Addressing, Transition from IPv4 to IPv6, Address Mapping: ARP, RARP, BOOTP, DHCP, ICMP, ICMPv6 and IGMP, Concept of Forwarding of Packets by Routers, Unicast Routing Protocols: Distance Vector, Link State, Path Vector with examples of each.

(vi) Transport Layer

Introduction, Basic Functions of Transport Layer: Client server Process with Port Numbers concept in detail, Concept of Socket Multiplexing vs De-multiplexing, Connectionless vs Connection Oriented, Reliable vs Unreliable, UDP in detail, TCP in detail.

(vii) Congestion Control

Flow control vs. congestion control. Congestion Basics, Congestion Control: Open-Loop Closed-Loop, Concept of Quality of Service, techniques to improve QoS.

(viii) Application Layer

Basic Function of Application Layer, Concept of Namespace and DNS, Basics of Remote Logging (telnet and ssh), E-mail: Architecture, Introduction to SMTP, POP, IMAP protocols, File Transfer: FTP, Anonymous FTP and TFTP, Concept of www and HTTP: www, http, https protocols, Basics of Network Management System: SNMP protocol

(ix) Networking Devices

Introduction; Goal of networking devices: Repeaters and their use, Hubs, Bridges, Managed vs Non Manageable switches, L-2 Switches, L-3 Switches, Stackable Switches, Concept of Collision Domain, Working of Hubs and Switches, Concept of Port Density, Concept of Broadcast Domain, Routers: Dedicated Hardware versus Server-Based Routers, Advantages and Disadvantages of dedicated hardware routers, Drawbacks of Routers, Gateways: Advantages of Gateways, Gateways Functionality, Other Devices: Brouter, Proxy Server, Wireless Access Point (WAPs)/Wireless Router, Wireless LAN Extender and Wireless LAN Controller

(x) Fundamentals of Mobile Communication

Introduction to wireless communication, wireless transmission:frequencies & regularion, signals, antena, multiplexing, modulation, spread spectrum & cellualr system. Evolution of Mobile Generation Technologies: 1G, 2G, 3G, 4G and 5G.

2.13.7. Reference Books/Study Material

1. Introduction to Computer Communication Networks,
2. Andrew S. Tanenbaum, Computer Networks

2.14. Module: A10.3-R5-Information Security Management

2.14.1. Introduction

This module is designed to focus on information security skills and techniques to protect and secure organization's information assets and business systems. Students understand of various types of security incidents, threats and attacks, and learn methods to prevent, detect and react to incidents and attacks.

2.14.2. Objective

This module is designed to focused on information security skills and techniques to protect and secure organization's information assets and business systems. Students understand various types of security incidents, threats and attacks, and learn methods to, detect react and mitigate attacks. After completing the module, the incumbent will be able to:

i. Identify different components of network, topology, protocol stacks and devices,

ii. Able to acquaint with various Information security threats and mitigate such threats /incidents

iii. Explain the usage of secret key cryptography and public key cryptography, algorithms used in cryptography, and applications

iv. Understand and identify the common types of attacks against networks and countermeasures

v. Identify vulnerabilities in web applications and mitigation strategies

vi. Identifies the phases of IT audit, performing risk assessment in Windows and Linux environment

vii. Acquaint with cyber law, incident handling and performing digital forensic analysis

2.14.3. Duration

120 Hours - (Theory: 48hrs + Practical: 72 hrs)

2.14.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. Network Fundamentals	6	9	i. Identify different components of network devices.

			ii. Identify the different types of network, topologies and the most common network technologies iii. Understand the properties and functions of network protocols and network protocol stacks
2. Introduction to cyber security and Attacks	6	9	i. Able to acquaint with various Information security threat and controls for it. ii. To fully understand the Principle of Least Privilege and Confidentiality, Integrity, Availability (CIA), iii. Conversant in the fundamentals of risk management, security policy, and authentication/authorization/accountability.
3.Cryptography	10	15	i. After completion of this unit, candidate will able to ii. Explain the concepts used in early substitution and translation ciphers iii. Understand Mathematical concepts underpinning cryptography iv. Demonstrate the use of hashing in maintaining data integrity v. Use encryption methods that ensure both confidentiality and integrity vi. Understand modern cryptosystem RSA, AES etc.

			vii. Understand algorithms used to protect users online and to understand some of the design choices behind these algorithms
4.Network Security and countermeasures	6	9	i. Understand and know the different types of topologies and the inherent security risks they create ii. Understand and identify the common types of attacks against networks iii. Understand the properties and functions of network protocols and the network protocol stacks iv. Understand the aspect of deploying and utilizing wireless networks and technologies v. Configure firewalls, IDS, HIDS, NIDS,NIPS on all platforms for all types of attack scenarios.
5.Web Server and Application Security	4	6	i. After completion of this unit, candidate will able to ii. Identify vulnerabilities in web applications, find a way in which the problems could be fixed or avoided. iii. Learn Mitigation strategies from an infrastructure, architecture, and coding perspective iv. Learn application coding errors like SQL injection and cross-site scripting v. Learn OWASP top 10 vulnerabilities and mitigation techniques.

6.Security Auditing	8	12	i. Identifies the phases of IT audit, and how to ensure that an audit provides value to the organization. ii. Learn risk management models exist for implementing a deeper risk management program in their organization. iii. Learn the elements of risk assessment and the data necessary for performing an effective risk assessment using Microsoft Security Assessment Tool iv. Learn Linux systems auditing v. Perform Risk Assessment based on ISO27001 using ISO27001 security toolkit vi. Prepare Audit Questionnaire and Performing Audit for ISO27001 Standard
7. Cyber Law and IT Act 2000	4	6	i. Know Legal Aspects, Cyber Law – Indian and Internationals perspective ii. Able to identify types of cybercrimes and penalties associated with the crimes
8. Cyber Forensics	4	6	i. Identify source of digital evidence ii. Know cyber forensics procedure identification, preserving, analysis, authentication presentation iii. Perform collection, imaging and analysis of the digital evidence

			iv. Perform volatile data collection and analysis v. Understand the importance of report, maintaining chain of custody

2.14.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Network Fundamentals	8
2. Introduction to cyber security and Attacks	13
3. Cryptography	16
4. Network Security and countermeasures	16
5. Web Server and Application Security	10
6. Security Auditing	18
7. Cyber Law and IT Act 2000	6
8. Cyber Forensics	13
9. Total	100

2.14.6. Detailed Syllabus

(i) Network Fundamentals

Introduction to Ethernet, OSI layers, TCP/IP models, Functions/ protocols & devices at each layer, Protocol headers for frame, TCP, UDP, IP ,ICMP, applications layers like http, snmpetc, Network Topology, Working of Hub bridge, switch, router, UTM, remote administration of and managed network devices, Types of Networks, VLAN, Subnetting, NAT Working with Number systems, Fixed Length subnet masking, Variable Length subnet, masking, Classless Inter Domain Routing, Inter VLAN routing, Static Routing, RIP, RIPv2, OSPF, EIGRP, IGRP using IPv4, Routing in Ipv6.

(ii) Introduction to cyber security and Attacks

Fundamentals of information security - CIA Triad, Cyber Security Controls, Logical Controls, Physical Controls, Tools & Techniques, understanding threats, attacks categories, hacking process, Vulnerability, Threat & Risk (with examples), Types

of Attacks (DDOS, Phishing, Malware etc. with examples), Threats at Client systems (malware, social engineering, open ports, etc.) Threats to Network, Web, Storage & Devices, Understanding the network security, Mitigation Techniques, fundamental of web/mobile application security, Web Application Attacks (SQL Injection, Cross site scripting etc.), Mobile Application Attacks, data center security, cloud computing and data security.

(iii) Cryptography

Data Transmission and Organization, error detecting and correcting codes, need of cryptography. Cryptology fundamentals, Symmetric-Asymmetric cryptography & cryptographic algorithms, Private key encryption, Public key encryption, Protocols, Key management, including key generation, key storage, Key exchange, Encryption folders(Graphical/ using cipher), Data recovery agent, Symmetric key encryption algorithm, DES/3DES, IDEA,RC5, AES, Public key algorithm, RSA & ECC, Diffie-Hellman key exchange, Hash functions, MD5-message digest algorithm, SHA-1 Secure Hash algorithm, HMAC, Applications of cryptography- Secure Email PGP, SSL TLS S/MIME, File Encryption IPsec, IOT Attacks against encryption, Public Key Infrastructure Understanding digital certificates and signatures.PKI Standards and Management, X.500, X.509, ETF, IRTF.

(iv) Network Security and countermeasures

Securing Networks, Network security devices– Router, ACL, firewalls, types of firewalls, configuration and deployment, overview of IDS, Network-based IDS (NIDS), Host-based IDS, Overview of IPS, Host-based IPS, (HIPS), Network-based IPS(NIPS), UTMTMG threat management gateway, network security tools (scanners, sniffers etc) and Countermeasures. wireless security, securing wireless networks: wireless overview, Bluetooth, 820.11

(v) Web Server and Application Security

Client-Server Relationship, Vulnerabilities in web server and applications, Attack methods, Buffer overflow, SQL injection, cross site scripting, session hijack etc., Secure Coding Practices, OWASP top 10 vulnerabilities and mitigation techniques, Web Application vulnerability scanning, tools (Nessus), Web application security challenges

(vi) Security Auditing

Audit planning (scope, pre-audit planning, data gathering, audit risk), Risk management, Overall Audit Risk, Risk based approach, Evidence, Evidence gathering techniques, Sampling, Control Self-Assessment, Risk analysis, Purpose of risk analysis, Risk based auditing, Types of Control, Risk Assessment using Simple Risk or Eramba (Open source Tools), 3 phase approach – Risk assessment IT/IS Audit, Log analysis, Using Microsoft Security Assessment Tool, Using Microsoft Security Baseline Analyzer, Configuring Windows File system auditing. Event ID Log Analysis, OS and Application specific auditing, Performing Risk Assessment

based on ISO27001 using ISO27001 security toolkit, Preparing Audit Questionnaire and Performing Audit for ISO27001 Standard.

(vii) Cyber Law and IT Act 2000

Information Technology Act 2000 (as amended in 2008), Rules under Information Technology Act 2000. The Rule of Cyberspace. Cyber Law – Policy Issues and Emerging Trends Online Contract. Digital Signature Cyber Crime, Data Protection, Liability of Intermediary, Copyright and Internet. Domain Name Dispute, Harmful content in Internet, Case Studies.

(viii) Cyber Forensics

Digital Evidence, identification of digital evidence, Cyber forensics Processes Identification, Preservation, seizure and acquisitions, Analysis, authentication and presentations, fundamental of Incident response and handling, Reporting, mitigation, Volatile evidence collection and analysis, disk imaging and analysis, Investigating Information-hiding, analysis of e-mail, Tracing Internet access, Understanding importance of report, writing of reports, generating report finding with forensics tools, Chain of custody forms, Laboratory documents and procedures.

2.14.7. Reference Books/Study Material

1. Cryptography and Network Security Principles and Practices, William Stallings, Seventh Edition, Pearson
2. Network Security Essentials: Applications and Standards Paperback, William Stallings
3. Cryptography and Network Security Paperback, Atul Kahate
4. Computer Networks, 5e (5th Edition) Paperback, Tanenbaum
5. Principles of Computer Security: CompTIA Security+ and Beyond, W.A. Coklin, G.White, Fifth Edition.
6. Cyber Law-Law of Information Technology And Internet Paperback, Anirudh Rastogi
7. Hands-on Incident Response and Digital Forensics, Jason Wayne

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

2.15.1. Introduction

The module is designed to equip the students to understand the advanced concepts of Internet of Things (IoT) and its applications. The Internet of Things (IoT) is expanding at a rapid rate, and it is becoming increasingly important for professionals to understand what it is, how it works, and how to harness its power to improve business. This introductory course will enable learners to leverage their business and/or technical knowledge across IoT-related functions in the workplace.

In the course, we will examine the concept of IoT. We will look at the 'things' that make up the Internet of Things, including how those components are connected together, how they communicate, and how they value add to the data generated. We will also examine cyber security and privacy issues, and highlight how IoT can optimize processes and improve efficiencies in your business.

2.15.2. Objective

After completing the module, the incumbent will be able:

i. To assess the vision and introduction of IoT.

ii. To Understand IoT Market perspective.

iii. To Implement Data and Knowledge Management and use of Devices in IoT Technology.

iv. To understand state of the art - IoT Architecture.

v. To understand IoT hardware platform and interfacing strategies.

vi. To classify Real World IoT Design Constraints IoT and Modern IoT

vii. To understand security threats in IoT

2.15.3. Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.15.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. Hardware platform for Prototyping IoT applications	10	18	i. Embedded Microcontrollers ii. Hardware platform for prototyping IoT

			iii. Open IDE for application development
2. Sensors, Actuators and its interfacing	10	17	i. The sensor & Actuator principles ii. The Embedded bus protocols iii. Modern sensors, actuators and their interfacing strategies
3. IoT - Networking & Protocols	8	10	i. The communication protocols ii. Layering concepts iii. IP Addressing iv. IoT Application protocols
4. Webserver basics for IoT	10	15	i. Webserver overview ii. client server model iii. Embedded web servers for IoT
5. The IoT database management & Cloud connectivity	6	6	i. The need for IoT database management ii. SQL and NoSQL based tools iii. Basics of cloud computing iv. Public and private cloud for IoT Application development
6. Security for next Generation IoT, IIoT	4	6	i. Current security issues for IoT ii. Future security threats for IoT iii. Penetration of Modern trends –IioT

2.15.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Hardware platform for Prototyping IoT applications	20
2. Sensors, Actuators and its interfacing	20
3. IoT - Networking & Protocols	20
4. Webserver basics for IoT	15
5. The IoT database management & Cloud connectivity	15
6. Security for next Generation IoT , IIoT	10
Total	100

2.15.6. Detailed Syllabus

(i) Hardware Platform for Prototyping IoT Applications:

Open IoT hardware platforms: ESP8266 - Architecture, Peripherals, NodeMCU architecture, Features, and its peripherals, pin diagram.

Open Embedded IDEs: Ardunio IDE, familiarization and setting up for NodeMCU/ESP8266, Enabling libraries for application development.

Programming: Overview of Arduino programming and interfacing

(ii) Sensors, Actuators and its Interfacing :

Sensors & Actuators: The principle of Sensing & Actuation, The sensors for IoT Applications, The operating principles of sensors & Actuators, Analog & digital sensors.

The interfacing principles: Analog to Digital Converters, Sampling theory, ADC Classification, Digital to Analog converters.

Protocols and its designs: I2C,SPI and CAN, Modern sensors interfacing with bus protocols.

Interfacing Sensors-Actuators: Interfacing digital and analog sensors with NodeMCU, Interfacing Actuators with NodeMCU

(iii) IoT - The Networking & Protocols :

Overview: Network layer architecture, communication model, Introduction to Application layer protocols - http, https, telnet, ftp, Connection oriented vs Connection less protocols, Basics of IP Addressing.

The IoT application protocols- MQTT, COAP, Its Applications.

IoT physical layer connectivity solutions:WiFi, Bluetooth, Zigbee, Sub1Ghz

Connecting IoT devices using IPv4 and IPv6 protocol.

(iv) Webserver Basics for IoT

Web servers: Socket and client basics, http, https servers, Web sockets

Apache servers- Installation & familiarization, Configuring and personalizing web servers.

Webserver -Tools, scripts & Languages: HTML basics- personalizing websites, creating buttons and text boxes on web pages. REST services, GET & POST methods, overview of CSS, JSS, PHP for modern web servers.

Embedded Webserver localisation: Intranet vs Internet access, Development of local webserver using NodeMCU for remote monitoring, development of remote webserver for actuator application. Developing Embedded client & server model with NodeMCU.

MQTT servers: MQTT broker, client basics, publishing and subscribing data, Publish and subscribe using open brokers.

(v) The IoT Database Management & Cloud connectivity - Public & Private:

Database management: MySQL, MySQL database creation, creation of remote and its database access. NoSQL based tools and its application.

Overview of cloud: Cloud computing introduction, functioning of cloud computing, cloud architecture, cloud storage and services, Industrial applications.

Discovery of Private and Hybrid Clouds- Introduction- Objectives, need for Privacy- Defining a private cloud- Public, Private, and Hybrid Clouds – A Comparison, Examining the Economics of the private cloud- Assessing capital expenditures- Vendor Private Cloud Offering.

IoT cloud services: Private and public cloud for IoT, working principle, Features and comparisons.

IoT cloud case studies: Thing speak cloud service, pushing data to thing speak from NodeMCU, developing smart environment monitoring and update to Thingspeak or open cloud.

(vi) Security for Next Generation IoT, IIoT

Current Security & privacy Issues: Password Complexity, Account Enumeration, Secure Communication, Hardware / OTA - Over the Air communication, Cloud server security, IoT Privacy, IoT Ethics and Legal issues

Penetration of Modern Technologies: Introduction to Industrial IoT, Security and privacy issues.

2.15.7. Practical/Use-cases

1. IoT – Networking and Protocols
   a. Familiarization of Network Devices in Detail.
   b. Familiarization of network IP and its configuration, classification.
   c. Connect the computers in Local Area Network and configure IP, identify basic network command and Network configuration commands.
   d. Setup WAN Connections
   e. Interpreting Ping, ARP and Trace route Output
2. Use of IoT in Automated Hydroponics System

   The case study based on use of IoT in automated Hydroponics System is to be discussed.
3. Familiarization of Arduino for NodeMCU
   a. This use case will be used for familiarizing the library and the board setup of NodeMCU using Arduino IDE.
   b. This use case will help to understand the GPIO, serial peripherals of NodeMCU. GPIO will tested in two different modes, Input - Button and LED - output mode.

      Interfacing Light Dependent Resistor (LDR) and LED, displaying automatic night lamp
   c. This use case will help to understand ADC peripheral and how to read analog data from sensors.

      Interfacing Temperature Sensor (LM35) and/or humidity sensor (e.g. DHT11)

      Interfacing Liquid Crystal Display (LCD) – display data generated by sensor on LCD
   d. This case study will demonstrate how to provide local display unit with Arduino micro controller. use suitable libraries for implementing this case studies.

2.15.8. Reference Books/Study Material

1. Macro Schwartz, Macro Schwartz, "Internet of Things with ESP8266", Open Home Automation.
2. Arshdeep Bagha and Vijay Madisetti, "Internet of Things- A Hands-on Approach" Universities Press, 2014.

3. David Hanes, Gonzalo Salgueiro, and Patrick Grossetete "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things"
4. Michael Margolis, "Arduino Cookbook", Oreilly, 2011
5. Catalin Batrinu "ESP8266 Home Automation Projects", Packt

2.16. Module: A10.4-R5-Internet of Things using Raspberry Pi

2.16.1. Introduction

The module is designed to make students understand the basics of Single Board Computer (SBC) specifically Raspberry Pi. The purpose is for installation, configuring and using Raspberry Pi in different verticals in the connected world of Internet of Things (IoT).

The genesis of this module lies around open source hardware/software. The file system and other basics of Linux operating system is discussed with respect to Raspberry Pi, along with installing and configuring new software. Raspberry host bundle of open source software and are being discussed in this module such as python programming language, interfacing hardware (GPIO programming) through C-language using wiringPi library. Visual programming editor Node-RED makes easy for novice to expert level programmer to interface hardware using easy flow based programming.

This module provides the theoretical and practical aspects of installing different software on Raspberry Pialong with interfacing sensors, storing and/or publishing data over Cloud. Configuring software to make web server run on Raspberry Pi.

2.16.2. Objective

After completing the module, the incumbent will be able to:

i. Know the history, uses and applications of Single Board Computer (SBC) - *Raspberry Pi*

ii. Install and Configure operating system on Raspberry Pi

iii. Know basics of Linux operating system and its file system

iv. Understand basic Linux shell commands to install new hardware and/or software

v. Write GPIO based programs using embedded 'C' Language and Python Language

vi. Understand WiringPi and BCM pinout

vii. Interface sensors with Raspberry Pi

viii. Visual programming/ flow-based programming in Node-RED

ix. Develop IoT applications using Raspberry Pi as central gateway connecting to Cloud.

2.16.3. Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.16.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. Introduction to Single Board Computer – Raspberry Piand other target platforms	6	9	i. Understand the need and use of Single Board Computer-Raspberry Pi ii. Know the uses of Raspberry Pi in IoT ecosystem iii. Comparing available SBCs in the market
2. Configuring and Managing Raspberry Pi	6	9	i. Select appropriate Raspberry Pi and its accessories ii. Operating System distribution- NOOBS, Raspbian iii. Uses of raspi-config command iv. Configuring Network- wired, wireless.
3. Linux Operating System Basics	10	15	i. Linux file system ii. Writing shell scripts iii. Use of pipes, redirection
4. Hardware interfacing - GPIO programming	14	21	i. GPIO pins ii. WiringPi, BCM pinout iii. Controlling hardware – input/output iv. Python language basics v. Python lists and dictionaries vi. Web access from Python

5. Raspberry Pi based IoT application use-cases	12	18	i. Configuring web server on Raspberry Pi ii. Controlling GPIO pins from web browser iii. Display sensor values on web page iv. Configure Apache-MySQL-PHP v. Pushing data to public and/or private web server. vi. Programming with Node-RED

2.16.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction to Single Board Computer – Raspberry Pi	15
2. Configuring and Managing Raspberry Pi	15
3. Linux Operating System Basics	20
4. Hardware interfacing - GPIO programming	25
5. Raspberry Pi based IoT application use-cases	25
Total	100

2.16.6. Detailed Syllabus

(i) Introduction to Single Board Computer – Raspberry Piand programming language Python

Introduction –Single Board Computer (SBC) History, Architecture, working, characteristics, applications/ use-cases, Introduction to SoC.

Introduction to programming through Python:

Python Basics – Python IDE – IDLE, variables, input/output, operators, strings, control statements, loops, functions, Modules, Packages.

Python List and Dictionaries – creating, accessing, iterating, enumerating, sorting.

(ii) Configuring and Managing Raspberry Pi

Understand Raspberry Pi family - Selecting the model of Raspberry Pi, power supply, operating system distribution- NOOBS, raspbain, preparing operating system on SD-card.

Using raspi-config command –change password, boot options, configure camera, etc.

Networking – connecting to wired or wireless network

(iii) Linux Operating System Basics

Introduction –using Terminal to access File system, creating, moving, deleting files/folders, Privileges/file permissions, ownership, apt-get, pip

Shell scripting – understanding and writing shell scripts, running scripts/command in background, creating aliases, pipes, running program or script automatically - on startup, as a service, at regular intervals.

(iv) Hardware interfacing - GPIO programming

Introduction–General Purpose Input Output(GPIO) pins, understanding WiringPi, BCM pinout, classification of pins- I2C, SPI, UART, digital/PWM

Controlling Hardware – Connecting LED, Buzzer, DC Motor, Digital Inputs-button/push switch, toggling, debouncing, keypad, etc. Interfacing sensors-light, temperature, humidity, gases, etc. LCD interfacing.

WiringPi – programming digital I/O's using WiringPi (C language) library. Arduino-styled programming for Raspberry Pi.

Advanced programming using Python– file handling, making web Requests from python, running Linux commands from python

Python packages of Interest for IoT – JSON, XML, HTTPLib & URLLib

(v) Raspberry Pi based IoT application use-cases

Web Server– simple python web server e.g. bottle, for controlling GPIO outputs through web.

Display sensor readings on a web page.

Configuring Apache-MySQL-PHP stack, to install WordPress.

Sending data to public and/or private web server.

Introduction to Node-RED – Using Node Red to make MQTT dashboard

2.16.7. Use-case for building IoT based application Using Raspberry Pi

i. Interfacing Light Emitting Diode(LED) and switch/button with Raspberry Pi:

This use case will familiarize the Raspberry Pi - GPIO pins and control the pins from command and Python program.

ii. Interfacing Temperature Sensor(LM35) and/or humidity sensor (e.g. DHT11)

This use case will display the value of sensor on the webpage hosted on web server configured on Raspberry Pi.

iii. IoT based Weather Monitoring Station

This use-case will help to understand the working of Weather Monitoring Station which collect data of environmental conditions such as pressure, temperature, pressure, humidity and light from multiple end nodes. Raspberry Pi collects the data send by these end nodes and further aggregates and analyzes.

iv. Smart Lighting / Home Automation

This case study will demonstrate controlling lights using MQTT and/or REST services.

v. Smart Parking

This use-case will demonstrate smart Parking using ultrasonic sensor. The ultrasonic sensor on the roof of parking area will send the occupancy status to central server-Raspberry Pi. The dashboard running on Raspberry Pi will display the complete occupancy status of parking lot and/or publish the same status on Cloud.

vi. Smart Irrigation

This use-case will demonstrate smart irrigation using soil moisture sensors. The soil moisture sensor determines the amount of moisture in the soil and release the flow of water. The water flow in pipes used for irrigation is controlled using solenoid valves. When moisture level crosses threshold value, valve is opened to release flow of water. The moisture level, solenoid valve operation(on/off) is stored and analyzed in Raspberry Pi.

2.16.8. Reference Books/Study Material

1. Simon Monk, "Raspberry Pi - Cookbook", 2nd Edition, Oreilly 2017
2. Maneesh Rao "Internet of Things with Raspberry Pi 3 : Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects" Packt
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things- A Hands-on Approach" Universities Press, 2014
4. Sai Yamanoor and Srihari Yamanoor, "Python Programming with Raspberry Pi", Packt

5. From The makers of The MagPi, "The official Raspberry Pi Projects Book volume 3", link: https://www.raspberrypi.org/magpi-issues/Projects_Book_v3.pdf

2.17. Module: A9.5-R5 –Artificial Intelligence Concepts and R Programming

2.17.1. Introduction

Artificial Intelligence is the intelligence exhibited by machines or software. The application areas of artificial intelligence are very vast and so this is a field of study which is gaining importance day by day. This branch of engineering emphasizes on creating intelligent machines that work and react like humans. There are different dimensions for artificial intelligence, in which the decision taking capacity is most important.

2.17.2. Objective

At the end of the course the students will be able to

i. Identify the scope and limits of the Artificial Intelligence (AI) field.
ii. Analyze the application areas of Artificial Intelligence.
iii. Explore data, process it and make it ready for developing AI based systems.
iv. Apply R Programming for data preparation, data exploration& visualization
v. Apply Probability and Statistics for solving problems in real life.
vi. Apply R programming tool to obtain results of statistical data analysis problems.

2.17.3. Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.17.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives (Learner will learn after completion of unit)
1. Introduction to Artificial Intelligence	6	4	i. Describe the building blocks of AI Systems. ii. List the environment and goals of agent-based systems and draw the design of an Agent.
2. Applciations of AI	4	6	i. Identify the suitability of applying AI as a solution, based on context of applications.

3. Data Preparation and Machine Learning Basics	18	30	i. Grab raw data, clean it and make it ready for building machine learning models. ii. Identify the suitable task to be performed on data for useful model development. iii. Apply suitable algorithm on the data to develop models. iv. Use suitable metrics to analyze the performance of ML models.
4. R Programming & Statistical Data Analysis	20	32	i. Write R programs and use its various data structures for data preparation and exploration. ii. Do data visualization using R. iii. Solve problems involving probability and do statistical data analysis using statistics and probability distribution methods.
Total	48	72	

2.17.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction to Artificial Intelligence	10
2. Applciations of AI	10
3. Data Preparation and Machine Learning Basics	40
4. R Programming& Statistical Data Analysis	40
Total	100

2.17.6. Detailed Syllabus

(i) Introduction To Artificial Intelligence

Introduction to Artificial Intelligence (AI), history of AI. Advantages of AI, need for AI for modern applications, Intelligent agents, structure of Agents, agent program: goal-based agents, utility-based agent, learning agents, agent

environment, multi agent systems, components of intelligence. Foundations of AI based Systems.

Introduction to Business Intelligence, Business Analytics, Data, Information, how information hierarchy can be improved/introduced, understanding Business Analytics, Introduction to OLAP, OLTP, data mining and data warehouse. Difference between OLAP and OLTP. Use of AI in data analytics.

(ii) Applications of AI

Applications of AI, health care sector, finance sector, smart cars, devices and homes, travel and navigations, entertainment, security, automation, automobile industry.

(iii) Data Preparation and Machine Learning Basics

Learning Systems. Supervised and Unsupervised Learning. Tasks performed by Machine Learning Algorithms – Classification, Regression, Clustering, Association rule Mining. Linear Regression, K-Nearest Neighbor Classifier, K-Means Algorithm. Performance evaluation metrics of machine learning algorithms- Accuracy Score, Confusion Matrix, Root Mean Squared Error.

(iv) R Programming

R Programming: Basics - Vectors, Factors, Lists, Matrices, Arrays, Data Frames, Reading data.

Data visualization –barplot, pie, scatterplot, histogram, scatter matrix.

(v) Statistical Data Analysis

Statistical data analysis –Summary Statistics, Correlation and Regression, Probability distributions- Normal distribution, Poisson distribution, Binomial distribution

Types of data- Structured, Unstructured and Semi structured data.

2.17.7. Reference Books/Study Material

1) R for Everyone By Jared P. Lander
2) Artificial Intelligence- Reshaping Life and Business by Prabhath Kumar
3) Introduction to Artificial Intelligence and Experts System, by Patterson Dan, W., PHI
4) Introduction to Artificial Intelligence, Eugene Chaniak, Drew McDermott, Pearson
5) Artificial Intelligence a Modern Approach, by Peter Novig, S. J. Russel, Pearson
6) R for Data Science, Hardly Wickham, Garrett Grolemund, O'Reilly

2.18. Module: A10.5-R5-Machine Learning Using Python

2.18.1. Introduction

The course would cover the spectrum of data analytics, machine learning, deep learning, natural language processing and computer vision. The student would dive straight into data analytics and applied machine learning and deep learning algorithms.

2.18.2. Objective

At the end of the course the students will be able to

i. Solve real world problems through machine learning implementation leading to predictions.

ii. Understand various learning models, methods and applications under supervised and unsupervised learning.

iii. Use NLTK Library which helps in text analytics.

2.18.3. Duration

120 Hours - (Theory: 48 hrs + Practical: 72 hrs)

2.18.4. Outline of Module

Module Unit	Duration(Theory) in Hours	Duration (Practical) in Hours	Learning Objectives(Learner will learn after completion of unit)
1. Advanced Python	14	21	i. Scientific computing and data analysis by understanding multi-dimensional arrays, data frames and analysis functions. ii. Make various types of Graphs and Plots using Python Graphical libraries.
2. Machine Learning	16	24	i. Solve problems through machine learning implementations leading to predictions.

			ii. Learn the evaluation and accuracy of various algorithms.
3. Computer Vision	6	9	i. Write programs using machine learning algorithms in OpenCV for detection and recognition of images.
4. Deep Learning	8	12	i. Learn to train and implement deep learning algorithms. ii. Understand the implementation of AI through real world examples of images.
5. Natural Language Processing	4	6	i. Understand the concepts of NLP and process linguistic data using the popular algorithms.
Total	48	72	

2.18.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Advanced Python	32
2. Machine Learning	36
3. Deep Learning	12
4. Computer Vision	10
5. Natural Language Processing	10
6. Total	100

2.18.6. Detailed Syllabus

(i) Advanced Python

Overview of Python language, Programming Constructs, Data Structures like lists, dictionaries, tuples, sequences and their manipulations. Python Functions.

Modules and Packages, Exception Handling, NumPy Library, Broadcasting and numpy functions. Pandas Library, working with dataframes, loading csv, manipulating dataframes, Aggregation functions, Analysis. Visualization using matplotlib and Seaborn.

(ii) Machine Learning

Categories of ML, Supervised, Unsupervised, Reinforcement, Semi-Supervised. Supervised Learning Models, Regression, Classification, Naive Bayes, Support Vector Machines, Decision Trees, K-nearest Neighbours, Ensemble Methods of Classification, Machine Learning Evaluation Metrics, Cross Validation.

(iii) Computer Vision

Introduction to Computer Vision, Face Recognition and Detection with OpenCV, Face Recognisers, Training data, Prediction.

(iv) Deep Learning

Artificial Neural Networks and Model, ANN structure, Feed Forward Neural network, Back Propagation, Deep Learning Concepts, Convolution Neural Network (CNN), Neural Network using TensorFlow.

Learning Algorithms, Error correction and Gradient Descent Rules, Perceptron Learning Algorithm.

(v) Natural Language Processing

Basics of text processing, Lexical processing, NLP tasks in syntax, semantics, and pragmatics. Applications like Automatic Summarization, Sentiment Analysis and Text Classification.

2.18.7. Reference Books/Study Material

1. Simon Monk, "Raspberry Pi - Cookbook", 2nd Edition, Oreilly 2017
2. Machine Learning an algorithmic Perspective by Stephen Marshland
3. Programming in Python by Mark Summerfield
4. Learning Python By Mark Lutz, David Ascher
5. Introduction to Machine Learning with python by Andreas C Muller, Sarah Guido
6. Learning OpenCV - Computer Vision with the OpenCV Library by O'Reilly
7. Open CV Essentials by Oscar Deniz Suarez, Noelia Vallez Enano by Packt Publishers

Section 3

Practical Assignments
and
Sample Question Papers

3.1. Module: A1-R5 – Information Technology and Network Basics

3.1.1. Practical Assignments

i. Do the following settings
   a. Display pointer trails
   b. Change the normal pointer of a mouse to another pointer
   c. Set the date advanced by 2 months
   d. Reset the system date & time
   e. Set the system time late by 2 hrs: 40 minutes.
   f. Set the Yesterday date and time in your Operating System.

ii. Do the followings
   a. Interchange the functions of left and right mouse buttons.
   b. Change the wallpaper of your computer and set it to a paint brush file made by you.
   c. Change the screen saver of your computer and change it to 'marquee'
   d. Set your name as the text and wait time should be 2 minutes.

iii. Create the following folders under the specified locations using windows.
   a. NIELIT on desktop
   b. R1 on the c: i.e. root
   c. D2 on desktop
   d. R2 on the c:
   e. Create a folder NIELIT-1 under the D1 folder
   f. Create a folder D2-1 under the D2 folder
   g. Copy this D2-1 folder and paste it under R1 folder.
   h. Delete the folder D2-1 from R1 folder
   i. Create the folder R1-1 under R1 folder
   j. Copy R1-1 folder under the R2 folder
   k. Rename folder R1-1 under R2 folder as 'subfolder of R2'
   l. From the c: copy all files to folder R2
   m. Delete all the files from the folder R2
   n. Recover all the deleted files

iv. Create a document in Word on a topic of your choice. Format the document with various fonts (minimum 10, maximum 12) and margins (minimum 1.5, maximum 3). The document should include

   a. A bulleted or numbered list
   b. A table containing name, address, basic pay, department as column heading
   c. A picture of lion using clip art gallery
   d. An example of word art
   e. A header with student name & date
   f. A footer with pagination

v. Create a document with the text given below and save it as **First**

A Read only Memory is a memory unit that performs the read operation only, it does not have a write capability. This implies that binary information stored in a ROM is made permanent during the hardware production of the unit and cannot be altered by writing different words into it. Whereas a RAM is a general-purpose device whose contents can be altered during the computational process, a ROM is restricted to reading words that are permanently stored within the unit. The binary information to be stored specified by the designer, is then embedded in the unit to form the required interconnection pattern.

Do the following

   a. Count the occurrences of the word "ROM" in the above document.
   b. Replace ROM with Read Only Memory in the entire document
   c. Underline the text Read Only Memory
   d. Make an auto correct entry for ROM and it should be replaced by Read Only
   e. Memory

vi. Use the file First to perform the following operations

   a. Make the first line of document bold.
   b. Make the second line italic.
   c. Underline the third line.
   d. Align the fourth line to center.
   e. Make the font color of first line as red.
   f. Change the font style of fifth line to Arial.
   g. Change the second line to 18 points.
   h. Insert the date & time at the start of document.

vii. Use the document saved earlier and perform the page setting as follows.

   a. Top Margin 1.3"

b. Bottom margin 1.4"
c. Left margin 1.30"
d. Right margin 1.30"
e. Gutter margin 1.2"
f. Header 0.7"
g. Footer 0.7"
h. Paper size executive
i. Orientation landscape

viii. Create a table in word as shown below with following fields.

Roll No	Name	Marks		Total Marks
		Physics	Chemistry	
1.	Ritu	78	88	166
2.	Amit	90	92	182
3.	Rakesh	67	78	145
4.	Rohit	50	50	100
5.	Niti	60	65	125
6.	Garima	89	67	156

ix. Do the followings.

a. In the total marks column, entries should be calculated using formulas and it is the sum of marks in physics and marks in chemistry.
b. Insert a new row at the end of the table and also find grand total using formula.
c. Sort the table based on total marks
d. The date and heading should be center aligned
e. Heading should be in bold and underlined

x. Below is given a letter and some addresses. This letter is to be sent to all these addresses.

User mail merge

Addresses are:

1) Amit, H No 424 sector 8D, Lajpat Nagar, New Delhi

2) Rohit, H No 444, Sector 125C, Chandigarh

3) Jyoti, H NO 550, Sector 16A, Gomti Nagar, Lucknow

The Letter is

To

<<Name>>

<<Address>>

Dear <<Name>>

You are advised to appear for an interview on the <<Date>>at 9:00 A.M with your original documents.

Yours Sincerely

ABC Limited,

Industrial Phase –7, New Delhi.

xi. Make a template for the bio-data with the following format

Bio-Data

Name :

Father's Name :

Date of Birth :

Age :

Address :

Educational Qualification

Sr No Qualification Board Percentage

Work Experience:

xii. Type the following data using spreadsheet tool and save the file as First

A	B	C	D	E
513				
501				
504				
513				
511				
516				
532				
504				
432				
501				
510				
517				
479				
494				
498				

Do the following

(a) Highlight column A and copy it to column C

(b) Sort the data in column C in ascending order

(c) What is the lowest number in the list (use a function)

(d) Copy the data in column A to column E and sort it in descending order

(e) What is the highest number in the list (use a function)

(f) How many numbers in this list are bigger than 500 (use a database function)

(g) How many numbers in column A are between 520 and 540 inclusive

(use a database function),

xiii. Type the following data in spreadsheet and save it as Second.

A	B	C	D
370	70.5		
61166	53.5		
684	65		
449	76.5		
643	70		
1551	71		
616	60.5		
403	51.5		

Do the following

(a) Complete column C for finding product x * y

(b) Find sum of x column at the end of data

(c) Find sum of y column at the end of data

(d) Find sum of x * y column at the end of data

(e) Find sum of x^2

(f) Find sum of y^2

xiv. Enter the following data using spreadsheet tool and save it in Grade

Name	Marks1	Marks2	Marks3	Total	Percentage
Amit	80	70	80		

Renu	70	60	90		
Rajeev	87	89	65		
Munish	76	67	44		
Sanjeev	98	76	78		
Anita	65	76	87		

Do the following.

(a) Compute the total marks and percentage of each student by entering appropriate formula.

(b) Compute the grades based on following criteria

If percentage >= 90 then grade = A

If percentage >= 80 and <90 then grade = B

If percentage >= 70 and <80 then grade = C

If percentage >= 60 and <70 then grade = D

If percentage < 60 then grade = E

(c) Draw a border around the worksheet

(d) Change the font size of heading to 14 points and underline it and hide column c

(e) Increase the width of column A to 15 characters

(f) Right Align the values in column B, C, F

xv. A university maintains a year wise result for four courses and then generates an average report as given below.

Sr. No.	Year	Course1	Course2	Course3	Course4	Average
1	2013	650	675	666	456	
2	2014	600	700	656	765	
3	2015	677	655	765	400	
4	2017	400	400	400	400	

5	2018	560	760	467	737	
Total						

(a) Complete the report to calculate the course wise average in row 6

(b) Provide formula to calculate year wise average in column G

(c) Generate a column chart to compare data.

xvi. A person wants to start a business and he has four schemes to invest money according to profit and years. Find out which scheme is the most profitable using scenario manager.

Investment Amount	Percentage for profit	No. of years
20000	10	6
40000	20	5
14000	30	4
12000	15	5

xvii. A company records the details of total sales (in Rs.) Item and month wise in the following format

Sector	Jan	Feb	March	April
PCs	12000	17000	15000	20000
Laptops	14000	18000	15000	16000
Printers	15000	18000	13000	12000
Scanners	16000	15000	14000	23000

(a) Enter the data using spreadsheet and save it as sector

(b) Using appropriate formula, calculate total sale for each sector

(c) Create a 3-D column chart to show sector wise data for all four months

(d) Create a 3-D pie chart to show sales in Jan in all sectors

xviii. Type the following data and save it in employee file using spreadsheet tool.

Name	Department	Designation	Salary	Address
Anju	TRG	MD	100000	CHD
Amit	TRG	AD	200000	MOHALI
Renu	BILL	MD	300000	CHD
Anita	BILL	AD	20000	MOHALI
Shivani	S/W	MD	10000	CHD

Do the following

a) Count the total number of employees department wise

b) List the name of employees whose designation is 'MD'

c) List the name and department of employees whose address is Chandigarh

d) List the name of employees whose salary is greater than 5000

e) List the Address of employees whose department is 'TRG'

xix. Set up a new presentation of three slides.

1. **On the master slide:**

a) Apply a theme of your choice to the master slide.

b) Include an automated page number in the bottom left of the footer

c) Place a clipart image of a pen or pencil as a logo in the top right corner.

2. **Add the following text in slide 1**

   Heading: Hothouse Design (Red, 25 point, Arial font, Left Aligned)

3. **On the second slide type the following text where font="Arial" size="20"**

   Earlier in the year we started to analyze the sales profile for the stationery business stream within Hothouse. The areas of initial investigation were selected as the management of our sales team, our customer base, website effectiveness, and an analysis of our most successful product lines.

4. **On the third slide where font="Arial" size="20"**

   Possible timings for these bonuses include:

   - Weekly
   - Monthly

- Quarterly
- Annually.

xx. Set up a new presentation consisting of 3 slides

1. **On the first slide**

a) Type Telephone Analysis for the title, using any word Art option.

b) Insert any appropriate image below the title and apply an Animation effect to the image.

c) Insert a Sound from the Clip Organizer.

2. **On the second slide:**

a) **create a pie chart** using the following data:

Call type	Minutes
International	1640
Peak Rate	7842
Cheap Rate	1543
Internal	16805

b) Insert the chart title "Telephone Analysis".

3. **On the third slide:**

Enter the following text: (font style="Times new roman", font size= "24")

As you can see that our vast majority of calls are internal. These figures are the average values per day for all departments, using a monitoring period of 2 weeks.

4. Use the same transitional effect between each slide.

5. Play a slide show.

xxi. Set up a new presentation consisting of 4 slides

1. **On the first slide**

d) Include an automated slide number left aligned.

e) Enter the heading **New Website**.

f) Enter the sub heading **Proposed Web Pages.**

g) Insert any appropriate image below the sub heading and apply an Animation effect to the image.

h) Create the following hyperlink http://www.google.com on the image

i) Insert a Sound from the Clip Organizer.

2. **On the second slide:**

c) **create a pie chart** using the following data:

Type of Trip	2008 Dives
Go deep	2512
Wreck Week	12680
Shark Experience	940
Cave Dives	353

3. **On the third slide:**

Enter the following text: (font style=times new roman, font size= 24)

During the development of this new website, we have realized that the proposed design brief may need to be amended.

4. **On the fourth slide:**

Insert a Movie from a File on Your Computer

5. Use a picture as background in all your slides.

6. Use the same transitional effect between each slide.

7. Play a slide show.

xxii. Write a paragraph on each of followings.

a) List five popular Browser Names.

b) What are Cookies, and Why Should I Enable Them?

c) How to delete History in Web Browser?

xxiii. Write a paragraph on each of followings.

a) What is difference between IPv4 and IPv6 Address?

b) How to set IP IPv4 address in your computer?

c) What is gateway?

xxiv. Write a paragraph on each of followings.

a) What is MPIN?

b) What are the requirements for using UPI App?

c) Explain the Work of BHIM App. How to install in Mobile.

d) What is the difference between RTGS and IMPS Service?

xxv. Write a paragraph on each of followings.

a) What is IOT; List the name of some IOT related device which we use in our daily life.

b) What is Big Data Analytics? Where it is used.

c) What is Robotics;

3.1.2. Sample Question Paper

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS TOTAL MARKS: 100

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1.1. The gutter margin is added to

(a) Left Margin when printing

(b) Right Margin when printing

(c) Left and Top when printing

(d) Top and Bottom for printing

1.2.The following view is not available in the View Tab for slides

(a) Slide Sorter

(b) Notes Page

(c) Print View

(d) Reading View

1.3. The printer on which output is printed by light beam and particles of ink

a) Character Printer
b) Laser Printer
c) Beam Printer
d) Line Printer

1.4.The symbol used to make a cell address as absolute

(a) #
(b) $
(c) %
(d) !

1.5.Which option help us to send same letter to different persons

(a) Mail Merge
(b) Macros
(c) Multiple Letter
(d) Template

1.6. The option used to join number of cells and place the contents in the middle of the joined cell

(a) Format Cell dialog box and click merge cells
(b) Format cell dialog box click merge cell and then center
(c) Right click the selected cells select format cell and merge and center
(d) Formatting Tool Bar and click merge and center

1.7. The main page of a website is called

(a) Main Page
(b) Home Page
(c) Index Page
(d) Bookmark

1.8.Which of the following does not have any limit on the money transfer digitally?

(a) IMPS

(b) NEFT

(c) UPI

(d) RTGS

1.9. Which of the following is not a search engine?

(a) Yahoo

(b) Bing

(c) Google

(d) Windows

1.10. When a Test Box object is deleted from a slide

(a) The object is deleted but a text box and text is left on the slide

(b) The text box and text both are deleted.

(c) The text box is deleted and the text is pasted on the slide

(d) The text is deleted and the text box is pasted

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1. Freeware is software that is available at no monetary cost.

2.2. CTRL + H key is used to hide the window.

2.3. Maximum number of lines supported by Drop Cap is 10.

2.4. Now() function is used to get current date only.

2.5. Sort and Filter option is available in the Home Tab Only.

2.6. The text of a cell can be moved to separate cells.

2.7. Animation does not exist in slide layout.

2.8. Hyperlinks cannot be inserted in slides.

2.9. IMPS enables user to transfer money 24x7.

2.10. Hacking a computer is illegal and punishable by law.

3. Match the words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1. Linux	1) F7
3.2. To go to first slide of the presentation	2) BCC
3.3. Open Source Software	3) Operating System
3.4. A security and privacy threat	4) Placeholders
3.5. A collection of worksheets	5) CTRL+HOME
3.6. Short cut key to check spelling and grammar error	6) Formula Bar
3.7. The objects on a slide that holds text	7) Linux
3.8. Copy formatting from one place and apply to another	8) Worm
3.9. To keep addresses hidden while copying mail	9) Format Painter
3.10. The actual contents of the cell are shown in	10) CTRL + PgUp
	11) Workbook

4. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

(a) Encryption	(b)CTRL + Space	(c) Flip cart	(d) Cookies
(e) Basic Code	(f) ESC	(g) Name Box	(h) CTRL + M
(i) 63	(j) MS SQL	(k) Formula Bar	(l) RAM

4.1	The _____ loses its contents when the power is switch off.
4.2	_____ is an e-commerce website
4.3	The current cell address is displayed in the _____
4.4	. _____ is scrambling of text to secure it during transmission.
4.5	The maximum number of columns supported by a table in a document_____
4.6	_____ .is the key used to insert new slide in a presentation.
4.7	_____ is the information stored on a user's computer when he visits a website
4.8	A slide show can be stopped by pressing_____ key.
4.9	_____ is a language used to build macros in a document
4.10	_____ is the short cut key to highlight entire column

PART TWO

(Answer any FOUR questions)

5.

(a) Describe the AutoCorrect Feature with example.

(b) What is the difference between primary memory and secondary memory? Briefly explain various types of primary and secondary storage devices.

(c) Write a short note on slide Handout Master.

(4+8+3)

6.

(a) Define Network Topology. Explain the various types of topologies.

(b) Define cell referencing. Explain different types of cell referencing with example.

(7+8)

7.

(a) Explain in detail the Bookmark and Hyperlinks feature.

(b) What are the advantages of presentation package? Give example of one such package. How can we create a transition and animation in a presentation?

(7+8)

8

(a) Briefly explain the different types of instant messaging services available.

(b) What are the different types of charts options available? Briefly explain the procedure to create a pie chart.

(c) Define e-mail. Explain the advantages and disadvantages of e-mail.

(5+5+5)

9. Briefly explain the following (Any three):

(a) Cache Memory

(b) Internet of Things

(c) Compiler and Interpreter

(d) Internet Banking

(e) Netiquette

(5*3=15)

3.2. Module: A2-R5 – Web Designing and Publishing

3.2.1. Practical Assignments

i. Create an HTML file (e.g. first_page.html) that specifies a page that contains a heading and two paragraphs of text. As the texts in the heading and paragraphs you can use any texts you like

ii. Write a HTML program to design a form which should allow to enter your personal data (Hint: make use of text field, password field, e-mail, lists, radio buttons, checkboxes, submit button)

iii. Write html code to generate following output.

1.Coffee

2.Tea

3.Black Tea

4.Green Tea

5.Milk

iv. Write HTML Code to demonstrate the use of Anchor Tag for the Following: -

1. Creating a web link that opens in a new window.
2. Creating a web link that opens in the same window.
3. C Reference within the same html document.
4. Reference to some image.
5. Making an image a hyperlink to display second image

v. Create an html page with following specifications

Title should be about my City. Place your City name at the top of the page in large text and in blue color. Add names of landmarks in your city each in a different color, style and typeface. One of the landmarks, your college name should be blinking. Add scrolling text with a message of your choice

vi. Create an html page with 7 separate lines in different colors. State color of each line in its text.

vii. Create an html page containing the polynomial expression as follows:

$a^0 + a^1x + a^2x^2 + a^3x^3$

viii. Write a HTML code to generate following output

<table>
<tr><td colspan="3">First Frame: Name and address</td></tr>
<tr><td colspan="2">Second frame
Bulleted list of qualifications</td><td>Third frame
Links to favourite sites</td></tr>
<tr><td>Fourth frame
Scrolling message</td><td>Fifth frame
Blinking reminders</td><td>Sixth frame
Image</td></tr>
</table>

ix. Create an html page with red background with a message "warning" in large size blinking. Add scrolling text "read the message" below it.

x. Write a HTML page to print Hello world in bold & Italic Form.

xi. Design a HTML page to display a picture. The picture should be removed from the screen after a mouse click on the picture.

xii. Create a HTML Document with JavaScript code that has three Textboxes and a button. The details should be accepted using textboxes are principal, rate of interest, and duration in years. When user clicks the OK Button a message box appears showing the simple interest of principal amount.

xiii. Write a HTML Script to insert a hyperlink. Create a hyperlink in html which when clicked links to www.google.com in a new window

xiv. Create a HTML file which displays three images at LEFT, RIGHT and CENTER respectively in the browser.

xv. Create table with ROWSPAN and COLSPAN attribute of TABLE in HTML(Prepare timetable of your class). Include CELLSPACING & CELL PADDING.

xvi. Create a web page, divide the web page into four frames. In one frame create three links that will display different HTML forms in the remaining three frames respectively. Write a program in Java Script to print factorial.

xvii. With CSS use the shorthand background property to set background image to eg."xyz.png", show it once, in the top right corner.

xviii. Write a program in javascript to generate series of prime numbers.

xix. `Write a JavaScript program to display the current day and time in the following format.
Sample Output:Today is: Tuesday.
Current time is: 10 PM: 30:38

xx. Write a program to sum and multiply of two numbers using JavaScript.

xxi. Write a program to redirect, popup and print function in JavaScript.

xxii. Create your first "Hello world" application in AngularJS.

xxiii. HTML page which has a title of "Event Registration" and has references to important libraries such as Bootstrap, Jquery and Angular.

xxiv. Write a code to display the words "AngularJS" in both text format and in a text box when the page is viewed in the browser.

xxv. Create a sample form program that collects the first name, last name, email, user id, password and confirms password from the user. All the inputs are mandatory and email address entered should be in correct format. Also, the values entered in the password and confirm password textboxes should be the same. After validating using JavaScript, in output display proper error messages in red color just next to the textbox where there is an error.

3.2.2. Sample Question Paper

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

Time: 3 Hrs **M. Marks: 100**

(PART ONE:40 marks, PART TWO:60 marks)

PART-ONE

(Answer all Questions. Each question carries ONE mark)

1. Answer the following multiple-choice questions **1x10=10**

Note: For each question, four choices are given, Choose the most appropriate option.

1.1 Text within STRONG tag is displayed as _____

(a) Indented
(b) Italic
(c) list
(d) Bold

1.2 TD tag is used for _____

(a) Table row
(b) Table Records
(c) Table heading
(d) Row Heading

1.3 The extension of JavaScript file is

(a) .html
(b) .js
(c) .css
(d) .ajs

1.4 "Yahoo", "Infoseek" and "Lycos" are _____?

(a) Search Engines
(b) News groups
(c) Browsers
(d) None of the above

1.5 What is a search engine?

(a) Program that search documents
(b) A program that searches engines for specified keywords
(c) A machinery engine that search data
(d) A hardware component

1.6 HTML document start and end with which tag pairs?

(a) HTML
(b) Web
(c) Body
(d) Head

1.7 <HR> tag is used for

(a) Line Break
(b) Horizontal row
(c) Heading
(d) Underline

1.8 What is the full form of HTML?

(a) Hyphenation text markup language

(b) Hyper text markup language

(c) Hyper text marking language

(d) Hyphenation test marking language

1.9 What does the CSS stand for?

(a) Creating Style Sheets

(b) Cascading Style Sheets

(c) Computer Style Sheets

(d) Colorful Style Sheets

1.10 What is the full form of HTTP?

(a) Hyphenation text test program

(b) Hypertext transfer protocol

(c) Hypertext transfer package

(d) None of the above

2) Fill in the blanks with appropriate words given below:

1x10=10

a) <select>	b) <p>	c) both Header & Body	d) loosely
e) ol	(f) <script>	(g) <input type="checkbox"/>	h) Create Flash movies
i) Header	j) var obj = {};	k) <input type="checkbox1" />	l) Selects the color at the cursor

2.1 _____ is a html list that lists the items with numbers.

2.2 Correct HTML for making a checkbox is _____.

2.3 Correct HTML for making a drop-down list is _____.

2.4 Inside HTML _____ tag we put the JavaScript code.

2.5 We cannot _____ with Photoshop.

2.6 Eyedropper tool _____.

2.7 _____start a new paragraph.

2.8 SCRIPT tag can be placed within _____.

2.9 JavaScript is _____ typed language.

2.10 With _____ you create a new object in JavaScript.

3) State which of the following is True or False: - 1x10=10

3.1 The extension of CSS file is .cs.

3.2 The use of Forms in HTML to collect user's input.

3.3 Using< P> tag will end the current paragraph.

3.4 TITLE tag can appear inside body tag.

3.5 In Photoshop "B" is the keyboard shortcut for Blur

3.6 Clicking and holding the mouse button on a toolbar icon Shows additional tools related to that tool in photo editor.

3.7 JavaScript can be used to validate input data in HTML forms before sending the content to the server.

3.8 HTML tag for the biggest heading <h6>

3.9 HTML for creating a hyperlink:

<a url="http://www.google.com">Google.com</a>

3.10 <table><tr><tt>are all <table> tags?

4) Match the following: 1x10=10

4.1	FTP	1. Forms
4.2	M	2. File Transfer Protocol
4.3	H1….H6	3. Case Sensitive
4.4	TITLE tag must be within	4. Hyper Text Transfer Protocol
4.5	<TD>	5. Cascading Style Sheet

4.6	collect user's input	6. Shows additional tools related to that tool
4.7	CSS	7. Marquee Tool
4.8	JavaScript	8. Head
4.9	HTTP	9. Cascading System file
4.10	Clicking and holding the mouse button on a toolbar icon	10. Headings
		11. File transmission Protocol
		12. Table Data

PART TWO

(Answer any FOUR Questions)

Q5.

a) What is Website? What are different types of Websites?

b) What is a Responsive Website?

c) What is browser? Name any three browsers.

(5+5+5)

Q6.

a) What are rowspan and colspan attributes? Explain with example.

b) What is the difference between Ordered list and unordered list. Explain with example.

c) Write a JavaScript function to find sum of first 20 even natural numbers. (4+5+6)

Q7.

a) Explain three different ways to implement CSS on web page.

b) Explain different types of Selectors in CSS with example. (7+8)

Q8.

a) What is AngularJs? How does it work with HTML?

b) Explain any three Selection Tools in Photo Editor with their significance and properties.

(7+8)

Q9.

a) What are the techniques to use W3.CSS Framework?

b) What are the classes used for creating responsive Design in W3.CSS framework?

(8+7)

3.3. Module: A3-R5 – Programming and Problem Solving Through Python

3.3.1. Practical Assignments

i. Write a program to print all Armstrong numbers in a given range. Note: An Armstrong number is a number whose sum of cubes of digits is equal to the number itself. E.g. 370=33+73+03

ii. Write a function to obtain sum n terms of the following series for any positive integer value of X

X +X3 /3! +X5 /5! ! +X7 /7! + …

iii. Write a function to obtain sum n terms of the following series for any positive integer value of X

1+x/1!+x2/2!+x3/3!+…

iv. Write a program to multiply two numbers by repeated addition e.g.

6*7 = 6+6+6+6+6+6+6

v. Write a program to compute the wages of a daily laborer as per the following rules :-

Hours Worked Rate Applicable Upto first 8 hrs Rs100/-

a) For next 4 hrs Rs30/- per hr extra

b) For next 4 hrs Rs40/- per hr extra

c) For next 4 hrs Rs50/- per hr extra

d) For rest Rs60/- per hr extra

vi. Accept the name of the labourer and no. of hours worked. Calculate and display the wages. The program should run for N number of labourers as specified by the user.

vii. Write a function that takes a string as parameter and returns a string with every successive repetitive character replaced by? e.g. school may become school.

viii. Write a program that takes in a sentence as input and displays the number of words, number of capital letters, no. of small letters and number of special symbols.

ix. Write a Python program that takes list of numbers as input from the user and produces a cumulative list where each element in the list at any position n is sum of all elements at positions upto n-1.

x. Write a program which takes list of numbers as input and finds:

a) The largest number in the list

b) The smallest number in the list

c) Product of all the items in the list

xi. Write a Python function that takes two lists and returns True if they have at least one common item.

xii. Write a Python program to combine two dictionary adding values for common keys.

d1 = {'a': 100, 'b': 200, 'c':300}
d2 = {'a': 300, 'b': 200, 'd':400}
Sample output: Counter ({'a': 400, 'b': 400, 'd': 400, 'c': 300})

xiii. Write a program that takes sentence as input from the user and computes the frequency of each letter. Use a variable of dictionary type to maintain and show the frequency of each letter.

xiv. Apply recursive call to do the following:

a) Product of two numbers using repetitive addition

b) Print Fibonacci series upto term n

xv. Write a program to input two numbers as input and compute the greatest common divisor

xvi. Write a function that takes two filenames f1 and f2 as input. The function should read the contents of f1 line by line and write them onto f2.

xvii. Write a function that reads the contents of the file f3.txt and counts the number of alphabets, blank spaces, lowercase letters, number of words starting with a vowel and number of occurrences of a work "hello"".

xviii. Write a program to replace 'a' with 'b', 'b' with 'c',….,'z' with 'a' and similarly for 'A' with 'B','B' with 'C', …., 'Z' with 'A' in a file. The other characters should remain unchanged.

xix. Write a NumPy program to find the most frequent value in an array.

xx. Take two NumPy arrays having two dimensions. Concatenate the arrays on axis 1.

3.3.2. Sample Question Paper

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1 Choose the most appropriate from given options:

1.1The _____ provides pictorial representation of given problem.

(a) Algorithm
(b) Flowchart
(c) Pseudocode
(d) All of these

1.2_____ is a procedure or step by step process for solving a problem.

(a) Algorithm
(b) Flowchart
(c) Pseudocode
(d) All of these

1.3 The _____ symbol is used at the beginning of a flow chart.

(a) Circle
(b) Rectangle
(c) Diamond
(d) None of these

1.4 What will be the output of the following code?

Print type(type(int))

(a) type 'int'
(b) type 'type'
(c) error
(d) 0

1.5 what is the output of the following code?

L=['a','b','c','d']
Print "".join[l]

(a) Error
(b) None
(c) abcd
(d) ['a','b','c','d']

1.6 np.eye() is used for creating:*

(a) Identity Matrix
(b) Upper triangle Matrix
(c) Lower Triangle Matrix
(d) None of the above

1.7 What is the output of the code print (9//2)?

(a) 4.5
(b) 4.0

(c) 4

(d) Error

1.8 What is the output of the following program?

```
i = 0
while i< 3:
print i
i++
print i+1
```

(a) 0 2 1 3 2 4

(b) 0 1 2 3 4 5

(c) Infinite loop

(d) 0 1 2 3

1.9Debugging is used to:

(a) Find errors from the program

(b) Check the functionality of the program

(c) Black box testing

(d) All of the above

1.10 The function which reads one line from standards input and returns it as a string (removing the trailing newline)

(a) raw_input

(b) input

(c) eval

(d) accept

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1 Numpy is a tool for data visualization.

2.2 The break statement is used for exiting from the loop to the statement following the close of the loop.

2.3 The scope rule in Python are summarized as ELGB (enclosed, local, global, built-in).

2.4 Strings in Python are mutable.

2.5 The symbol used for both input and output is

2.6 if list1=[10,20,30], then operation list1*2 returns [20,40,60].

2.7 The symbol used for conditional statement in a flow chart is

2.8 You cannot obtain a value in a dictionary using a key for a single element.

2.9 It is mandatory to have __main__ function in python.

2.10 Python allows you to assign a single value to multiple variables simultaneously.

3. Match words and phrases in column X with the nearest in meaning in column Y.

No.	X	Y
3.1	Data structure used in recursion	1. Numpy
3.2	Function takes a list of lines to be written to file	2. Stack
3.3	The function that yields current position in the file	3. tell()
3.4	The operator used for concatenating two strings	4. write()
3.5	Statement used for error checking	5. writelines()
3.6	The function used to find power of a number	6. Tuple
3.7	Array processing package	7. pow()
3.8	Immutable object	8. exp()
3.9	Key value pair	9. +
3.10	The operator used to calculate remainder after division	10. Assert
		11. Queue

		12. Dictionary
		13. //
		14. %

4. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

A	*	B	Range	C	pass
D	Get	E	Input	F	random
G	@	H	eval	I	list
J	Convert	K	int	L	{ }
M	Continue	N	( )	O	[ ]
P	Module	Q	Dictionary		

4.1	The _____ command is used to take input from the keyboard.
4.2	The _____function is used to convert a string value to int.
4.3	The function used to evaluate the value of a string is _____
4.4	The _____ function takes the parameter filename and the mode during file processing. .
4.5	List structure in python where elements are stored in _____ parenthesis.

4.6	The _____ statement lets the program go through the piece of code without performing any action.
4.7	_____ operator repeats a list for the given number of items.
4.8	_____ is a set of functions you want to include in your application.
4.9	The structure having keys and values is called _____.
4.10	The _____ function generates a sequence of numbers from 1 to n.

PART TWO

(Answer any FOUR questions)

5.

a. Make a flow chart to input any number and find its factorial and print.

b. Explain the role of linker and loader in compilation.

c. Write a flowchart that finds the sum of series:

s=1+x/1!+2x/2!+3x/3!+ upto n terms

d. What is a NumPy array. How they are different from lists?

(5+2+5+3)

6.

a. Write a recursive function to find the sum of digits of a number.

b. Write a program that takes a sentence as input from the user and returns the frequency of each letter. Use a variable of dictionary type to maintain the count.

c. Program to check whether a string is palindrome or not.

(5+5+5)

7

a. Take an array of 2 rows and three columns, populate it and find the transpose.

b. Explain the following with example:

1. LEGB rule
2. Seek() function
3. Tell()
4. String slicing
5. List comprehension

(5+10)

8

a. Write a function that takes data to be stored in the file f1 as interactive input till user responds with nothing as input. Each character taken as input from the user must be capitalized and stored in file f1.

b. Write a function that reads the contents of the file myfile.txt and counts the number of alphabets, lowercase letters, uppercase letters, digits and no of words.

c. Take two NumPy arrays having two dimensions. Concatenate the arrays on axis 1.

(6+6+3)

9

a. Write a recursive function to count the sum of digits of a number

b. Write a program that takes m as an input parameter and creates a list of m lists such that x^{th} list contains first three multiples of x.

c. Store the monthly earnings of a year of a store splitting up the earnings by quarter into a list of lists. Retrieve the earnings of every month in a loop and display the quarter with maximum earnings.

(5+5+5)

3.4. Module: A4-R5 – Internet of Things (IoT) and its Applications

3.4.1. Practical Assignments

(i) Write a program to Blink default Light Emitting Diode(LED) on Arduino board with the delay of 2 sec.

(ii) Write a program to interface LEDs on pin no. 10,11,12,13 and blink alternatively at the delay of 1 sec.

(iii) Write a program to run pattern(s) on LEDs connect at pins 10,11,12,13.

Pattern example:

on, off, off, off off, on off, off off, off, on, off off, off, off, on	on, on, off, off off, on, on, off off, off, on, on

(iv) Write a program to interface buzzer with Arduino board to buzz on/off with the delay of 1sec.

(v) Write a program to interface LED and Buzzer with Arduino board, so that buzzer is put on whenever LED is on and Buzzer is put off when LED is off.

(vi) Write a program to interface Button and LED, so that LED blinks/glow when button is pressed.

(vii) Write a program to interface Button, buzzer and LED, whenever the button is pressed the buzzer gives beep for 100ms and LED status is toggled.

(viii) Write a program to interface LEDs at pins 10,11,12,13 and buttons at pins 7,8. When first time button at pin 7(increment button) is pressed first LED at pin 10 is switched on, when second time button is pressed the next LED at 11 is switched on. Similarly, when the button at pin 8 (decrement button) is pressed the LEDs are switched off sequentially.

(ix) Write a program to interface LEDs at pins 10,11,12,13 and button at pins 7. The press of button changes the pattern of LED glow. (considering four patterns of LED glow)

(x) Write a program to interface Light Dependent Resistor (LDR) and display the values read on the Serial monitor after delay of 2 seconds each.

(xi) Write a program to interface Light Dependent Resistor (LDR) and LED with Arduino board. Whenever there is sufficient light falls on LDR the LED is off and when there is dark around LDR the LED is put on.

(xii) Write a program to interface LEDs at any two PWM pins and exhibit LED fading.

(xiii) Write a program to interface LED at PWM pin and LDR, in such a way that when the light intensity falling on LDR rises the LED glow should be reduced and after a threshold value the LED should be put off. (representing smart street light concept)

(xiv) Write a program to interface LEDs at any two PWM pins and button, to exhibit LED fading at the click of button

(xv) Write a program to interface any analog (pollution) sensor and display the values read on Serial monitor.

(xvi) Write a program to interface LCD with Arduino board and display 'Hello world' on it .

(xvii) Write a program to interface keypad with Arduino board and display the key pressed on Serial monitor.

(xviii) Write a program to interface LCD and keypad with Arduino board and display the key pressed from keypad on LCD.

(xix) Write a program to interface LCD and keypad (4 X 4) , to exhibit the functionality of a basic calculator.

1	**2**	**3**	**4**
5	**6**	**7**	**8**
9	**0**	+	**-**
/	*	**Clear**	**enter**

(xx) Write a program using LCD, LEDs, Buzzer and keypad to simulate a password based security lock system. User enters 4-digit password and if the password is correct buzzer and Green LED is put on. But if the password is incorrect Red LED is put on. After three incorrect attempts Red LED along with buzzer blinks continuously.

(xxi) Write a program to interface LCD and DHT11, displaying the value read from sensor DHT on LCD.

(xxii) Write a program to interface DHT11 or any other temperature sensor, DC Motor, to exhibit a real-life situation that whenever temperature rises above a threshold value the DC motor (representing fan) starts and when temperature falls below a value, the motor stops.

(xxiii) Write a program to interface LCD and Bluetooth module, to exhibit the values received from mobile handset via Bluetooth on LCD.

(xxiv) Write a program to interface LED and Bluetooth module, to switch on the LED if 1 is passed through Bluetooth and switch off the LED if 0 is send.

(xxv) Write a program to interface Relay and Bluetooth module to switch on AC load (5W LED bulb, table lamp, etc.) connected to relay if 1 is passed through Bluetooth and switch off the AC Load if 0 is send.

3.1.1. Sample Question Paper

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1.2. Microcontroller used in Arduino UNO prototyping board is

(a) ATmega328m

(b) ATmega328p

(c) ATmega2560

(d) ATmega356p

1.3.Which of the following is not a main element of IoT?

(a) People

(b) Process

(c) Security

(d) Things

1.4. To easily interface add-on modules with Arduino we can use

(a) General PCB

(b) Connectivity circuit boards

(c) Arduino shields

(d) Other high-end Arduino boards

1.5.Which symbol is used in Arduino to calculate Modulo?

(a) #

(b) $

(c) %

(d) !

1.6. With respect to the body language, the handshake conveys the confidence is

(a) Firm

(b) Limp

(c) Loose

(d) Incomplete knowledge

1.7. Botnet is often used to launch _____ attack

(a) DoS

(b) DDoS

(c) Brute force

(d) Passive

1.8.The IIoT stands for

(a) Indepth Internet of T

(b) Innovative Internet of Things

(c) Industrial Internet of Things

(d) Information Internet of Things

1.9.The default method(s) in Arduino program is/are

(a) Only loop()

(b) only setup()

(c) setup() and loop()

(d) can be either loop() or setup()

1.10. Which of the following communication medium supports highest data rate?

(a) Optical fiber

(b) Wifi

(c) Ethernet

(d) Bluetooth

1.11. Which of the following is not a standard protocol used in IoT domain?

(a) Wifi

(b) Z-wave

(c) Zigbee

(d) LoMe

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.11. The total resistance of resistor is low when connected in series.

2.12. Microprocessor has only processing capability, no serial interface or interrupts are available.

2.13. Capacitor blocks AC and allows DC to pass through.

2.14. Ohms law calculates the power consumed by an electrical appliance.

2.15. IIoT targets applications related to health and fitness.

2.16. Time management is primarily creating an environment conducive to effectiveness.

2.17. Arduino program statement for generating one second delay is - *delay(100);*

2.18. Stress is an emotional reaction to physical and psychological demands.

2.19. In ATmega328p, p stands for pico power.

2.20. Mirai botnet attack was originated from IoT cameras.

3. Match words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1. Default bootloader for Arduino	1) sketch
3.2. PWM pins in Arduino UNO	2) 0-255
3.3. Informal Communication	3) Optiboot
3.4.analogRead method in Arduino UNO returns value range	4) 1999
3.5. Open source Operating System	5) 6
3.6. Program written in Arduino IDE	6) Setup()
3.7. The term 'IoT' was coined in	7) Grapevine
3.8.Single line comment	8) 0-1023
3.9.AnalogWrite method in Arduino UNO accepts value range	9) //
3.10. Function called once in Arduino program	10) Windows
	11) Linux

4. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

(a) microcontroller	(b)Massimo Banzi	(c)Fog Computing	(d) Lilypad
(e) Kevin Ashton	(f) microprocessor	(g) mask	(h) Analog
(i) Report	(j) PWM	(k) mirai	(l) Nano

4.1	_____ IC contains memory, input-output peripherals along with processing capability.
4.2	analogWrite method is used for _____ pins in Arduino.
4.3	The term Internet of Things was first coined by _____
4.4	Modern PC has _____ as main component in CPU.
4.5	_____is medium weighted extension of cloud computing in IoT domain.
4.6	_____ is designed to launch botnet attacks from IoT .
4.7	The founder of Arduino project is _____
4.8	Personality is derived from Latin word – persona meaning _____
4.9	The statement describing what has happened is called _____
4.10	_____ board of Arduino family can be used to sewn into clothing

PART TWO

(Answer any FOUR questions)

5.

(a) What is a sensor? Explain its working with example.

(b) What are the different communication modes available to connect things in an IoT domain?

(c) What is the role of setup method in an Arduino program?

(4+8+3)

6.

(a) What are Things in IoT domain? what is meant by connected things.

(b) Write a C program to depict an IoT uses where LED is switched ON once the button is pressed and released and next time button is pressed and released, the LED is switched OFF

(7+8)

7.

(a) Explain the different functional blocks in a IoT ecosystem?

(b) Discuss the role of digital, analog and PWM pin in Arduino UNO?

(7+8)

8

(a) What are the determinants of personality? Explain motivation and self-esteem in detail.

(b) Write a C program to interface DHT sensor and LED. The program will switch ON LED once the temperature rises above 25 degrees?

(7+8)

9. Briefly explain the following(Any three):

(a) Microcontroller

(b) OSI Model

(c) Stress management

(d) Etiquettes & manners

(e) Botnet

(5*3=15)

3.5. Module: A5-R5 – Data Structure Through Object Oriented Programming Language

3.5.1. Practical Assignments

(i) Write a program to Blink default Light Emitting Diode(LED) on Arduino board with the delay of 2 sec.

(ii) Write a C++ program that reads a number from the user and counts the number of digits and sum of digits of the number

(iii) Create a class in C++ called rational1 that stores numerator and denominator. Write the functions to input the data (ensure that denominator is not equal to 0), to display the number. Also use operator overloading to overload the arithmetic operators: +,-,*,/ and also relational operators: >,<,>=,<=,++,!=.

(iv) In the assignment no.2, use friend function to overload operators: +,-,/,*

(v) Define a class to represent a bank account. Include the following:

a. Data Members:

b. Account n.

c. Name of the account holder

d. Balance amount

e. Member Functions:

f. To assign initial data

g. To deposit an amount

h. To display the data

(vi) Write main() function to test the above class

a. Create two derived classes from already defined class in Assignment 4 (Current Account and Saving Account). The Saving Account should have a minimum balance.

b. Create a function to withdraw an amount from Saving account. The balance should not be less than minimum balance after withdrawal.

c. Create a function to withdraw an amount from Current Account. The account allows the overdraft facility.

(vii) Create a class MAT of size m*n. Define following matrix operations for MAT type objects:

Sum, product, transpose

(viii) Define a class String. Use overloaded == operator to compare two string type objects.

Write a program that can be used as a database of student's information for a department. The program should be able to dynamically allocate or deallocate storage for the student's records using singly linked list. The database should have the following fields: the first and last names, a course code, and a grade for a student. The program should display the following menu:

a. Welcome to the database menu!
b. Press 1 to insert a new record
c. Press 2 to delete a record
d. Press 3 to search the database (by last name)
e. Press 4 to print a range in the database
f. Press 9 to quit

(ix) Write a program to traverse a singly linked list

a. Merge two sorted linked lists to form a third sorted linked list.

(x) Given a linked list of integers sorted from smallest (at the head end) to largest, make appropriate function that inserts the node in the linked list so that it remains in sorted order.

(xi) Implement a data structure using array that supports the following operations: insert, findMin, findMax, deleteMin, deleteMax, isEmpty, makeEmpty.

a. Note: You must use the following algorithm: maintain a sorted array. Insert new items into the correct position in the array, sliding elements over one position to the right, as needed. findMin and findMax, and deleteMax are trivial. For deleteMin remove the item in position 0, and slide over all the other items one position to the left.

b. Consider a database of patient's information for a hospital. The program should be able to allocate and deallocate storage memory for the patient's records. The database should have the following information field: the first and last names, patient id, address , related disease , date of admission Devise an appropriate C++ class Queue using arrays to implement the following functions a) inserting an element(a record) in the queue, b) deleting the record from the queue, and c) searching record from the queue by patient id.

(xii) Consider a database of patient's information for a hospital. The database should have the following information field: the first and last names, patient id, address, related disease, date of admission Devise an appropriate C++ class Queue using array to implement the following functions a) inserting an element (a record) in the queue, b) deleting the record from the queue, and c) searching record from the queue by patient id.

(xiii) Consider a database of patient's information for a hospital. The program should be able to allocate and deallocate storage memory for the patient's records. The database should have the following information field: the first and last names, patient id, address, related disease, date of admission Devise an appropriate C++ class Queue using linked list to implement the

following functions a) inserting an element(a record) in the queue, b) deleting the record from the queue, and c) searching record from the queue by patient id.

(xiv) Implement stack as class in C++ having a constructor. Create the functions with the functionalities for the operations: push(), pop(), isempty(), isfull().

Display a Main Menu as below:

"Stack Operations Main Menu"

1.Push

2.Pop

3.IsEmpty

4.IsFull

0.Exit

Implement the stack using array.

(xv) Implement stack as class in C++ having a constructor. Create the functions with the functionalities for the operations: push(), pop(), isempty(), isfull().

Display a Main Menu as below:

"Stack Operations Main Menu"

1.Push

2.Pop

3.IsEmpty

4.IsFull

0.Exit

Implement the stack using linked list.

(xvi) Infix, Postfix and Prefix notations are three different but equivalent ways of writing expressions.

Infix notation: X + Y Operators are written in-between their operands. This is the usual way we write expressions. An expression such as A * (B + C) / D is usually taken to mean something like: "First add B and C together, then multiply the result by A, then divide by D to give the final answer."

Postfix notation (also known as "Reverse Polish notation"): X Y + Operators are written after their operands. The infix expression given above is equivalent to A B C + * D /

Prefix notation (also known as "Polish notation"): + X Y Operators are written before their operands. The expressions given above are equivalent to / * A + B C D

Write a program in C++ to convert an infix expression into a) prefix and b) postfix expression?

(xvii) Write a C++ program for the evaluation of postfix expression (created in assignment no 17) using Stack?

(xviii) Build a Binary Search tree by adding the following items into an empty Binary Search Tree, in order: J, T, E, G, F, B, A, R, O, P, U, M, N, K, L, H, D, S, C, Q, I

Write the functions for the tree traversal in each of the following orders:

a) Pre-order traversal

b) In-order traversal

c) Post-order traversal

(xix) Consider a database of student's information for a department. The data should be stored in array of Structures. The database should have the following fields: the first and last names, a course code, and a grade for a student. Create a C++ function to search a particular student's information from the database using linear search

(xx) Given a two-dimensional array, containing names of all officers in an organization in the alphabetical order. Write a C++ program to input the name of an officer and then search the name in the given array. In case the name is found, print the position of the same in the array, else print the message "Search Unsuccessful"". Use binary search technique.

(xxi) Two arrays of size 20 each containing numbers in sorted order. Merge the two lists (arrays) in a fashion that the resulting list (array) also contains the numbers in sorted order.

(xxii) There are different sorting techniques used for arranging the values present in the list. Suppose we have a list of names of persons as a) "Rajan", "Rohit", "Aman", "Jinny", "Sanjay", "Bhatachariya" Write C++ programs arrange these names alphabetically using: a) Bubble Sort, b) Selection Sort, c) Insertion Sort, d) Quicksort

(xxiii) A bank needs to maintain records of its customers. It is decided to create a database using B-Tree (2-3 tree). The order is based on the Aadhaar number of each Customer. Each record contains the following information. Name, Aadhaar Number. A DBMS needs to be designed to provide menu driven facility to its users. The facilities are:

I. Insert the record for a new customer

F. Find and display the record for a customer specified by name or by Aadhaar number

D. Delete the record of a customer from the database.

(xxiv) Depth First Search is any search algorithm that considers outgoing edges (children) of a vertex before any of the vertex's siblings that is, outgoing edges of the vertex's predecessor in the search. Extremes are searched first. This is typically implemented with a stack. Write a program in C++ to find the DFS of a given graph.

(xxv) Breadth First Search is any search algorithm that considers neighbours of a vertex, that is, outgoing edges of the vertex's predecessor in the search, before any outgoing edges of the

vertex. Extremes are searched last. This is typically implemented with a queue. Write a program in C++ to find the BFS of a given graph.

3.5.2. Sample Question Paper

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. Each question below gives a multiple choice of answers. Choose the most appropriate one.

1.1. Which of the following is used to make an abstract class?

(a) Declaring it abstract using static keyword.

(b) Declaring it abstract using virtual keyword.

(c) Making at least one member function as virtual function.

(d) Making at least one member function as pure virtual function.

1.2. Which of the following provides a reuse mechanism?

(a) Abstraction

(b) Inheritance

(c) Dynamic binding

(d) Encapsulation

1.3. Which of the following is not the member of class?

(a) Static function

(b) Friend function

(c) Const function

(d) Virtual function

1.4. Which of the following points is/are true about Linked List data structure when it is compared with array?

(a) Arrays have better cache locality that can make them better in terms of performance.

(b) It is easy to insert and delete elements in Linked List.

(c) Random access is not allowed in a typical implementation of Linked Lists.

(d) All of the above

1.5. Which of the following pairs of traversals is not sufficient to build a binary tree from the given traversals?

(e) Preorder and Inorder

(f) Preorder and Postorder

(g) Inorder and Postorder

(h) None of the Above

1.6. Which traversal of tree resembles the breadth first search of the graph?

(a) Preorder

(b) Inorder

(c) Postorder

(d) Levelorder

1.7. How many undirected graphs (not necessarily connected) can be constructed out of a given set V= {V 1, V 2, V n} of n vertices?

(a) n(n-1)/2

(b) 2^n

(c) n!

(d) 2^(n(n-1)/2)

1.8. When inorder traversing a tree resulted E A C K F H D B G; the preorder traversal would return?

(a) FAEKCDBHG

(b) FAEKCDHGB

(c) EAFKHDCBG

(d) FEAKDCHBG

1.9. Which of the following name does not relate to stacks?

(a) FIFO lists

(b) LIFO list

(c) Piles

(d) Push-down lists

1.10. A variable P is called pointer if

(e) P contains the address of an element in DATA.

(f) P points to the address of first element in DATA.

(g) P can store only memory addresses.

(h) P contains the DATA and the address of DATA.

2 Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1. A constructor is called at the time of declaration of an object.

2.2. Class data members are private by default while that of structure are public by default.

2.3. All function calls are resolved at compile-time in OOPS.

2.4. Stack is used for breadth first search.

2.5. Queue is a linear structure which follows the order is Last-In-First-Out (LIFO) to access elements.

2.6. If inorder traversal of a binary tree is sorted, then the binary tree is BST.

2.7. Both structures and classes use the concept of Data Encapsulation

2.8. A data structure is said to be linear if its elements form a sequence or a linear list. Examples: Array. Linked List, Stacks and Queues.

2.9. In Doubly Linked List two references are associated with each node, One of the reference points to the next node and one to the previous node.

2.10. In a complete binary tree of 'n' levels, there are: 2n leaves and 2n-1 non-leaf nodes.

3 Match words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1. The data structure which allows deletions at both ends of the list but insertion at only one end	1) heap
3.2. A graph which has all the vertices with minimum possible number of edges	2) binary search

3.3. A special case of balanced binary tree where the root-node key is compared with its children and arranged accordingly	3) Encapsulation
3.4. In OOPS, defining a class in terms of another class, which makes it easier to create and maintain an application is known as	4) Recursion
3.5. In this traversal method, the root node is visited first, then the left subtree and finally the right subtree	5) Spanning Tree
3.6. Some computer programming languages allow a function to call itself known as	6) Pre-order
3.7. A mechanism of exposing only the interfaces and hiding the implementation details from the user is called	7) circular linked list
3.8. In this traversal method, the left subtree is visited first, then the right subtree and finally the root node	8) Output restricted dequeue
3.9. The fast search algorithm with run-time complexity of O(log n) is	9) Input restricted dequeue
3.10. The data structure in which the first element points to the last element and the last element points to the first element is called	10) Post order
	11) data abstraction
	12) Linear search
	13) Inheritance

4 Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

A	Out-degree	B	Copy Constructor	C	Multiway search
D	O(nlogn)	E	Exception	F	linear time
G	O(n2)	H	Stack	I	O(n)
J	Quick Sort Algorithm	K	leaf	L	Queue

M	Linear	N	Binary	O	:: (Scope resolution)

4.1	_____ Searching technique requires elements to be placed in sorted order.
4.2	_____ operator cannot be overloaded.
4.3	A tree node that has no children is called a_____node.
4.4	The B-tree is derived from_____trees.
4.5	The_____of a vertex is the number of edges this vertex has that are connected to other vertices.
4.6	_____works by partitioning the array to be sorted, then recursively sorting each partition.
4.7	A_____performs the copying for value returns as well as for value parameters.
4.8	The complexity of merge sort algorithm is_____.
4.9	The worst-case time for binary search finding a single item in an array is _____.
4.10	In recursion_data structure issued.

PART TWO

(Answer any FOUR questions)

5. (a) Write a program to reverse a linked list.

   (b) What are circular queues? Write down routines for inserting and deleting elements from a circular queue implemented using arrays.

(7+8)

6. (a) The In-order and Post-order traversal of a binary tree are given as below. Draw thetree.

   (i) In-order :BEDFCAGHJIK

   (ii) Post-order :EFDCBJKIHGA

   (b) After two passes of a sorting algorithm, the following array:

   47 3 21 32 56 92

   has been rearranged as shown below.

   3 21 47 32 56 92

   Which sorting algorithm is being used? Also define its average, worst and best case time complexity.

   (c) What are the benefits of Linked list over an array

(7+2+6)

7. (a) Create binary search tree by inserting the integer keys 15, 3, 4, 13, 14, 12, 5, 1, 8, 2, 7, 9, 11, 6, 20 in that order, starting from an empty tree. Now delete the key 4 and show the modified tree

   (b) What is the advantage of doubly ended queue and priority queue?

(10+5)

8. (a) Draw the B-tree of order 3created by inserting the following data arriving in the sequences.

   24 6 7 11 8 22 4 5 16 19 20 78

   (b) Write an algorithm for Breadth First Search and Depth First Search in a graph

(7+8)

9. (a) Draw the B-tree of order 3created by inserting the following data arriving in the sequences.

24 6 7 11 8 22 4 5 16 19 20 78

(b) Write an algorithm for Breadth First Search and Depth First Search in a graph

(7+8)

3.6. Module: A6-R5 – Computer Organization and Operating Systems

3.6.1. Practical Assignments

(i) Do as directed below.

a. Convert to decimal: 0x3d7e

b. Convert to binary: 0x3d7e, 0x2ED1

c. Convert from decimal to binary: 764

d. Convert from decimal to hexadecimal: 764

(ii) Do as directed below.

a. Shift operations (left shift and right shift - logical and arithmetic) on single byte quantities. Each of the answers should be 8 binary digits or 2 hexadecimal digits. Answer the following questions for x = 0x54

b. What is its binary representation?

c. What is x << 3 in binary representation and in hexadecimal representation?

d. What is x >> 2 (logical) in binary representation and in hexadecimal representation?

e. What is x >> 2 (arithmetic) in binary representation and in hexadecimal representation?

(iii) Do as directed below.

a. Design an AND gate and an EX-OR gate using NAND gates

(iv) Do as directed below.

a. What Is Digital Logic?

b. What Is Combinational Logic?

c. Explain Sequential Logic?

(v) Do as directed below.

a. What Are The Developments Of Computer Design?

b. Explain About Program Counter (pc)?

c. What Are Memory Address Register (mar) & Memory Data Register (mdr)?

(vi) Do as directed below.

a. What is an Interrupt Service Routine?

b. Mention what are different types of interrupts in a microprocessor system? Explain?

(vii) There are three components in a course: Quiz (Q), Assignment (A), and Journal (J). You pass the course (P) only if you pass any two or more components. Draw the truth table and design a minimized combinational circuit to show the concept.

(viii) Prove the following Boolean algebra identities:

a. (A+B).(A+C)=A+B.C
b. A+A.B=A
c. (A+B'+A.B)(A+B')(A'.B)=0
d. A+A'.B=A+B

(ix) Given the Boolean function F= a'.b' + a'.d.c' + b.c.d'

a. List the truth table of the function.
b. Draw the logic diagram using the given Boolean expression.
c. Simplify the Boolean expression using Boolean Algebra Identities.
d. Draw the logic diagram using the simplified Boolean expression.
e. Check whether the truth table of part b and of part c is identical.

(x) Perform the arithmetic operations given below with binary numbers using signed 2's complement representation wherever required. Use eight bits to accommodate each number together with its sign.

a. (+12) + (+56)
b. (-35) + (- 49)
c. (-85) – (+71)
d. (-109) + (-11)

(xi) Do as directed below.

a. Getting Help type the 'date' command to display today's date
b. Learn more about this command by accessing its manual page
c. Start a forward search for the word "file" by typing:

   /file

   You can move forward to the next match by pressing n. Also try moving backwards through the matches by pressing N:
d. Execute the following command to display a summary of all man pages that have the keyword "password" in the description
e. Explore whatis, info and –help for getting help

(xii) Try the following commands and write their output:

a. whoami
b. who
c. uname
d. pwd
e. date
f. cal
g. wc

(xiii) Do as directed below.

a. Bash shell maintains a history of the commands that you type. Try 'history' command.
    i. Display last 5 commands from history.
    ii. Identify how you can recall the previous command.
    iii. What does !34 does?
b. Change the history size.

(xiv) Do as directed below.

a. Find the location of the crontab file.
b. How does locate command work?
c. Try find command
d. Find files that were modified (or created) less than 5 minutes ago
e. find files in the /usr directory that are larger than 2MB in size
f. try following command and write its output
g. whereis passwd
h. Explain the difference between locate and find command.

(xv) Do as directed

a. Check your current working directory
b. Make the root directory your current working directory and verify with the pwd command
c. Change back to your home directory
d. (hint: cd command can be executed without a path)
e. Using an absolute path, change to the /usr/bin directory
f. What do you understand by Absolute and Relative pathnames
g. Using a relative path, change to the /usr/share/doc/bash directory

h. Use a relative path to change to the directory above the current directory.

(xvi) Do as directed below.

a. Listing files and directories

Execute the following command

ls -l /etc/hosts

Your output should be similar to the following:

sysadmin@localhost:~$ ls -l /etc/hosts

-rw-r--r-- 1 root root 150 Jan 22 15:18 /etc/hosts

b. So, what does all of this extra output mean?

-	
rw-r—r--	
1	
Root	
Root	
150	
Jan 22 15:18	

List contents of subdirectories along with directories

Display hidden files in the /etc directory.

List all files in the /etc directory that are exactly four characters long

Display all files in the /etc directory that begin with the letters a, b, c or d

Display inode numbers of the files.

(xvii) Do as directed below.

a. Make a copy of the /etc/hosts file and place it in the current directory

b. What will be the output if you use -v switch with this command.

c. Explain the purpose of following commands:

i. mkdir

ii. rmdir

iii. cat

iv. touch

v. rm

d. Explain the difference between touch and cat command.

e. How can you append the contents in an existing file

f. Create a file named 'myfile' in your home directory. Create a directory named 'mydir'. Move 'myfile' inside 'mydir'.

(xviii) Do as directed below.

a. View a large text file with the help of cat command.

b. Use the more command to display the entire contents of the /etc/passwd file.

c. Use less command for the same purpose.

d. What is the difference between more & less command?

e. Use head command to display the contents of /etc/passwd. By default, how many lines will be displayed in the output

f. Try to use tail command.

g. Write the head command to display the first four lines of the /etc/passwd file

h. Write an alternate command to perform the above operation.

i. (Hint : use -n option)

(xix) Do as directed below.

a. _____account is a special user account that has virtually unlimited access and control over the system.

b. To access the root user account, the su or sudo commands are normally used. Use su command to switch user

c. The sudo command is typically used to execute a single command as the root user by prefixing that command with sudo.

d. Which users can use sudo command? How you can grant sudo access to a user

(xx) Using vi editor, do followings.

a. Create a subdirectory named vi_work in your home

b. Create a new file called my_file. Write an essay that should fill the screen. Practice insert, save, and quit.

c. practice using simple search forwards and backwards.

d. Change all occurrences of the word "XXX" to "YYY"

e. Move first six lines to the bottom of the file

f. Create an abbreviation ho to expand to holiday.

(xxi) Do as directed below.

a. Create a new user named 'student' who is a secondary member of the 'research' group and a primary member of their own private group. Use a comment of 'Linux Student' that will appear as the full name of the user when they do a graphical login.

b. Use the passwd command to set the password for the student user and view the shadow file entry for the student user.

c. Use the 'last' command to see if the student has ever logged in.

d. Use the grep command to view the record for 'student' account in /etc/passwd and /etc/shadow files.

e. Explain the various fields of colon delimited /etc/passwd file and /etc/shadow file

f. View account information for your account using id command. Check the same information for root user also.

g. Try to execute following commands:

i. whoami

ii. groups

(xxii) Do as directed below.

a. Create a directory named 'public'. Create a file 'pub-file' inside this directory.

b. Write command to see the permissions on this directory and file

c. use the chmod command with symbolic notation to add write permission for others on 'public' directory

d. Create another directory named 'private'.

e. Use the chmod command with numeric notation to remove any permission from the group or others on the private directory.

f. Grant all users the same read and write permission of the pub-file using symbolic notation

g. Change the ownership of the file. Also, change the group ownership of the file.

h. Who can change the ownership of the file?

(xxiii) Do as directed below.

a. Use the redirection symbol > to redirect the output from the normal output of stdout (terminal) to a file

b. Append some text to this file

c. Execute following commands
d. find /etc -name hosts 2> err.txt
e. cat err.txt
f. redirect 'stdout' and 'stderr' into two separate files
g. Write a command to convert contents of a file a.txt to lower case
h. List the contents of etc directory and send the output to the more command
i. Extract all of the usernames from a database called /etc/passwd with the help of cut command
j. Display the output of Step 7 in sorted order.

(xxiv) Do as directed below.

a. Create a file named 'source' containing the text "data" by using redirection
b. View the details and inode information of the source file
c. Use the ln command to create a hard link
d. Whether the hard link file and the original source file share the same inode?
e. What is the link count of the source file
f. Remove the last link that was created and list the files. Is there any change in link count?
g. Create a symbolic link to the source file and view the details of both files? Do both files have same inode?

(xxv) Do as directed below.

a. From the terminal, type the following command:
b. ping localhost > /dev/null
c. This command is running in "foreground". Terminate the foreground process by pressing Ctrl-C
d. Start the same process in the background by adding the ampersand & to the end of the command
e. Use jobs command to see the commands running in current terminal.
f. Bring the first command to the foreground
g. Use kill command to stop the process

3.6.2. Sample Question Paper

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1) Each question below gives a multiple choice of answers. Choose the most appropriate one.

1.1 Which one of the following is universal gate?

A) AND B) OR

C) NOR D) NOT

1.2 The dedicated processor used for data transfer is

A) CPU B) DMA

C) ALU D) None of the above

1.3 Which one of the following CPU registers holds the address of the instructions (instructions in the program stored in memory) to be executed next?

A) MAR (Memory address register) B) MBR (Memory Buffer Register)

C) IR (Instruction Register) D) PC (Program Counter)

1.4 An interrupt for which hardware automatically transfers the program to a specific memory location is known as

A) Software Interrupt B) Hardware Interrupt

C) Maskable Interrupt D) Vector Interrupt

1.5 The permission -rwxr–r– represented in octal expression will be

A) 777 B) 666

C) 744 D) 711

1.6 Which Linux command can be used to create a new user account?

A) newuser B) useradd

C) mkuser D) usercfg

1.7 Which command is used to terminate a process?

A) shutdown B) haltsys

C) kill D) cancel

1.8 Which of the following command can you execute to count the number of lines in a file?

A) lc B) wc –l

C) cl D) count

1.9 The permissions set rwxr-xr-- indicates that

A) group has read permission only B) other has read permission only

C) owner has read permission only D) group has write permission only

1.10 With what command can you see your user name?

A) pwd B) I

C) whoami D) me

2) Each statement below is either TRUE or FALSE. Choose the most appropriate one

2.1 Locate searches file in to current directory by traversing current directory.

2.2 Users can read, write or execute each other's' files without permission.

2.3 PATH is an environment variable

2.4 Aliases let you create shortcuts to commands.

2.5 Instruction register stores address of the next instruction.

2.6 A decimal 92 is the equivalent of an octal 5C.

2.7 chown is used to change group of the file.

2.8 A file can have a single link in Linux.

2.9 The secondary memory is slower than that of main memory but has a larger capacity.

2.10 In boolean algebra, $A.A=A^2$.

3) Match words and phrases in column X with the closest related meaning/ word(s)/phrase(s) in column Y.

X		Y	
3.1	Displays the contents of a file on a terminal one screenful at a time.	**A.**	Open Source
3.2	your current directory.	**B.**	Trap
3.3	The process is dead but have not been removed from the process table.	**C.**	Alters file permission
3.4	Fork	**D.**	99
3.5	This type of interrupt arise from the illegal or erroneous use of an instruction or data	**E.**	Accumulator
3.6	chmod	**F.**	more
3.7	Kernel	**G.**	pwd
3.8	Fast memory	**H.**	127
3.9	Decimal number equivalent to 1100011	**I.**	Zombie

3.10	Register in which intermediate arithmetic and logic results are stored.	**J.**	Cache memory
		K.	Core of the Unix operating system.
		L.	Creates a process
		M.	Alters file ownership

4) Each statement below has a blank space to fit one of the word(s) or phrase(s) in the list below. Choose the most appropriate option

A. NOT	**B.** Start and stop bits	**C.** Hierarchical	**D.** Pipes
E. suspended	**F.** PATH	**G.** ugo+r	**H.** Hit ratio
I. CACHE	**J.** Instruction Register	**K.** Program Counter	**L.** foreground

4.1 _____ is an environment variable in UNIX.

4.2 UNIX has a _____ file organization.

4.3 The performance of cache memory is measured by _____.

4.4 _____ grants read access to all.

4.5 _____ can connect commands.

4.6 The _____ logical operator has got highest precedence.

4.7 _____ are used in serial asynchronous data transfer.

4.8 Background and _____ processes are usually manipulated via job number (job ID).

4.9 The address of the next instruction to be executed is available in _____.

4.10 _____ memories are expensive compared to random access memory.

PART TWO

(Answer any FOUR questions)

5.

a) Discuss the origin of Linux.

b) Explain the nature of open source software.

c) Describe the structure of an inode.

(5+5+5)

6.

a) Which command is used to change permission associated to File/Directories? List and explain methods to change permission of File/Directories.

b) Explain following command with two options:

i) find

iii) grep

iii) ls

(6+9)

7.

a) List the system calls used for process management.

b) Discuss the role of a System Administrator.

c) Give a brief overview of the run levels used by Linux and Unix operating systems

(5+5+5)

8. Write short notes on:

a) DMA Transfer in computer

b) Virtual memory

(8+7)

9.

a) What is a register? Describe the use of the instruction register, address register, data register and the accumulator register?

b) What do you mean by an instruction cycle? Explain its all phases?

(8+7)

3.7. Module: A7-R5 – Database Technologies

3.7.1. Practical Assignments

(i) Create a table called EMP with the following structure:

NAME	TYPE
EMPNO	NUMBER(6)
ENAME	VARCHAR2(20)
JOB	VARCHAR2(10)
MGR	NUMBER(4)
DEPTNO	NUMBER(3)
SAL	NUMBER(7,2)
Allow NULL for all columns except ENAME and JOB	

(ii) Add a column commission to the EMP table. (Commission numeric and null allowed.)

(iii) Modify the column width of the job field of emp table.

(iv) Add columns DoB to the emp table.

(v) Insert 5 records into EMP table:

EMPNO	ENAME	JOB	MGR
7369	SMITH	CLERK	7566
7399	AJAY	SALESMAN	7566
7499	ALLEX	SALESMAN	7698
7521	WENNER	SALESMAN	7698
7566	JONES	MANAGER	7839

(vi) Delete the row whose EMPNO is 7566.

(vii) Create a DBMS table named Student containing stdno, stdname, stream, roll. Indicate the primary key.

(viii) Create another table named Std_record containing the fields stdname, stream from the previous table and adding new fields such as admission (admission year) and graduation (graduation year). Which field is the foreign key in this table? Explain.

(ix) How to install MariaDb in a Linux or Unix environment? Install it step by step and mention the steps.

(x) Create a simple table using MariaDB named Weather, consisting three records as Month, Day and Temperature. Set it as the current default database.

(xi) Clone this table.

(xii) Change the innodb_page_size for the previously created original table.

(xiii) Suppose there are two sets of candidate keys as:

(supplier_no, part_no) and (supplier_name, part_no).

How many types of relations we can establish between them?

(xiv) If there are three sets of established relation from the previous question such as quantity, supplier_name, supplier_no, then under which normal form this table is existing and why?

(xv) Create a database Games in MongoDb and make a collection with name "Play". Show the newly created database.

(xvi) Insert records SL No, Name, Country, into Play collection. Now show the table consisting of these records.

(xvii) Find the document from Play collection where any game's name starts with "C".

(xviii) Create a JSON object country with attribute countryname with value in string and attribute continent in string also.

(xix) Now access these JSON objects and show them.

(xx) Setup the connection for connecting a remote MongoDB in mongo shell environment.

(xxi) Create a table Area. Insert fields as sl_no, area_name, number_of_people, total_voters, no_of_children. Show the table.

(xxii) Drop only one field from any of the fields.

(xxiii) Update a field by changing its area_name.

(xxiv) Now show the latest updated table.

(xxv) Use Maria DB and the following database tables:

STUDENT				
ROLL_NO	NAME	SUBJECT_ CODE	PHONE	EMAIL
1	Meena	E1	000 000 0000	meena@some.com
2	Teena	E2	000 000 0000	reena@ some.com
3	Reena	E1	000 000 0000	reena@ some.com

SUBJECT	
SUB_CODE	SUBJECT_NAME
E1	B.TECH
E2	B.C.A
E3	COMPUTER SCIENCE

a. Create the above tables for Database College and fill in values

b. Query to find all the students **name and roll no.** enrolled for Subject – "B.C.A"

c. Query to find all email id for student.

d. Query to Update name "Meena" to "Heena" for Roll_No 1.

e. Query to print all columns from both tables having subject "B. Tech".

f. Query to print all students without email and phone

3.7.2. Sample Question Paper

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1.1. One of the following is a valid record -based data models

(a) Object-oriented model

(b) Relational model

(c) Entity-relationship model

(d) None of the above

1.2. A distributed database has which of the following advantages over a centralized database?

(a) Software cost

(b) Software complexity

(c) Slow Response

(d) Modular growth

1.3. An abstraction concept for building composite objects from their component object is called

(a) Specialization

(b) Normalization

(c) Generalization

(d) Aggregation

1.4. What are the main features of MariaDB?

(a)MariaDB can run on different operating systems and support a wide variety of programming language

(b) MariaDB follows a standard and popular querying language

(c) MariaDB provides Galera cluster technology

(d) All of these

1.5. What are the different types of clauses used in MariaDB?

(a) MariaDB Where Clause

(b) MariaDB Like Clause

(c) Both A and B

(d) None

1.6. If a relation A has m attributes and relation B has n attributes and A divide by B is possible then A divide by B has

(a) m*n attributes

(b) m-n attributes

(c) n-m attributes

(d) m / n attributes

1.7. Object based data models are used in

describing the abstraction of the following

level(5).

(a) Only physical

(b) Conceptual and view

(c) Physical and conceptual

(d) None of the above

1.8. Type of constraints that specifies uniqueness of data stored in database are considered as

(a) Semantics

(b) Business rules

(c) Controlled rules

(d) Dtructural rules

1.9. Which of the following is a NoSQL Database Type ?
(a) SQL

(b) Document databases

(c) JSON

(d) All of the mentioned

1.10. Most NoSQL databases support automatic _____, meaning that you get high availability and disaster recovery
(a) Processing

(b) Scalability

(c) Replication

(d) All of the mentioned

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1 Sharding solves the problem to modify the schema where a table is already present.

2.2 Cardinality of a relationship means the number of attributes in the relation.

2.3 MariaDB is a community-developed branch of the OpenSolaris database, which uses the Maria engine by default.

2.4 The DBA is the coordinator between the DBMS and application rograms.

2.5 DDBMS is designed for heterogeneous database platforms.

2.6 The database schema is written in Data Control Language.

2.7 NoSQL databases is used mainly for handling large volumes of semi-structured data.

2.8 MongoDB has official drivers for a variety of popular programming languages and

development environments.

2.9 Locks that are placed expecting a conflict are termed pessimistic locks.

2.10The vast majority of NoSQL technologies are ACID compliant.

3. Match the words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1. Normalization	1) Douglas Crockford
3.2. The father of JSON	2) Table
3.3. Database Recovery	3) Primary Key
3.4. SQL keyword used to sort the result	4) Relationship
3.5. Two-Phase locking	5) Basically Available Soft state Eventual consistency
3.6. BASE	6) Functional dependency
3.7. command is used to select and use a database in MariaDB	7) Order by
3.8. MongoDB is a _____ database that provides high performance, high availability, and easy scalability	8) Use database
3.9. Strong entity set	9) document
3.10. Data dictionary	10) Growing and shrinking phase
	11) Shadow copy
	12) Foreign Key
	Meta data

4. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

(a) Aggregate	(b)Javscript	(c) replication	(d) Partitioned
(e) Implicit	(f) admin.system.roles	(g) Union	(h) Vertical Partitioning
(i) Shared locks	(j) Deadlock	(k) Schema	(l) ACID
(m) Isolation			

4.1	The _____ collection stores custom roles that administrators create and assign to users to provide access to specific resources.
4.2	In MariaDB, the SELECT statement can be used with_____ statement.
4.3	A lock placed automatically by the DBMS is called _____lock.
4.4	The properties of a transaction are termed_____properties.
4.5	Some of the columns of a relation are at different sites is_____.
4.6	MongoDB Queries can return specific fields of documents which also include user-defined _____ functions
4.7	The same storage capacity is a disadvantage of_____.
4.8	MIN, MAX, AVG, SUM are all examples of___functions.
4.9	A distributed database_____ into segments at different sites
4.10	The characteristics of transactions_____

PART TWO

(Answer any FOUR questions)

5.

(d) Discuss the main categories of data models

(e) Describe the three-schema architecture. Justify the need for mappings between the schema levels with a suitable illustration

(f) Discuss the integrity constraints supported in Relational database. Explain each constraint with suitable example.

(g) Why keys are important in relational model? Write about candidate keys, primary keys, alternate key and foreign key

(h) What is database system? What are the benefits of database?

(2+3+4+4+2)

6.

(a) Define Normalization also differentiates between 3NF and BCNF

(b) Describe the purpose of normalizing data. How is the concept of functional dependency associated with the process of normalization?

(c) Consider a relation:

R(A,B,C,D,E,F,G,H,I,J)

Given Functional Dependency:

F={AB->C, A->DE, B->F, F->GH, D->IJ}

Identify the Keys.

Decompose the relation into 2NF and 3NF.

(d) Why keys are important in relational model? Write about candidate keys, primary keys, alternate key and foreign key.

(e) What is database system? What are the benefits of database?

(2+2+2+5+4)

7.

(a) What are the Main features of Maria database ?

(b) Write the syntax for Delete and Truncate query and explain the difference between them.

(c) Write the query to check if table is present within Database.

(d) What is database security? Why is it Important? Also discuss the various security issues

(4+4+2+5)

8.

(a) Define Transaction. Name the features available to maintain transaction.

(b) Discuss in brief about ACID Property.

(c) What is deadloack in database?

(d) How to set Schema privilages

(4+4+2+5)

9.

(a) Explain the reasons why JSON is useful over other notation types.

(b) Name the data types supported by JSON object. Syntax to build JSON Object.

(c) State the difference between SQL and NoSQL.

(d) How to define database schema in Mongo Db? Does MongoDB Support foreign key elements?

(e) Define Covered Query in MongoDB.

(2+3+2+6+2)

3.8. Module: A8-R5 – Systems Analysis, Design and Testing

3.8.1. Practical Assignments

(i) If an information system were to be designed for a hospital, what would be the strategic and tactical information?

(ii) How data will be processed to meet the functional requirements of a store if the important functions of a store are:

a. to keep an up to date ledger containing stock positions,

b. cater to requisitions for issue of items from the store,

c. initiate reorder of items whose stock is below a specified limit,

d. update stock register when items are received, and

e. answer enquiries regarding availability of items in stores.

(iii) What kind of information will you gather during implementation of a hostel information System?

(iv) A manager states the following as goals of a production planning system:

a. Reduce stocks of semi-finished products.

b. Provide better information for the production planning

c. Prevent overproduction.

How would you quantify the goals? How would you obtain sub-goals and quantify them if appropriate?

(v) A university administrator calls a systems analyst to improve the administration of sponsored research projects. The main problems are delay in obtaining latest financial position to project coordinators, reconciliation of advances given to coordinators, prompt demands not sent to sponsors to collect promised grants and lack of information to answer following questions: Which areas of research get maximum grants?

a. Which agency aids which type of projects?

b. What trends can be seen in the nature of grants?

Now:

a. Classify the above problems into missing functions, unsatisfactory performance and excessive cost of operation.

b. How would you set the goals to meet the deficiencies? 3. How would you quantify them?

(vi) Create a report for your Manager on Information-Gathering Techniques. You are the Project Manager of XYZ Enterprises. Your manager gives you the task to gather information and problems in current Hostel management system as the hostel owner wants to replace their Hostel Management System.

(vii) What activities will you carry out during implementation of a hostel information System?

(viii) A project costs Rs. 2 lakhs and the net benefits are Rs. 50,000 (1st year), Rs. 80,000 (2nd year), Rs. 90,000 (3rd year), Rs. 70,000 (4th year), Rs. 50,000 (5th year) and Rs. 30,000 (6th year). Assuming 10% interest rate, would you proceed with your project if your criterion is cost-benefit?

(ix) Hostel warden states the following requirements for a hostel information system:

"Our hostel has 500 rooms and 4 messes. Currently, there are 1000 students in all in 2-seated rooms. They eat in any one of the messes but can get a rebate if they inform and do not eat for at least 4 consecutive days. Besides normal menu, extra items are entered in the extras book.

At the end of the month a bill is prepared based on the normal daily rate and extras and given to each student. We find that bill preparation is delayed. We are also not able to keep proper track of payments and billing for extras. We need a system to streamline this."

Obtain a document flow diagram for the problem described above.

(x) A magazine is published monthly and is sent by post to its subscribers. Two months before the expiry of subscription, a reminder is sent to the subscribers.

If subscription is not received within a month, another reminder is sent. If renewal subscription is not received up to two weeks before the expiry of the subscription, the subscriber's name is removed from the mailing list and the subscriber informed.

Obtain logical DFDs for this problem and also a flowchart.

(xi) Obtain a physical DFD for a simple payroll system described below.

A list of employees with their basic pay is sent to a clerk. He calculates the gross pay using standard allowances which are known for each pay slab. Deduction statements such as loan repayment, subscription to associations etc. are also sent to another clerk who matches these slips with the slips of gross pay and calculates net pay.

This slip is used by a third clerk to write out pay cheques for each employee and sent to respective employees. The total net pay amount paid and bills paid are also computed.

(xii) If the procedure of the above problem is to be computerized, obtain a logical DFD for the computer-based system.

(xiii) Develop E-R diagram for the following:

Customer withdraws money from his account

Students write examinations.

Students attend classes

Professors write books

Driver drives a car

(xiv) Draw an ER diagram that best represents the following situation. There are three types of accounts in a bank, with these attributes:

a. Checking: Acct-no, Date-opened, Balance, Service-charge

b. Savings: Acct-no, Date-opened, Balance, Interest-rate

c. Loan: Acct-no, Date-opened, Balance, Acct-limit

(xv) Draw an ER diagram for the following

Each employee in an engineering company has at most one recognized skill, but a given skill may be possessed by several employees. An employee is able to operate a given machine-type (e.g., lathe, grinder) if he has one of several skills, but each skill is associated with the operation of only one machine type. Possession of a given skill (e.g., mechanic, electrician) allows an employee to maintain several machine-types, although maintenance of any given machine-type requires a specific skill (e.g., a lathe must be maintained by a mechanic).

(xvi) Draw an ER diagram for an apartment is located in a house in a street in a city in a country.

(xvii) Olympic games happen in a certain year at a certain place. Each year, there is at most one instance of Olympic games. In each discipline of an Olympic game, there is exactly one gold medalist, one silver medalist, and one bronze medalist. All these medalists are athletes. Give an ER model for this mini world.

(xviii) Propose a use case diagram for an ATM machine for withdrawing cash. Make the use case simple yet informative; only include the major features.

(xix) Draw a class diagram for the single class Complex. A Complex object has a private real and an imaginary part (of type double), and can perform addition, subtraction, multiplication and division by another complex number.

(xx) Draw an UML class diagram to express the structural relationships in the following program and draw an UML sequence diagram to express the dynamic behavior.

```
import java.util.Vector;

public class Driver {
   private StringContainer b = null;

   public static void main(String[] args){
      Driver d = new Driver();
```

```
        d.run();
    }

    public void run() {
        b = new StringContainer();
        b.add("One");
        b.add("Two");
        b.remove("One");
    }
}

class StringContainer {
    private Vector v = null;

    public void add(String s) {
        init();
        v.add(s);
    }

    public boolean remove(String s) {
        init();
        return v.remove(s);
    }

    private void init() {
        if (v == null)
            v = new Vector();
    }
}
```

(xxi) Create an UML class diagram that models the data relationships described in the following paragraph.

To be a collector you have to have one or more collections. Each collection must have 2 or more items. Each collection belongs to one collector. A collection is made up of items owned. A particular item may be in more than one collection (i.e. an old Coke sign may be in both a Coke memorabilia collection and a sign collection.)

(xxii) Model the operation of a cell phone using a state machine diagram. Show the main states a cell phone can be in and the events that cause it to transition between these states. Use sub-states if it helps simplify your diagram.

(xxiii) Create an activity diagram with two nodes: Initiate Project and Plan Project. Use object flow notation to show an instance of a Vision Document flowing between the two nodes.

3.8.2. Sample Question Paper

Note:

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for PART ONE is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE (Answer all the questions; each question carries ONE mark)

1. Each question below gives a multiple choice of answers. Choose the most appropriate one.

1.1 Statutory information is needed for

A. Day to day operations

B. Meet government requirements

C. Long range planning

D. Short range planning

1.2 Decision support systems are used for

1. Management decision making
2. Providing tactical information to management
3. Providing strategic information to management
4. Better operation of an organization

1.3 Feasibility study is carried out by

A. managers of the organization
B. system analyst in consultation with managers of the organization
C. users of the proposed system
D. systems designers in consultation with the prospective users of the system

1.4 A physical DFD specifies

A. what processes will be used ?
B. who generates data and who processes it ?
C. what each person in an organization does ?
D. which data will be generated?

1.5 Bar charts are used when

A. it is required to illustrate geographical distribution of data
B. relative distribution of data in specified categories is to be shown
C. percent use of resources under various heads is to be show
D. trends as a function of time is to be illustrated

1.6 Control in design of an information system is used to

A. inspect the system and check that it is built as per specifications
B. protect data from accidental or intentional loss
C. ensure that the system processes data as it was designed to and that the results are reliable
D. ensure privacy of data processed by it

1.7 Electronic Data Interchange is necessary in

A. B2C e-Commerce b.

B. C2C e-Commerce c.

C. B2B e-Commerce d.

D. Commerce using internet

1.8 In an E-R diagram relationship is represented by

A. circles

B. rectangles

C. diamond shaped box

D. ellipse

1.9 Inheritance in object-oriented system is used to

A. create new classes from existing classes

B. add new operations to existing operations

C. add new attributes to existing attributes

D. add new states to existing states

1.10Decision trees are superior to decision tables when

A. The number of conditions to be tested is very large

B. When sequence of testing conditions is not particularly important

C. When sequence of testing conditions is not particularly important

D. When a large number of actions are to be specified

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1 The objective of using decision trees is to specify sequence of conditions to be tested and actions to be taken.

2.2 The role of a system analyst drawing up a requirements specification is similar to a contractor constructing a building.

2.3 By technical feasibility of a solution we mean that persons have technical ability to implement it

2.4 A rectangle in a DFD represents an external entity.

2.5 Decision trees are superior to decision tables when sequence of testing conditions is not particularly important.

2.6 EDI standards are not required for B2B commerce.

2.7 An audit trail is established in a system to localize the source of an error in a system.

2.8 By relation cardinality we mean number of items in an entity.

2.9 A data dictionary has information about only numeric data elements in a data flow.

2.10 EDI over internet uses HTTP to send business forms.

3. Match words and phrases in column X with the closest related meaning/word(s)/phrase(S) in column Y.

X		Y	
3.1	A Web Page	A.	Large Data
3.2	Meta Data	B.	Government
3.3	Data Mining	C.	Cryptography
3.4	Context Diagram	D.	Operational
3.5	Statutory	E.	Strategic
3.6	Performance appraisal of machines	F.	E-Commerce
3.7	Preventive maintenance schedules	G.	Uniform resource Locator
3.8	List of items rejected from a vendor	H.	Data about data
3.9	Digital Signature	I.	DFD
3.10	Information Security	J.	Tactical

4. Each statement below has BLANK space to fit one of the word(s) or phrase(s) in the list below. Enter your choice in the answer sheet, following instructions there in.

(a)	Decision Tables	(b)	System Analyst	(c)	TCP/IP
(d)	Data Dictionary	(e)	1	(f)	Decision Trees
(g)	0	(h)	User	(i)	Detailed
(j)	Context Diagram	(k)	Summarized	(l)	Well organized
(m)	S/MIME	(n)	unstructured	(o)	Top Level Managers

4.1 For secure EDI transmission on internet _____ is used.

4.2 Logical correctness of a specification can be systematically checked by using _____.

4.3 _____ is preferred when Sequencing of testing conditions is important.

4.4 A _____ is usually developed When DFD is developed.

4.5 Modulus-11 check digit for the code 45672 is _____.

4.6 A _____ is used as the first step in developing a detailed DFD of a system.

4.7 Feasibility study is carried out by _____ in consultation with managers of the organization.

4.8 Volume of tactical information is _____.

4.9 Operational information is _____.

4.10 Decision support systems are used by _____.

PART TWO (Answer any FOUR questions)

5.

a. As a student what information would you consider as important in a student's hostel? What activities will you carry out during implementation of a hostel information system?

b. Is it essential that an operationally feasible solution should be technically feasible? Discuss with examples.

6.

a. What is the difference between tangible and intangible benefits? Give examples of tangible and intangible benefits.

b. A project costs Rs.2 lakhs and the net benefits are Rs. 50,000 (1st year), Rs.80,000 2nd year),Rs. 90,000 (3rd year), Rs.70,000 (4th year), Rs. 50,000 (5th year), and Rs.30,000 (6th year). Assuming 10% interest rate, would you proceed with this project if your criterion is cost/benefit?

c. Are there some guidelines for good interviewing? State them.

7.

a. Prepare physical and logical DFDs for the following activities:

i. Issuing out a book from the library

ii. Returning a book to the library

iii. Getting a ticket reserved for a train journey

iv. Getting an item issued from a store

v. Getting your mark-sheet from a University office.

b. Admission procedure in a University is as follows:

An advertisement is issued giving essential qualifications for the course, the last date for receipt of application, and the fee to be enclosed with the application. A clerk in the Registrar's office checks the received applications to see if mark-sheet and fee are enclosed and sends valid applications to the concerned academic department. The department checks the application in detail and decides the applicants to be admitted, those to be put in the waiting list, and those rejected. Appropriate letters are sent to the Registrar's office which intimates the applicant.

Give physical and logical DFDs corresponding to the above problem.

8.

a. What do you understand by EDI? Is EDI used in B2C or B2B E-Commerce? Why is EDI important in E-Commerce?

b. What is a digital signature? Why is it necessary in E-Commerce? What are the necessary conditions a hash function used in digital signature should satisfy?

c. What is the purpose of a data validation program? Explain with an example.

9.

a. What do you understand by the term polymorphism in object oriented system? Why is it useful? Give an example of polymorphism.

b. What is the role of E-R diagrams in database design?

c. What is a data dictionary? What data about a data element is stored in a data dictionary?

3.9. Module: A9.1-R5 – Big Data Analytics Using Hadoop

3.9.1. Practical Assignments

(i) Create a file, first.txt and write following lines in Ubuntu using gedit editor and copy it to HDFS.

This is first assignment in Big data module.

The module focuses on analyzing large volume of data.

(ii) Write a Java program to find greatest among three numbers.

(iii) Write a Java program to accept four numbers as argument and print the average. Before calculating average, ensure that arguments passed are of integer.

(iv) Write a program in Java to demonstrate use of for loop using pattern

1

22

333

444

(v) Write a program to input course and total number to student enrolled in a college. The program should stop taking input when null is entered as course. After the input, print total number of students enrolled in a college.

(vi) Write a program to input course and total number to student enrolled in a college. The program should stop taking input when null is entered as course. After the input, print average number of students in class.

(vii) Create a csv file, flight.csv in Ubuntu having data of following items

Flight No.

Source

Destination

Scheduled Departure from source

Scheduled Arrival at destination

Actual Arrival

Actual Departure

Enter 20 records in file and save in Ubuntu as well as at HDFS. The table is to be used in following assignments (viii) to (xiv).

(viii) Writer a program using MAP REDUCE programming techniques that accept file created above as input and find the flight wise average delay.

(ix) Writer a program using MAP REDUCE programming techniques that accept file created above as input and find the numbers of times flight departed and reached on time

(x) Writer a program using MAP REDUCE programming techniques that accept file created above as input and find overall average delay.

(xi) Write a GUI using HIVE – JDBC to input flight number from combobox and display the details on schedule arrival and actual arrival in a Java table.

(xii) Write a GUI using HIVE – JDBC to input flight number from combobox and display the details on schedule departure and actual departure in a Java table.

(xiii) Write a GUI using HIVE – JDBC to display flight number and average delay in a Java table.

(xiv) Write a program in HIVE-JDBC to predict the delay in a particular flight. Use probability to predict the delay.

(xv) Write a UDF in HIVE to find the greatest among three numbers. The numbers are to be passed as three arguments.

(xvi) Write a UDF in HIVE to find the greatest among three string values. The values are to be passed as three arguments.

(xvii) Write a UDF in HIVE that accepts either number or string to find greatest among them (three values). The UDF should override the method evaluate().

(xviii) Write a Java program to create menu. Attach the programs done from (xiii) to (xvii) as menu items and execute it.

Create the following tables in HIVE

Table: Player

Columns: player id (int)

Player name (varchar)

Match number (int)

Match type (char (ODI, T20)

Runs (int)

Year (int)

Sixes (int)

Fours(int)

Write the HIVE-QL for following assignments.

(xix) Find the highest run.

(xx) Find the year wise highest run

(xxi) Find the player wise highest and lowest run

(xxii) Find the name of player who made maximum sixes

(xxiii) Find the name of player who made maximum hundreds

(xxiv) Find the player wise total runs, total sixes, total hundred, total fifties and total number of fours.

(xxv) Write GUI using HIVE – JDBC for assignments (xix) to (xxiv) and attach in a menu.

3.9.2. Sample Question Paper

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. Each question below gives a multiple choice of answers. Choose the most appropriate one.

1.1. Which type of data models are used by databases configured for OLAP?

(a) Multidimensional

(b) Single dimensional

(c) Two dimensional

(d) Three dimensional

1.2. Which of the following is reserved word in Java?

(a) method

(b) class

(c) array

(d) reference

1.3. Which of the following are three legal declarations?

1. int [] myScores [];
2. char [] myChars;
3. int [6] myScores;
4. MyClassmyClass [];

(a) 1,2,4

(b) 2,3,4

(c) 1,2,3

(d) All the four statements

1.4. Modular operator (%) can be applied to which of the following

(a) Integers

(b) Floating

(c) Strings

(d) Both Integers and Floating

1.5.All of the following accurately describe HADOOP except

(a) Open Source

(b) Java Based

(c) Real Time

(d) Distributed Computing

1.6.A User creates a UDF function which accepts arguments of different data types each time it is run, is an example of

(a) Aggregate function

(b) Generic function

(c) Standard UDF

(d) Super function

1.7.HIVE is a/an

(a) OLTP

(b) Data warehouse solution

(c) Programming language

(d) RDBMS

1.8.Partitioning of a table in HIVE creates more

(a) Subdirectories under database name

(b) Subdirectories under table name

(c) Files under table name

(d) Files under database name

1.9.Functions in R are defined using which of the following directives and are stored as R Objects

(a) Function()

(b) Func()

(c) Functions()

(d) Fun()

1.10. HBASE table can be dropped

(a) Directly

(b) After disabling table

(c) After enabling table

(d) After compressing table

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1.Columns in HBASE are organized into column list

2.2.HADOOP was named after toy of son of Cutting

2.3.Functions in R are Second Class Objects

2.4.Is.null is used to check whether R object is null or not.

2.5.HIVE supports multiline comments

2.6.Unix shell command cannot be run from HIVE

2.7.In Java && operator evaluates both the Boolean expressions always

2.8.In Java, a variable declared inside for loop is accessible outside loop

2.9.== operator can be used to compare two strings in Java

2.10. A database has data and relationships

3. Match words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1.Relational Database Model	1. /* …. */
3.2. Bitwise OR operator in Java	2. 2
3.3. Logical OR operator in Java	3. 3
3.4. Multiline comments in Java	4. CODD

3.5.Default replication factor of HDFS	5. &
3.6.Complex Data Type in HIVE	6. SerDe
3.7.Used to read and write files using Java input and output format	7. Directory
3.8.Dropping a View in HIVE	8. &&
3.9.Used to store database in HIVE	9. Cutting
3.10. HBASE	10. Map
	11. Drop view
	12. Remove View
	13. Matrix
	14. Column Oriented Database

4. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

(a)	Variable	(b)	Switch	(c)	Commodity Hardware	(d)	Control structure
(e)	fixed	(f)	random	(g)	limit	(h)	join
(i)	Reserved	(j)	Hiveserver2	(k)	Multitaskin g	(l)	concat

4.1	Ubuntu is a _____ operating System
4.2	In Java, Key words are also called _____
4.3	_____ is used to address the memory location where data is found
4.4	_____ is used to transfer the control to other part of the program in Java
4.5	The _____ structure of Java consists of series of case keyword

4.6	The term _____ is used for affordable devices in Hadoop
4.7	_____ is used to join two strings in Hive
4.8	_____ supports beeline command shell
4.9	_____ is used to limit number of rows in Hive
4.10	HBASE provides _____ access to database

PART TWO

(Answer any FOUR questions)

5.

a) Differentiate between OLAP and OLTP with help of examples

b) Explain the concept of exception handling in Java. Write a program in Java that accepts 10 numbers using command line arguments and print average. Introduce exception handling wherever required.

(6,9)

6.

a) Write program in Java that accepts three value, year (numeric only), item and sale (numeric only). Items can be UPS, PC, Laptop, Scanner and Printer. Use the appropriate control to design a GUI in Java to input these values a store the data in table using JDBC.

b) What are terms throw and throws? Explain the scenario in which these two terms are used in Java.

(10,5)

7.

a) Write a program in MAP-REDUCE to find the highest marks obtained in Maths. Assume that data is available in CSV file having rollno, name, course, subject and marks as columns.

b) Explain the concept of UDF in HIVE.

c) Explain the architecture of HIVE.

(6,4,5)

8. How is HIVE started in server mode? Write a program in HIVE to predict sale of item using regression equation. Assume that a table contains year and sale of item.

(15)

9. Explain the following terms

a) JSON file

b) HDFS

c) R Control Structure

(15)

3.10. Module: A10.1-R5 – Python with Data Science

3.10.1. Practical Assignments

(i) Given a one dimensional numpy array, negate all elements which are between 3 and 8, in place

(ii) Write a program to find common values between two numpy arrays.

(iii) Write a NumPy program to create a random vector of size 10 and sort it.

(iv) Write a program to generate all permutations of a list in Python.

(v) Write a program to flatten a shallow list.

Input - [[2,5,8],[4,2,5],[7,9]]

Output - [2,5,8,4,2,5,7,9]

(vi) Create a two dimensional numpy array with 1 on the border and 0 inside

(vii) Calories from carbs, proteins, Fats in 100g of different foods is as follows:

	Apples	Nuts	Eggs	Potatoes
Carb	56.0	0.0	4.4	68.0
Protein	1.2	104.0	52.0	8.0
Fat	1.8	135.0	99.0	0.9

(viii) Create a numpy array using above data and calculate % of calories from Carb, Protein and Fat in all type of foods

(ix) Write a Pandas program to select the rows

a) where the score is missing, i.e. is NaN.

b) where the score is between 15 and 20 (inclusive).

(x) Write a Pandas program to count city wise number of people from a given of data set (city, name of the person).

name: ['Anu', 'Dima', 'Kiara', 'Jimmy', 'Emily','Amit','Dimple', 'Jaish','kevin','samarth']

city: ['Chandigarh', 'Delhi', 'Chandigarh', 'Chandigarh ', 'Chandigarh ', 'Delhi', 'Delhi', Mumbai', 'Mumbai', 'Delhi']

(xi) Using the below dataset from automobile_data.csv:

Index	company	body-style	wheel-base	length	engine-type	num-of-cylinders	horsepower	average-mileage	price
0	alfa-romero	convertible	88.6	168.8	dohc	four	111	21	13495
1	alfa-romero	convertible	88.6	168.8	dohc	four	111	21	16500
2	alfa-romero	hatchback	94.5	171.2	ohcv	six	154	19	16500
3	audi	sedan	99.8	176.6	ohc	four	102	24	13950
4	audi	sedan	99.4	176.6	ohc	five	115	18	17450
5	audi	sedan	99.8	177.3	ohc	five	110	19	15250
6	audi	wagon	105.8	192.7	ohc	five	110	19	18920
9	bmw	sedan	101.2	176.8	ohc	four	101	23	16430

(xii) Find the most expensive car company name

(xiii) Print all Toyota cars details from above dataset

(xiv) Find each company's highest price car

Using dataset company_sales_data.csv:

month	Face cream	Face wash	toothpaste	Bathing soap	shampoo	moisturizer	Total units	Total profit
1	2500	1500	5200	9200	1200	1500	21100	211000
2	2630	1200	5100	6100	2100	1200	18330	183300
3	2140	1340	4550	9550	3550	1340	22470	224700
4	3400	1130	5870	8870	1870	1130	22270	222700
5	3600	1740	4560	7760	1560	1740	20960	209600
6	2760	1555	4890	7490	1890	1555	20140	201400
7	2980	1120	4780	8980	1780	1120	29550	295500
8	3700	1400	5860	9960	2860	1400	36140	361400
9	3540	1780	6100	8100	2100	1780	23400	234000
10	1990	1890	8300	10300	2300	1890	26670	266700
11	2340	2100	7300	13300	2400	2100	41280	412800
12	2900	1760	7400	14400	1800	1760	30020	300200

(xv) Get Total profit of all months and show line plot with the following Style properties

(xvi) Generated line plot must include following Style properties: –

- Line Style dotted and Line-color should be red
- Show legend at the lower right location.
- X label name = Month Number
- Y label name = Sold units number
- Add a circle marker.
- Line marker color as read
- Line width should be 3

(xvii) Read toothpaste sales data of each month and show it using a scatter plot

(xviii) Write a Pandas program to find the number of rows and columns and data type of each column of diamonds Dataframe, which has been populated from diamonds.csv.

Carat	Cut	color	clarity	depth	table	price	x	y	z
0.23	Ideal	E	SI2	61.5	55	326	3.95	3.98	2.43
0.21	Premium	E	SI1	59.8	61	326	3.89	3.84	2.31
0.23	Good	E	VS1	56.9	65	327	4.05	4.07	2.31
0.29	Premium	I	VS2	62.4	58	334	4.2	4.23	2.63
0.31	Good	J	SI2	63.3	58	335	4.34	4.35	2.75
0.24	Very Good	J	VVS2	62.8	57	336	3.94	3.96	2.48
0.24	Very Good	I	VVS1	62.3	57	336	3.95	3.98	2.47
0.26	Very Good	H	SI1	61.9	55	337	4.07	4.11	2.53
0.22	Fair	E	VS2	65.1	61	337	3.87	3.78	2.49
0.23	Very Good	H	VS1	59.4	61	338	4	4.05	2.39
0.3	Good	J	SI1	64	55	339	4.25	4.28	2.73
0.23	Ideal	J	VS1	62.8	56	340	3.93	3.9	2.46

(xix) Write a Pandas program to concatenate the diamonds DataFrame with the 'color' Series.

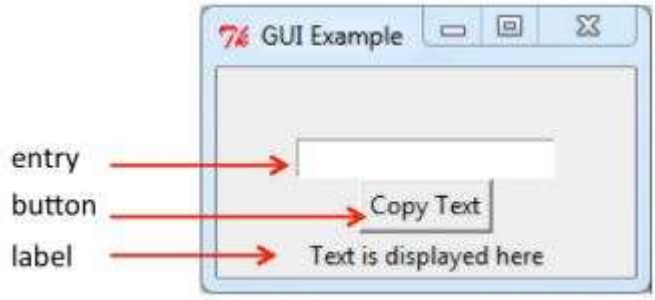
(xx) Write a Pandas program to find the details of the diamonds where length>5, width>5 and depth>5.

(xxi) Compare the distribution of diamond depth for 3 different values of diamond cuti.eIdeal, Fair, Good usingmultiple histogramsin the same plot.

(xxii) Write a Pandas program to check the number of rows and columns and drop those row if 'any' values are missing in a row of diamonds DataFrame.

```
import pandas as pd
diamonds = pd.read_csv('diamonds.csv')
print("Original Dataframe:")
print(diamonds.head())
print("Number of rows and columns:")
print(diamonds.shape)
print("After droping those rows where values are missing:")
print(diamonds.dropna(how='any').shape)
```

(xxiii) Create the following window using tkinter :



When the button is presses, the Label text is updated with the entered text

(xxiv) Write a tkinter program to generate a simple calculator.

(xxv) Write a tkinter program which accepts two different courses in a checklist, whether student or professional in a radio button and calculates the fees according to the given criteria:

If a student chooses one course, discount of 10% , if two courses chosen, discount of 20% on fees to be given.

If a professional and chooses one course, discount of 5% , if two courses chosen, discount of 10% on fees to be given.

3.10.2. Sample Question Paper

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1.1 What is the result of round(0.5) – round(-0.5)?

(a) 1.0

(b) 2.0

(c) 0.0

(d) None of the above

1.2 What is the output of this expression, 3*1**3?

(a) 27

(b) 9

(c) 3

(d) 1

1.3 Following set of commands are executed in shell, what will be the output?

```
>>>str="hello"
>>>str[:2]
>>>
```

(a) he
(b) lo
(c) olleh
(d) hello

1.4 Suppose list1 is [1, 3, 2]. What is list1 * 2 ?

(a) [2, 6, 4]
(b) [1, 3, 2, 1, 3]
(c) [1, 3, 2, 1, 3, 2]
(d) [1, 3, 2, 3, 2, 1]

1.5 The _____ function returns its argument with a modified shape, whereas the _____ method modifies the array itself

(a) reshape, resize
(b) resize, reshape
(c) reshape2,resize
(d) All of the above

1.6 To create sequences of numbers, NumPy provides a function _____ analogous to range that returns arrays instead of lists

(a) A range
(b) A space
(c) A line
(d) None of the above

1.7 Which of the following is commonly referred to as 'data fishing' ?

(a) Data bagging

(b) Data booting

(c) Data merging

(d) Data Dredging

1.8 Point out the wrong statement:

(e) Series is 1D labeled homogeneously-typed array

(a) DataFrame is general 2D labeled, size-mutable tabular structure with potentially heterogeneously-typed columns

(b) Panel is generally 2D labeled, also size-mutable array

(c) None of the above

1.9 Which of the following is used for machine learning in python?

(a) Scikit-learn

(b) Seaborn-learn

(c) Stats-learn

(d) Pandas

1.10 Which of the following is a property of likelihood?

(a) Ratios of likelihood values measure the relative evidence of one value of the unknown parameter to another

(b) Given a statistical model and observed data, all of the relevant information contained in the data regarding the unknown parameter is contained in the likelihood

(c) The Resultant likelihood is multiplication of individual likelihood

(d) All of the above

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1 ndarray.dataitem Size is the buffer containing the actual elements of the array.

2.2 Pylab is a package that combine numpy, scipy& matplotlib into a single namespace.

2.3 Data visualization is the organization of information according to preset specifications

2.4 k-NN algorithm does more computation on test time rather than train time

2.5 Series is a one-dimensional labeled array capable of holding any data type

2.6 To add a new element to a list, we use command addLast().

2.7 If data is a ndarray, index must be the same length as data.

2.8 Series can be passed into most NumPy methods expecting a ndarray

2.9 Null is the standard missing data marker used in pandas

2.10 value_counts() function returns object containing counts of unique values

3. Match words and phrases in column X with the nearest in meaning in column Y.

No.	X	Y
3.1	Graph to show categorical data	1. cross_validation
3.2	Key-value pair in dictionary	2. histogram
3.3	Principal Component Analysis	3. shape
3.4	Loading a csv	4. items()
3.5	Accessing dataframe data	5. loadcsv
3.6	Fill the missing values	6. describe
3.7	Several common aggregations	7. interpolation
3.8	Dimensions of numpy array	8. size
3.9	Data summarization	9. read_csv
3.10	model validation technique	10. loc
		11. dropna
		12. group by
		13. dimensionality reduction
		14. bar graph

4. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

A	Stats models	B	Data Cleansing	C	accuracy_score
D	Linear Regression	E	column_stack	F	Random
G	Seaborn	H	in	I	List
J	last(10),	K	K-NN	L	Fillna
M	metrics	N	row_stack	O	Dropna
P	Panel	Q	tail(10)	R	Head

4.1	_____ function stacks 1D arrays as columns into a 2D array
4.2	_____ machine learning algorithm can be used for imputing missing values of both categorical and continuous variables.
4.3	_____ is used for testing for membership in the list of column names
4.4	In pandas _____ function gives information about top level data.
4.5	_____ function is used to remove all the missing values from the data.
4.6	_____is used to check the accuracy of a predictive model in sklearn
4.7	_____ is prominent python "statistics and econometrics library.
4.8	_____ structure is used for three-dimensional data analysis in Pandas.
4.9	To view the last 10 records in a Pandas DataFrame, we will use _____.
4.10	_____ is performed by data scientist after acquiring the data.

PART TWO

(Answer any FOUR questions)

5.

a. What is data science? What are the steps performed before Data analytics can be applied?

d. What is a NumPy array. How they are different from lists?

(10+5)

6.

Perform the following on given dataset

a. Using apply method, convert all the male values to 0 and female values to 1 in gender column.

b. Count the total number of females, male and missing value, if any, in gender column.

Do you celebrate Thanksgiving?	What is typically the main dish at your Thanksgiving dinner?	How is the main dish typically cooked?	How is the main dish typically cooked? - Other (please specify)	What kind of stuffing/dressing do you typically have?	What is your gender?
Yes	Turkey	Baked	NaN	Bread-based	Male
Yes	Turkey	Baked	NaN	Bread-based	Female
Yes	Turkey	Roasted	NaN	Rice-based	Male

(10+5)

7

a. Difference Between Correlation and Regression in Statistics.
b. Explain the following widgets used for creating GUI applications in python
    1. canvas
    2. button
    3. entry
    4. frame
    5. label

(5+10)

8

a. How will you handle missing data? Explanisnull() and dropna() functions?.
b. What are libraries? Explain which library is used for data visualization in python.

(10+5)

9

a. What is the difference between supervised and unsupervised machine learning?
b. When should you use classification over regression? Explain.
c. Differentiate between Histogram and Bar Graphs used for data visualization.

(5+5+5)

3.11. Module: A9.2-R5 – Web Application using PHP

3.11.1. Practical Assignments

(i) Write the commands to do the followings in Linux

1. Create following directory structure

   NIELIT→Delhi-→Student→Your Roll No (Use mkdir and mkdir –p commands)
2. Create files first and second in Your Folder.
3. To display list of login users?
4. To display count of login users.
5. To display total number of users present on the system?
6. To convert a file contents to uppercase
7. To display contents of a file in reverse order.
8. To display name of files in descending order of size.
9. To display list of subdirectories only.

(ii) Write commands to do the following tasks in Linux

1. Copy file first to first.txt and second second.txt then remove first and second file?[Using cat and cp command]
2. Create symbolic link of file first.txt using cp command.
3. By using ls –l find number of links and name of all the files in your current directory?
4. Display the above results in upper case?
5. Write a command to concatenate contents of first file to second?
6. Write a command to display contents of file in reverse order (Last Line first)?
7. Write a command to display line numbers in a file?
8. Redirect the output of above command to a new file?
9. Use 'ls -al' command in /dev directory and prepare meaning of each field appearing in the output.
10. Using '1s-l' command, identify the information available in I-node for a file / directory.

(iii) Do as directed below.

1. Write a shell script to print "hello NIELIT" on screen?

2. Write a shell script to change the file-name of all files in a directory from lower case to upper case.
3. Write a shell script to change permission, ownership and group of a directory.
4. Write a script to display time in am/pm format using "If / Then", "case", "for loop" statements.

(iv) Do as directed below.

1. Write a shell script to find sum of prime numbers between 2 and 200?
2. Write a shell script to display total salary of each employee in file emp.master?

[By considering DA,DP,HRA,CCA and EPF etc.

(v) Do as directed below.

1. Write a PHP program to print hello world on web?
2. Write a PHP program to display sum of 2 numbers?
3. Write a PHP program to combine one or more text strings in a variable and display the result?

(vi) Do as directed below.

1. Write a php program to compare two strings?
2. Write a PHP program to reverse a string?
3. Write a switch statement that adds, subtracts, multiplies, or divides two numbers?
4. Write a for loop to count from 10 to 1?

(vii) Do as directed below.

1. Write a program to display information about the PHP environment.
2. Write a program using function to print md5 signature of string "NIELIT".
3. Write a program to store first name, middle name and last name in an array and print it in reverse order last name first name and middle name?

(viii) Do as directed below..

1. Write a program to create following registration form

Name: Text Box

Father's Name: Text Box

Sex Code: ○ Male ○ Female

Address:

SUBMIT BUTTON

(ix) Write a program to create following registration form. Take the value in fields from array.

Name: Text Box

Father's Name: Text Box

Age: Text Box

Sex Code: Male ○ Female ○

Address

SUBMIT BUTTON

After clicking on submit button display the following:

"**Welcome Mr./Mrs. Name**

You are ____years old.

(x) Do as directed below.

1. Create table DEPARTMENTS as per structure given below with department_id as primary key and Insert data into the table.

2. Create table EMPLOYEES as per structure given below with employee_id as primary key and insert data into the table.

Name	Null?	Type
DEPARTMENT_ID	NOT NULL	NUMBER(4)
DEPARTMENT_NAME	NOT NULL	VARCHAR2(30)
MANAGER_ID		NUMBER(6)
LOCATION_ID		NUMBER(4)

Name	Null?	Type
EMPLOYEE_ID	NOT NULL	NUMBER(6)
FIRST_NAME		VARCHAR2(20)
LAST_NAME	NOT NULL	VARCHAR2(25)
EMAIL	NOT NULL	VARCHAR2(25)
PHONE_NUMBER		VARCHAR2(20)
HIRE_DATE	NOT NULL	DATE
JOB_ID	NOT NULL	VARCHAR2(10)
SALARY		NUMBER(8,2)
COMMISSION_PCT		NUMBER(2,2)
MANAGER_ID		NUMBER(6)
DEPARTMENT_ID		NUMBER(4)

3. Create a query to display the last name, job code, hire date, and employee number for each employee, with employee number appearing first. Provide an alias JOINING DATE for the HIRE_DATE column
4. Create a query to display unique job codes from the EMPLOYEES table.
5. Display the first name concatenated with the last name, separated by a space, and name the column NAME.

(xi) Do as directed below.

1. Display the first name and department number of all employees in departments 20 and 50 in alphabetical order by name.
2. Display the first name and job title of all employees who do not have a manager.

3. Display the last name, salary, and commission for all employees who earn commissions. Sort data in descending order of salary and commissions.
4. Display the last names of all employees where first name starts with A or a.

(xii) Do as directed below.

1. Write a query to display the last name, department number, and department name for all employees.
2. Create a unique listing of all jobs that are in department 80. Include the location of the department in the output.
3. Write a query to display the employee last name, department name, location ID, and city of all employees who earn a commission.

(xiii) Write a query to display the last name, job, department number, and department name for all employees who work in Chandigarh (or any other city).

The structure of the JOB_GRADES table is shown below

Name	Null?	Type
GRADE_LEVEL		VARCHAR2(3)
LOWEST_SAL		NUMBER
HIGHEST_SAL		NUMBER

(xiv) Do as directed below.

1. Create a query that displays the name, job, department name, salary, and grade for all employees
2. Create a query to display the name and hire date of any employee hired after employee (any employee name in your database).
3. Display the highest, lowest, sum, and average salary of all employees. Label the columns Maximum, Minimum, Sum, and Average, respectively.

(xv) Do as directed below.

1. Modify the above query to display the minimum, maximum, sum, and average salary for each job type.
2. Determine the number of managers without listing them. Label the column Number of Managers.
3. Write a query that displays the difference between the highest and lowest salaries department wise. Label the column DIFFERENCE

(xvi) Do as directed below.

1. Create a query that displays the name, job, department name, salary, and grade for all employees.

2. Use mysqldump to take backup of your database Now delete the database.
3. Restore entire database using mysqldump ?

(xvii) Do as directed below.

1. Use load data to insert records in a table employee?
2. What series of commands removes all of the user privileges of and then deletes the user account and wipes it from the system?

(xviii) Write a function using array to create list box. [list of elements is in an array]

(xix) WAP to perform the following tasks:

Select Foods:

Italian Mexican Chinese

After Clicking on Go. It should display

The foods selected are:
Italian
Mexican
Chinese

(xx) Write a program to perform the followings tasks.

Your Name: CASSETS CDS MOBILES .

After clicking on GO it should display

Welcome Sanjeev
The ITEMS selected are:
SONGS
MOVIES
HANDSET

(xxi) Write a Program(WAP) to create login screen and display welcome login name if username and password are correct? Apply all the validations.

(xxii) Write a program to construct Add modify delete screen for employee table.

(xxiii) Do as directed

1. WAP to search an employee in employee table [User will enter either employee_id or emp_name].

2. WAP to search an employee in employee table [User will enter either employee_id or emp_name].

(xxiv) Do as directed

1. WAP to generate pay slip of a particular employee in appropriate format [user will enter emp_id]?
2. WAP to generate salary of each employee in a particular department. [Apply the appropriate validation]

(xxv) Do as directed.

1. By using the concepts of session WAP to construct login screen?
2. If login id and password is correct then it should display the following screen

Title	Pages	Buy
Linux in a Nutshell	112	Click to purchase
Classic Shell Scripting	256	Click to purchase
Linux in a Nutshell	234	Click to purchase

After Clicking on purchase it should display the following screen

Thanks for your purchase!

User	Title	Pages	Author	Purchased
Sanjeev	Linux in a Nutshell	1	Ellen Siever	2008-01-01 15:42:01
Etc……..	…….	……	…….	…….

Use appropriate tables.

3. WAP to delete item from shopping cart .

3.11.2. Sample Question Paper

NOTE:

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1.1 What is a CMS in web design?

a) Content Management System
b) Creative Management System
c) Content Mixing System
d) Creatives Managerial System

1.2 Which of the following **statement is false.**

a) You can make a website without using HTML
b) You can make a website without using PHP

c) You can make a website without using CSS

d) You can make a website without using Javascript

1.3 Shell Script Program is stored in a file called

a) Unix

b) sh

c) dd

d) cc

1.4 Referential Integrity Constraint is

a) foreign key

b) candidate key

c) Primary Key

d). Alternate key

1.5 To open a file in PHP_____command is used

a) read()

b) fread()

c) fopen()

d) fclose()

1.6Which of the following function is associated with selection of database in Mysql?

a) mysqli_select_db()

b) mysqli_query()

c) mysqli_connect()

d) mysqli_connection()

1.7 The basic operation of PHP is to interpret a script.

a) True

b) False

1.8 What returns a result to the client?

a) Stored functions

b) Stored procedures

c) Triggers
d) Events

1.9 The statement used to create a trigger is _____

a) Random access
b) Sequential access
c) Indexed sequential access
d) Index sequential

1.10 The symbol used in PHP variable declaration is

a) @
b) $
c) &
d) None of above

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1 Linux is an open source Operating System.

2.2 Every variable is started with @ in PHP.

2.3. Strings should be enclosed in double quotes in PHP.

2.4. The function used to upload file is move_upload() in PHP.

2.5. Every statement is terminated by colon in PHP.

2.6. PHP stores string in associative arrays.

2.7. Export functions in MYsql is used for taking Backup.

2.8. Cookies are client side variables.

2.9. The html tags are embedded in PHP script using echo command.

2.10. The extension of backup file of SQL is .sql.

3.Match words and phrases in column X with the nearest in meaning in column Y.

X		Y	
3.1	Auto_increment	A.	Combination of Webpages
3.2	include_once()	B.	takes variable with value to new page
3.3	mysql_fetch_row()	C.	to write code PHP
3.4	$_GET()	D.	Access both GET and POST variable
3.5	$_REQUEST()	E.	shows variable and their carried values in URL
3.6	Website	F.	includes the called file only once
3.7	<? Php …. ?>	G.	accepts always unique value
3.8	Unique constraint	H.	get the row from the result set.
3.9	tmp_name	I.	Primary key
3.10	Querystring	J.	stores temporary file name
		K.	Command console
		L.	takes variable with value to new page

4.Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below

a. for	b. $_COOKIE	c. DATE_ADD
d. fgets()	e. associative	f. NOW()
g. dateTimePicker	h. one to one	i. mysql_row_count()
j. isset()	K \n	l.$

4.1 _____ arrays use strings as their indexes.

4.2 _____each item is related to one and only one other item.

4.3 MYSQL provides the function_____ to allow you to add days from dates.

4.4 The_____function is used to read line from a file.

4.5 _____escape sequence inserts new line in the text.

4.6 _____function returns the current date and time according to the setting of your computer's system date and time.

4.7 _____is super global array variable that is used to display cookie value.

4.8 _____function is used to check whether variable is set or not.

4.9 Variable name in PHP starts with_____.

4.10 The_____function used to count affected rows by executed query.

PART TWO

(Answer any FOUR questions)

5.

a) Explain the difference between Session and Cookies.

b) Explain the functions used to set session and cookies in PHP.

c) What is the significance of following functions?

1. Mysqli_connect()
2. Mysqli_fetch_array()
3. Mysqli_query()

(5+4+6)

6.

a) What is difference between ORDER BY and GROUP BY in MySQL?

b) Write a simple program to make database connection to mysqli in PHP?

(7+8)

7.

a) What are Super Global Variables in PHP? .Explain any three super global variables.

b) Design the registration form having details as:

Employee name, Contact No, Email id, Address. Write down the HTML code for designing

c)Write down the script to insert the data in table register.

(5+5+5)

8.

a) What does jQuery connect?

b) What is the use of jQuery load method?

c) What are different types of lists in HTML. Explain all ags related to Lists wth example.

d) What are the advantages and disadvantages of Ajax?

(3+3+5+4)

9.

a) Explain different types of Arrays in PHP.

b) Explain the difference between GET and POST method

c) Difference between require() and include() function.

(7+4+4)

3.12. Module: A10.2-R5 – Full Stack Development using MVC Framework

3.12.1. Practical Assignments

(i) Do as directed below.

1. Create directories config, controller, model,view and view/voiture.
2. Rename the file Voiture.php to ModelVoiture.php
   Rename the class in ModelVoiture. Comment temporarily the method afficher().
3. Don't forget to update the references to this class name, especially in the setFetchMode() which should now create objects of class ModelVoiture
4. Don't forget to update the references to this class name, especially in the setFetchMode() which should now create objects of class ModelVoiture.

(ii) Do as directed below.

1. Move your files ModelVoiture.php and Model.php in the directory model/.
2. Move Conf.php in the directory config.
3. Fix the relative path of the inclusions ofModel.php, especially inConf.php
4. Create the view view/voiture/list.php for the preceding code

(iii) Do as directed below.

1. Create the controller controller/ControllerVoiture.phpwith the previous code.
2. Test your webpage by requesting the URL…/controller/ControllerVoiture.php

(iv) Do as directed below.

1. Modify the code of Controller Voiture.php and create a file controller/routeur.php which matches the code above;
2. Test the new architecture by calling the webpage…/controller/routeur.php.

(v) Do as directed below.

1. Create a view ./view/voiture/detail.php which displays all the information of the object of class ModelVoiture stored in the variable$v. Use the same display as in the previous method afficher().

   Note: The variable$v will be initialized later in the controller.
2. Add an action read to the ControllerVoiture.php. This action will retrieve the license plate given in the URL, call the method getVoitureByImmat()of the model, assign to the variable$v the concerned car and call the previous view.
3. Test this view by calling the router with the adequate parameters in the URL.

(vi) Do as directed below.

1. Add hypertext links<a>on the license plates of the viewlist.phpthat points to the detail view of the adequate car.
2. We want to handle unknown license plates: Create a view./view/voiture/error.php that shows an error message and call this view when getVoitureByImmat()does not find a car that matches this license plate.

(vii) Do as directed below.

1. Let's begin with the action create which display the form:
   i. Create a view./view/voiture/create.php which uses code from formulaireVoiture.html of TD1. The processing page of this form will be the router with action created.
   ii. Add an action create to ControllerVoiture.php which displays this view.
2. Test your webpage by calling the action create of routeur.php.
3. Create the action created in the controller which will
   i. retrieve the car data from the URL,
   ii. create an instance of ModelVoiture with previous data,
   iii. call the method save of the model,
   iv. call the method readAll() to display the array of all cars.

(viii) Do as directed below.

1. Test the action created of routeur.php by manually giving a license plate, a make and a color in the URL.
2. Test the whole thing, i.e. create the car in the form (action create), submit the form and it should call the action created and show that the car has been added.

(ix) Do as directed below

1. Add a feature *"Delete a car"*(action delete). Add hypertext links to delete a car directly from the list of cars (action readAll).

(x) Do as directed below.

Database table structure: -

1. Create a database
2. Create products table
3. Insert products sample data
4. Create categories table
5. Insert categories sample data
6. Output

(xi) Do as directed below.

Create the layout files: -

1. Create header layout file
2. Create footer layout file
3. Create custom CSS file
4. Output

(xii) Do as directed below.

Creating record in PHP the OOP way: -

1. Create create_product.php file
2. Create "Read Products" button
3. Get a database connection
4. Create the database class

(xiii) Do as directed below.

Creating record in PHP the OOP way: -

1. Create an HTML form
2. Show categories drop down
3. Create "categories" object
4. Add readName() method
5. Code when the form was submitted
6. Create "products" object
7. Output

(xiv) Do as directed below.

Reading and paging record in PHP the OOP way: -

1. Create index.php file
2. Add "Create Product" button
3. Configure pagination variables
4. Retrieve records from the database
5. Add readAll() method

(xv) Do as directed below.

Reading and paging record in PHP the OOP way:-

1. Display data from the database
2. Add action buttons
3. Create paging.php file

4. Add countAll() method
5. Include paging.php file
6. Output

(xvi) Do as directed below.

Updating record in PHP the OOP way

1. Create update_product.php file
2. Create "Read Products" button
3. Read one record
4. Add readOne() method
5. Put form values
6. Show categories dropdown
7. Code when form was submitted
8. Add update() method
9. Output

(xvii) Do as directed below.

Read One Record in PHP the OOP way

1. Create read_one.php file
2. Read one record
3. Display record on HTML table
4. Output

(xviii) Do as directed below.

Deleting record in PHP the OOP way

1. Put this JavaScript code in layout_footer.php
2. Create delete_product.php
3. Add delete() method
4. Output

(xix) Do as directed below.

Search records in PHP the OOP way

1. Change index.php code
2. Create read_template.php file
3. Create core.php file
4. Change paging.php code
5. Include core.php and read_template.php
6. Create search.php file
7. Add search() and count All_BySearch() methods
8. Output

(xx) Do as directed below.

File upload in PHP the OOP way

1. Change HTML form
2. Set value of "image" field
3. Change create() method
4. Call uploadPhoto() method
5. Add uploadPhoto() method
6. Validate submitted file
7. Return error messages
8. Show uploaded image file
9. Output

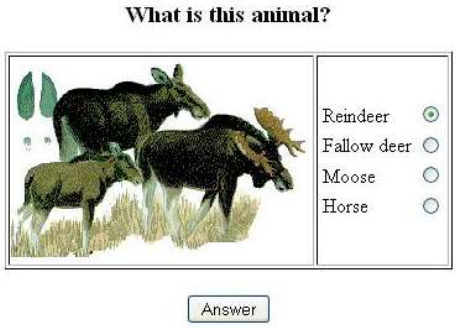
(xxi) Write a PHP program using nested for loop that creates a chess board.

(xxii) Do as directed below.

You need to write a program in PHP to remove specific element by value from an array using PHP program.

(xxiii) Do as directed below.

Implement simple web-application (see picture below) that asks question from user and evaluates if the answer is correct. Use conditional statement to determine, if answer is correct or not.



(xxiv) Export the data of MySQl having tables insq format.

(xxv) Import the data in your project from Sql File Backup.

3.12.2. Sample Question Paper

NOTE:

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

2. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1.1. Microcontroller used in Model-View-Controller(MVC) architecture, viewcorresponds to the

a) Interface layer
b) Data-access layer
c) Domain object layer
d) Business-logic layer

1.2. Which of the following function can be used to get an array in the reverse order?

a) array_reverse()

b) array_search()Security

c) array_shift()

d) array_slice()

1.3.In model-view-controller (MVC) architecture, model defines the

b) Data-access layer

c) Presentation layer

d) Business-logic layer

e) Interface layer

1.4.The updated MySQL extension released with PHP 5 is typically referred to as.

(a) MySQL

(b) mysql

(c) mysqli

(d) mysqly

1.5.Which of the following magic constant of PHP returns full path and filename of the file?

(a) _LINE_

(b) _FILE_

(c) _FUNCTION_

(d) _CLASS_

1.6. What is the first file that gets loaded when you run an application using a CakePHP?

(a) index.php

(b) config.php

(c) bootstrap.php

(d) core.php

1.7.The view layer in CakePHP can be made up of a number of different parts. What are the deferent parts of view layer?

(a) View

(b) Element

(c) Controller

(d) Model

1.8. Which function is executed before every action in the controller?

(a) beforeFilter

(b) lastFilter

(c) afterFilter

(d) firstFilter

1.9. Which of the following method of Exception class returns formatted string of trace?

(a) getMessage()

(b) getCode()

(c) getTrace()

(d) getTraceAsString()

1.10. Using which of the following way can you embed PHP code in an HTML page?

(a) <?php PHP code goes here?>

(b) <?-PHP code goes here?>

(c) <script language="php"> PHP code goes here </script>

(d) All of the above.

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.11. In MVC Architecture, Controller receives events.

2.12. Multidimensional array represents an array containing one or more arrays.

2.13. In php, doubly quoted strings are treated almost literally, whereas singly quoted strings replace variables with their values as well as specially interpreting certain character sequences.

2.14. In PHP file_exist function is used to check if a file exists or not.

2.15. $this keyword is used to refer to properties or methods within the class itself.

2.16. Method overloading is supported in PHP.

2.17. errno() method returns the error code generated from the execution of the last MySQL function.

2.18. #include 'filename' is used to include a file in PHP.

2.19. fetch_array() and fetch_column() methods are used to manage result sets using both associative and indexed arrays.

2.10.$this->session-read () function is used to retrieve the session value in CakePhp.

3. Match words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1.Which version of PHP introduced Try/catch Exception?	1) Database.php.default
3.2.How many methods does the DateTime class have?	2) PHP 5
3.3.Method introduced in PHP 5, is invoked just before an object is garbage collected.	3) 9
3.4.Name of cake's database configuration file.	4) crypt()
3.5.Output if a protected method is given as argument to the function method_exist ().	5) __destruct ()
3.6.Method used to execute the statement after the parameters have been bound.	6) TRUE
3.7.method rolls back the present transaction.	7) Business Layer
3.8.In MVC model logic is _____	8) rollback()
3.9.encryption functions in PHP.	9) strcmp()
3.10. Compares two strings (case sensitive)	10) bind_result()
	11) FALSE
	12) bind_param()
	13) Datasource.php.default

4. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

A.	session_unset ()	**B.**	___construct ()	**C.**	Controller
D.	final	**E.**	$THIS	**F.**	mvc_construct()
G.	protected	**H.**	$this	**I.**	$num=111
J.	fetch()	**K.**	split ()	**L.**	.php
M.	str_split ()				

4.1	_____ Splits a string into an array by using a regular expression as the delimiter.
4.2	_____Converts a string into an array where the size of the elements can be specified
4.3	PHP files have a default file extension of_____
4.4	_____PHP statement/statements will store 111 in variable num.
4.5	_____variable can be assigned a value to it.
4.6	_____ used to erase all session variables stored in the current session.
4.7	You can extend the exception base class, but you cannot override any of the preceding methods because they are declared as_____.
4.8	_____method retrieves each row from the prepared statement result and assigns the fields to the bound results.
4.9	_____is a term in MVC architecture that receives events is called
4.10	To define constructor pf Model class in MVC framework _____function is used.

PART TWO

(Answer any FOUR questions)

5.

(a) State and explain principles of MVC design pattern.

(b) What are the advantages of MVC model?

(c) What is the use of controller class in MVC? Explain with the help of suitable example.

(4+8+3)

6.

a) What are the differences between get and post methods in form submitting, give the case where we can use get and we can use post methods?

b) What is the difference between include_once () and include ()?

c) What are the uses of explode () and implode () functions?

(6+4+5)

7.

a) What is meant by 'passing the variable by value and reference' in PHP?

b) How can you make a connection with MySQL server using PHP? State and explain class method of php-MySQL connectivity.

c) How can you retrieve data from the MySQL database using PHP?

(5+5+5)

8.

a) What is the use of strip_tags() method?

b) What is the use of $_REQUEST variable?

c) What is the difference between for and foreach loop in PHP?

d) Explain the following terms:

i) session

ii) cookies

(3+3+3+6)

9.

a) What are components in CakePHP. List some commonly used CakePHP components?

b) What is Composer?

c) How to use Pagination in Cakephp?

(5+5+5)

3.13. Module: A9.3-R5 –Network Management

3.13.1. Practical Assignments

i. Installation and configuration of Network interface card
ii. Configuration of LAN for Internet connectivity
iii. Study of network components
iv. Wiring Tutorial for 10BaseT Unshielded Twisted Pair (UTP) CAT5, CAT6 cables
v. Configuration of network operating system
vi. Study of Proxy & Web Server Settings
vii. Web server implementation
viii. Configure a Network topology using packet tracer software.
ix. Configure a Network using Distance Vector Routing protocol.
x. Packet capture and header analysis by wire-shark (TCP,UDP,IP)
xi. Connect the computers in Local Area Network.
xii. Study of network IP.
xiii. Configure Network using Link State Vector Routing protocol.
xiv. Study of basic network command
xv. Configuration of network command
xvi. Basic Frame Relay Implementation with PVC
xvii. DNS, Web, DHCP, FTP server configuration

3.13.2. Sample Question Paper

NOTE:

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TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

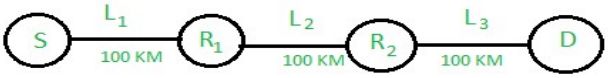
1. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1) Which of the following transport layer protocols is used to support electronic mail?
(A) SMTP (B) IP
(C)TCP (D)UDP

2)In the IPv4 addressing format, the number of networks allowed under Class C addresses is
(A) 2^14 (B) 2^7
(C)2^21 (D)2^24

3) Consider a source computer (S) transmitting a file of size 106 bits to a destination computer ((D)over a network of two routers (R1 and R2) and three links (L1, L2 and L3). L1 connects S to R1;L2 connects R1 to R2; and L3 connects R2 to D. Let each link be of length 100km. Assume signals travel over each link at a speed of 10^8 meters per second. Assume that the link bandwidth on each link is 1Mbps. Let the file be broken down into 1000 packets each of size 1000 bits. Find the total

sum of transmission and propagation delays in transmitting the file from S to D?



(A) 1005ms (B) 1010ms
((C)3000ms ((D)3003ms

4) A layer-4 firewall (a device that can look at all protocol headers up to the transport layer) CANNOT
(A) block HTTP traffic during 9:00PM and 5:00AM(B) block all ICMP traffic
(C)stop incoming traffic from a specific IP address but allow outgoing traffic to same IP
(D)block TCP traffic from a specific user on a specific IP address on multi-user system during 9:00PM and 5:00AM

5)One of the header fields in an IP datagram is the Time to Live (TTL) field. Which of the following statements best explains the need for this field?

(A) It can be used to prioritize packets (B) It can be used to reduce delays

(C)It can be used to optimize throughput (D)It can be used to prevent packet looping

6)Which of the following system calls results in the sending of SYN packets?

(A) socket (B) bind
(C)listen (D)connect

7)In the slow start phase of the TCP congestion control algorithm, the size of the congestion window
(A) does not increase (B) increases linearly
(C)increases quadratically (D)increases exponentially

8)Packets of the same session may be routed through different paths in:
(A) TCP, but not UDP(B) TCP and UDP
(C)UDP, but not TCP(D)Neither TCP nor UDP

9) The address resolution protocol (ARP) is used for:
(A) Finding the IP address from the DNS (B) Finding the IP address of the default gateway
(C)Finding the IP address that corresponds to a MAC address (D)Finding the MAC address that corresponds to an IP address

10) The maximum window size for data transmission using the selective reject protocol with n-bit frame sequence numbers is:
(A) 2^n (B) 2^(n-1)
(C)2^n – 1 (D)2^(n-2)

2 **Fill in the Blank**

1) A modem is a ---------- device.
2) ---------- is a protocol which allows users to download E Mail messages from mail server to a local computer.
3) ---------- is used to access and operate a remote computer on a network.
4) ---------- is the service in Windows 2000 that allows computers to connect to the server using Dial Up networking facility.
5) Gateways used in VPN are called ---------- gateways.
6) ----------is a way of sending several channels over a single line.
7) ----------_ provides ISP in India.
8) The language used to develop web pages is called ----------.
9) A network of networks is known as ----------.
10) In a network a machine is identified by unique address called ----------.

4. **True and false**

1. An ISP is an organization that buys a relatively high-speed live from a telecommunication organization.
2. DARPA was a group behind Internet.
3. Web server is a simple program.
4. The web server does not waits and listens the requests from Web browsers.
5. To access the Web the user opens a program called a Web browser.
6. HTTP is hyper text transfer protocol.
7. FTP is used for transferring files between networks.
8. WWW came into exist in 1980.
9. Tags are used only for markup language.
10. The markup language is a programming language.

4. Match the following

(1) SMTP	(a) Point to point protocol
(2) BGP	(b) Transmission Data
(3) TCP	(c) Data link layer
(4) PPP	(d) Network layer
(5) Route determination	(e) Physical layer
(6) MAC	(f) Cyclic Redundancy Check
(7) Flow control	(g) Media access control
(8) Interface to transmission media	(h) Power Supply
(9) Provides access for the end user	(i) Rate of Transmission
(10) CRC	(j) Transmission Control Protocol
	(k) Application Layer

PART TWO
(Answer any FOUR questions)

5.
a) With neat diagram explain Time division Multiplexing (TDM)
b) Explain line coding and decoding mechanism
c) Explain in brief major function performed by transport layer (4+8+3)

6.
a) Describe forwarding of IP packet based on destination address.
b) Draw neat labeled diagram of UDP header and explain in detail.
c) Explain DNS in detail(4+8+3)

7.
a) Explain architecture of web.
b) What is hamming distance for each of following code words?
a)d(10000,00000) b)d(10101,10000) c)d(11111,11110) d)d(000,011)
c) Explain major functions performed by data link layer.

8.
a) Differentiate between OSI & TCP/IP model.
b) Explain different types of connecting devices
c) Using a suitable flow chart explain the procedure of channel access for pure ALOHA protocol (4+8+3)

9.
a) Explain the IPV6format with the help of neat diagram
b) What is the need of routing algorithm? Explain Distance vector Routing in detail
c) What is traffic shaping? Explain how token bucket algorithm is better than leaky Bucket algorithm? (4+8+3)

3.14. Module: A10.3-R5 – Information Security Management

3.14.1. Practical Assignments

i. To configure TCP/IP addressing on a system.
ii. To study TCP/IP command line utilities.
iii. To Study Network Protocols using Wireshark Network Protocol Analyzer.
iv. To configure IP Routing by creating static routing and dynamic Routing.
v. To configure VLAN and Inter VLAN Routing.
vi. To study traditional cipher system using Crypto tools.
vii. To study Modern cipher system using Crypto tools.
viii. Study of Symmetric-Asymmetric cryptography using Crypto tools.
ix. Study of Hash functions and various hash algorithms using Crypto tools.
x. Study of Diffie-Hellman key exchange using Crypto tools.
xi. Configure IPsec to secure network traffic between 2 nodes.
xii. Configuring Access Control List on a router to regulate inbound and outbound network traffic.
xiii. Using nmap tool to scan a network.
xiv. Using Wireshark tool as sniffer, to analyze the network protocols.
xv. Configuring Host based IDS on a Linux host.
xvi. Configuring wireless security in Wireless Access point.
xvii. To study SQL injection
xviii. To study Secure Coding Practices in respect of any server side scripting.
xix. To study OWASP top 10 vulnerabilities and mitigation techniques
xx. Log analysis on a Microsoft based system.
xxi. Using Microsoft Security Baseline Analyzer
xxii. Case study of recent cybercrime and Judgment under IT Act.
xxiii. Using forensic tools available in Kali Linux.
xxiv. To study Information-hiding techniques and investigating Information-hiding.
xxv. To study Network forensic using Wireshark.

3.14.2. Sample Question Paper

Note:

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS TOTAL MARKS: 100
(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. **Each question below gives a multiple choices of answers. Choose the most appropriate one.**

1.2. Which type of routing protocol uses the shortest path first algorithm?
- (a) Distance Vector
- (b) Link State
- (c) Hybrid
- (d) None

1.3. To verify a digital signature the following is required
- (a) The signer's public key
- (b) The signer's private key
- (c) The verifier's private key
- (d) The verifier's public key

1.4. A method to provide for the secure transmission of e-mail is called
- (a) RSA
- (b) DES
- (c) PGP
- (d) BVD

1.5. IPSec performs operation in
- (a) Transmit mode
- (b) Transport mode
- (c) Tunnel mode

(d) Both b & c

1.6. A Hash function is
(a) reversible
(b) irreversible
(c) Both a & b
(d) All of the above

1.7. Computer forensics involves all of the following stated activities except
(a) interpretation of computer data
(b) extraction of computer data
(c) manipulation of computer data
(d) preservation of computer data

1.8. From which of the following, crucial evidence can be recovered?
(a) The "test.js" uploaded to the server from IP add 169.254.234.34
(b) The "test.js" uploaded to the server from IP add 169.255.234.34
(c) The "test.js" uploaded to the server from IP add 192.168.234.34
(d) The "test.js" uploaded to the server from IP add 169.254.0.1

1.9. Vignere is
(a) Additive Cipher
(b) Transposition Cipher
(c) Poly alphabetic Cipher
(d) None of the above

1.10. SQL injection is an attack in which _____ code is inserted into strings that are later passed to an instance of SQL Server.
(a) malicious
(b) redundant
(c) clean
(d) non malicious

1.11. What does a VLAN provide?
(a) the fastest port to all servers.
(b) Multiple collision domains on one switch port
(c) Breaking up broadcast domains in a layer 2-switch Internet work.
(d) Multiple broadcast domains within a single collision domain.

5. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1. Digital forensics is the science of preserving and analyzing digital data; this data can then be used in court cases as well as for crime detection and prevention
2.2. RIP has a maximum hop count of. 15 Hops
2.3. Diffie-Hellman Key Exchange is method for encryption.
2.4. Network address translation (NAT) is a method of remapping one IP address space into another by modifying network address information in the IP packets.

2.5. DDoS is a type of attack where a single compromised system is used to target a system.
2.6. SQL injection attacks are used to redirect users to websites where attackers can steal data from them.
2.7. 3DES is a cryptographic cipher algorithm.
2.8. An X.509 certificate is a digital certificate that uses the widely accepted international X.509 public key infrastructure (PKI) standard
2.9. Wired Equivalent Privacy (WEP) is a security algorithm for IEEE 802.15bluetooth networks.
2.10. A stateful firewall is configured to distinguish legitimate packets for different types of connections.

6. Match the words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1. OWASP	1) The process of collecting digital evidence from an electronic media.
3.2. Section 65	2) The practice of concealing a file, message, image, or video within another file, message, image, or video.
3.3. Risk-based auditing	3) Exclusive right given to the creator of a creative work to reproduce the work, usually for a limited time.
3.4. Session Hijacking attack	4) Act of Cyber Terrorism
3.5. Copyright	5) Tampering with computer source documents
3.6. Nessus	6) A style of auditing which focuses upon the analysis and management of risk
3.7. Section 66F	7) Compromises the session token by stealing or predicting a valid session token to gain unauthorized access to the Web Server.
3.8. Acquisition	8) Community that produces articles, methodologies, documentation, tools, and technologies in the field of web application security
3.9. Anomaly-based intrusion detection systems	9) Vulnerability scanners for vulnerability assessments and penetration testing .
3.10. Steganography	10) Introduced to detect unknown attack based on behavior.

7. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

(a) ISO 27001	(b)IDS	(c) Data Diddling	(d) IPSec
(e) CERT-IN	(f) DES	(g) CCA	(h) PGP
(i) MD5	(j) Buffer Overflow	(k) OSPF	(l) IPv6

4.1	…….. is the India nodal agency for responding to information security related
4.2	Changing of data before or during entry into the computer system is known as _____
4.3	The _____ is a symmetric-key block cipher published by the National Institute of Standards and Technology (NIST).
4.4	_____ uses a link state routing (LSR) algorithm and falls into the group of interior gateway protocols (IGPs).
4.5	_____is an attack that forces an end user to execute unwanted actions on a web application in which they're currently authenticated.
4.6	The _____algorithm is a widely used hash function producing a 128-bit hash value
4.7	The IT Act provides for the _____to license and regulate the working of Certifying Authorities and also to ensure that none of the provisions of the Act are violated
4.8	_____ is the process of monitoring the events occurring in your network and analyzing them for signs of possible incidents, violations, or imminent threats to your security policies
4.9	In information security and programming, a ____is an anomaly where a program, while writing data to a buffer, overruns the buffer's boundary and overwrites adjacent memory locations
4.10	_____is the international standard which is recognized globally for managing risks to the security of information

PART TWO
(Answer any FOUR questions)

5.
(f) How client Authentication is achieved using Kerberos ?
(g) Explain different types of logical ports used in TCP/IP .
(h) Explain different modes of operation of IPSec.

(6+4+5)

6.
(a) Explain Volatile &Non Volatile Digital Evidence.
(b) Explain TCP SYN Flooding attacks.

(7+8)

7.
(a) Define Cyber Law and explain its structure (IT Act 2008).
(b) What is PKI? Explain different components of PKI. (7+8)

8
(a) Explain the Key questions to be addressed during security audit
(b) What is Forensic Analysis and explain the steps involved in Forensic Analysis.

(8+7)

9. Briefly explain the following (Any three):
(a) VLSM
(b) Cross Site Scripting Attacks
(c) SSL & TLS
(d) Certifying Authorities (CA)
(e) Digital Signature

(5*3=15)

3.15. Module: A9.4-R5 – Internet of Things (IoT)- A Practical Approach

3.15.1. Practical Assignments

i. Configure NodeMCU in Arduino IDE. (using board manager)

ii. Write C-program to interface LED and make it blink at delay of 1sec on NodeMCU.

iii. Write C-program, to interface configure analog sensor and display the read value in serial monitor.

iv. Write C-program, to interface LCD/sensor using I2C protocol.

v. Write C-program, to read the analog sensor data and display on LCD.

vi. Write C-program, to exhibit Temperature controlled fan use-case, using temperature sensor, fan.

vii. Write C-program, to exhibit Air Pollution meter use-case, using MQ135 sensor, LEDs(green –acceptable range, orange- warning level, red for danger)

viii. Exhibit motion sensor based home appliance control system, using PIR sensor, Relay module along with NodeMCU

ix. Write C-program to demonstrate water level identifier use-case, using ultrasonic sensor, NodeMCU

x. Write a C-program, to connect the NodeMCU with existing Wi-Fi network and display the IP address in Serial Monitor.

xi. Configure NodeMCU and write C-program, to control on-board LED using Wi-Fi connection.

xii. Configure NodeMCU to act as simple web-server controlling on-board LED. HTML code in C-Program should have ON/OFF buttons.

xiii. Configure Node-MCU to exhibit voice-controlled device to control electrical appliances at home.

xiv. Write a C-program to interface Bluetooth module (HC-05) using serial communication with NodeMCU and control on-board LED from mobile.

xv. Write a C-program to push data read form analog sensor to MySQL database installed on local machine in a LAN.

xvi. Configure the apache web server, MySQL and PHP stack (XAMP) on Local Machine and access the hosted webpage in LAN.

xvii. Using setup discussed in above question, make temperature-humidity logging station.

xviii. Write a C-program to push data read form analog sensor to online website e.g. Thing speak or any other website and display the saved data on dashboard graphically.

xix. Write a C-program for NodeMCU to publish/subscribe MQTT topic and control on-board LED.

xx. Using NodeMCU write C code to publish/subscribe MQTT topic and control two LEDs from '*MQTT Dashboard*' android app or any other app.

xxi. Demonstrate Energy meter use-case, in which the energy consumption of electrical appliance is displayed using current sensor and NodeMCU.

xxii. Demonstrate Rotating-Solar-Panel use-case. Use two LDRs to get intensities from two directions and after comparing rotate the solar panel with help of servo motor to align towards sunlight.

xxiii. Demonstrate Smart parking use-case. The ultrasonic sensor connected to NodeMCU updates the MySQL server when vehicle come in front of the sensor, which in-turn updates the online dashboard

xxiv. Demonstrate the wifi-controlled robo-car use-case.

xxv. Write C-program, to control output of RGB LED connected with NodeMCU from mobile phone.

3.15.2. Sample Question Paper

NOTE:

5. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
6. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
7. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1.1.The size ofIPv4 in bits is

(a) 24

(b) 32

(c) 40

(d) 48

1.2.NodeMCU has on-board LED connected at

(a) GPIO1

(b) GPIO2

(c) GPIO3

(d) GPIO4

1.3.UART stands for

(a) Universal Automatic Receiver Transmitter

(b) Universal Asynchronous Receiver Transmitter

(c) Uniform Asynchronous Receiver Transmitter

(d) Universal Asynchronous Receiver Transport

1.4.SPI stands for

(a) Serial Peripheral Interface

(b) Serial Parallel Interface

(c) Sequential Peripheral Interface

(d) Serially Pins Interface

1.5.The 802.11g standard is

(a) Wireless PAN

(b) Wireless LAN

(c) Wireless WAN

(d) Wireless MAN

1.6.NodeMCU is an open-source IOT platform

(a) Express Systems

(b) Espressif Systems

(c) Expressif Systems

(d) Expertif Systems

1.7. Hybrid cloud uses

(a) Only private cloud services

(b) Only public cloud services

(c) Both public and private cloud services

(d) Any one out of public or private cloud services but one at a time

1.8. In classic model of information security, main objectives are

(a) integrity, and availability

(b) confidentiality and availability

(c) confidentiality, integrity or availability

(d) confidentiality, integrity, and availability

1.9.In RDBMS, _____ key does not allow NULL and is always unique

(a) Primary key

(b) Foreign key

(c) Candidate key

(d) Unique key

1.10. I2C can be used to connect up to

(a) 64 nodes

(b) 127 nodes

(c) 255 nodes

(d) 512 nodes

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1	Man-in-the-middle attacks are a known as cancer for IoT
2.2	NodeMCU has two ADC pins
2.3	SPI is typically much faster than I2C
2.4	In IoT ecosystem, Certificate Management System is used to protect encryption keys
2.5	MAC address is logical address, which uniquely identify nodes in a network

2.6	Establishing connections and synchronizing data is important for any IoT device to perform optimally.
2.7	RX pin of NodeMCU is connected to GPIO16.
2.8	In cloud computing paradigm, SaaS provide virtual machines, virtual storage
2.9	TCP/IP protocol suite has four layers
2.10	In order to use PWM, programmer can call analogWrite method

3. Match words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1.Protocol has SDA, SPI pins	1) Connection less protocol
3.2. MQTT runs at port no	2) OTA
3.3. New software for mobile devices	3) 4
3.4. TCP	4) I2C
3.5. SPI interface present in ESP8266	5) Booting
3.6. Loading of firmware	6) 1883
3.7.key accepts multiple NULL values	7) 2
3.8. PWM channels present in ESP8266	8) Things
3.9. UDP	9) Connection oriented protocol
3.10. superstars of the IoT ecosystem	10) Sensors
	11) Foreign key

4. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

(a) 423	(b) 255	(c) I2S	(d) TCP
(e) 16	(f) MQTT	(g) 80	(h) IIoT
(i) I2C	(j) AI	(k) blockchain	(l) 10

4.1	The http protocol in web server runs at port _____
4.2	_____ port is used by https protocol
4.3	_____ protocol has SDA and SCL pins related to it.
4.4	IPv6 is _____ byte address.
4.5	8-bit ADC can scale analog signal in a range of 0-_____
4.6	_____ is a publish/subscribe messaging protocol for constrained IoT devices and low-bandwidth
4.7	_____ is anaudio protocol for transmitting data streams
4.8	NodeMCU has _____ bit ADC
4.9	In a _____each block contains a cryptographic hash of the previous block
4.10	_____uses smart sensors and actuators to enhance manufacturing and industrial processes

PART TWO

(Answer any FOUR questions)

5.

(a) Write steps required for enabling Arduino IDE to program NodeMCU/ESP8266.

(b) What is the difference between Get and Post methods of Request object?

(c) What is RDBMS. How it is different from NoSQL tools.

(5+5+5)

6.

(c) Explain MQTT protocol in context to IoT ecosystem. Discuss the working of MQTT along with MQTT broker, publish/subscribe topic.

(d) Differentiate between Intranet and Internet.

(10+5)

7.

(a) Write a C program to depict an IoT use-case where default LED on NodeMCU is switched ON/OFF from the webpage hosted by C program and accessed from mobile/PC connected to NodeMCU through Wi-Fi hotspot.

(b) What is the role of AI in improving and securing IoT ecosystem?

(10+5)

8

(d) Write a C program to depict an IoT use-case where two LEDs are controlled remotely through PC/mobile device using MQTT protocol.

Consider following details while answering

ClientID :Light Control

Server : iot.eclipse.org

Topic ID (for first LED) : room1/light1

Publish value : on1/off1

Topic ID (for second LED) : room1/light2

Publish value :on2/off2

(e) Explain the role of public and private cloud in context to Cloud computing.

(10+5)

9. Briefly explain the following (Any three):
    1. TCP/IP protocol suite
    2. Microcontroller vs Microprocessor
    3. Web Server
    4. IIoT

(5*3=15)

3.16. Module: A10.4-R5 – Internet of Things (IoT)- Using Raspberry Pi

3.16.1. Practical Assignments

i. Familiarize rasp berry pi board and install rasbian OS on to SD card and boot

ii. Demonstrate how to configure network in Raspberry Pi

iii. Demonstrate how to configure WiFi on Raspberry Pi

iv. Show how to access Raspberry pi over remote using ssh protocol

v. Show how to install new packages and software on Raspberry pi

vi. Demonstrate how to install python packages on Raspberry Pi

vii. Demonstrate how to run a python scripts on raspberry pi during boot time

viii. Demonstrate how to access the device files on Raspberry pi from command line.

ix.

x. Write a python program to turn ON Light Emitting Diode(LED) connected to raspberry pi GPIO

xi. Write a python program to turn ON and OFF Light Emitting Diode(LED) connected to raspberry pi GPIO with one second delay

xii. Write apython program to interface LEDs on GPIO pins (multiple pins at least 3) using raspberry pi and blink alternatively at the delay of 1 sec.

xiii. Write a python program to interface buzzer with raspberry pi board to buzz on/off with the delay of 1sec.

xiv. Write a python program to interface LED and Buzzer with raspberry pi board, so that buzzer is put on whenever LED is on and Buzzer is put off when LED is off.

xv. Write a python program to interface to interface Button and LED on raspberry pi , so that LED blinks/glow when button is pressed

xvi. Write a python program to interface Light Dependent Resistor (LDR) and LED with Raspberry pi board. Whenever there is sufficient light falling on LDR the LED is off and when there is dark around LDR the LED is put on.

xvii. Write a python program to interface LCD with raspberry pi board and display 'Hello world' on it

xviii. Write a python program to interface LCD and keypad with raspberry pi board and display the key pressed from keypad on LCD.

xix. Write a python program develop a simple webserver and test it / access it from the LAN/WLAN.

xx. Write a python program update web server by adding button option and button will be able to control any one GPIO test it with Relay / LED also access the web page from the LAN/WLAN using PC/Mobile.

xxi. Demonstrate how to install appache server on raspberry pi and remotely access html web page

xxii. Create a web page for controlling led connected to GPIO of raspbery pi and launch this server using appache settings. Also demonstrate it by controlling the status remotely

xxiii. Interface a temperature sensor to raspberry pi and update the details to the webserver running on the raspberry pi.

xxiv. Interface a relay boards to the raspberry pi and update the html page so that the devices connected on the relay can be controlled with the help of webserver running on the raspberry pi.

xxv. Identify the procedure to install MQTT broker on Raspberry Pi and test the publish and subscribe scenario from a mobile mqtt applications.

3.16.2. Sample Question Paper

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1.1. What do we use to connect TV to RPi?

(a) Male HDMI

(b) Female HDMI

(c) Male HDMI and Adapter

(d) Female HDMI and Adapter

1.2. How power supply is done to RPi?

(a) USB connection

(b) Internal battery

(c) Charger

(d) Adapter

1.3. What is the Ethernet/LAN Port used in RPi?

a) Cat5
b) Cat5e
c) Cat6
d) RJ45

1.4. Which instruction set architecture is used in Raspberry Pi?

(a) X86
(b) MSP
(c) AVR
(d) ARM

1.5. What is the default user in Debain on Raspberry Pi?

(a) root
(b) pi
(c) admin
(d) user

1.6. What are the distributions are supported by raspberry Pi?

(a) Arch Linux
(b) Debain
(c) Fedora Remix
(d) All of the above

1.7. What bit processor is used in Pi 3?

(a) 64-bit
(b) 32-bit
(c) 128-bit
(d) Both 64 and 32 bit

1.8. What is the speed of operation in Pi 3?

(a) 900MHz
(b) 1.2GHz

(c) 1GHz

(d) 500MHz

1.9.The dmesg command

(a) Shows user login logoff attempts

(b) Shows the syslog file for info messages

(c) kernel log messages

(d) Shows the daemon log messages

1.10. Which command is used to display the operating system name

(a) os

(b) unix

(c) kernel

(d) uname

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1.Raspberry pi is a Micro-controller based device.

2.2. SBC stands for "single board computer"

2.3. Raspberry pi has inbuilt memory to put operating system.

2.4. Python works only on Linux Devices.

2.5. Raspberry pi has inbuilt battery.

2.6. Raspberry 3 pi has onboard Bluetooth and WiFi.

2.7. Raspberry pi board can run only on Linux.

2.8. Raspberry pi 4 has Gigabit Ethernet port .

2.9. Raspberry pi 4 has only USB 2.0 port.

2.10. Raspberry pi 3 has only USB 2.0 port.

3. Match the words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1. Linux	1) SBC
3.2. Debian	2) Linux Command
3.3. Raspberry Pi	3) Operating System
3.4. MQTT	4) Linux distribution
3.5. dmesg	5) Protocol

4. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

(a) ls	(b)w	(c) wc	(d) rmdir
(e) Unix	(f) Own Machine	(g) rm	(h) lscpu
(i) Debian	(j) lpr	(k) grep	(l) dir

4.1	_____ command is used to count the total number of lines, words and character in a file?
4.2	_____ command is used to remove the directory?
4.3	_____ command is used to remove files?
4.4	http://127.0.0.1 is the address of
4.5	Which of the following is not a communication command?
4.6	What command is used to add printing jobs to the queue?
4.7	Macintosh is a variant of

4.8	_____ command is used to list contents of directories?
4.9	Which of the following is a command in Linux?
4.10	_____ is the world's largest non-commercial Linux distribution

PART TWO

(Answer any FOUR questions)

5.

(a) Describe the raspberry pi hardware.

(b) Write down the procedure to setup a new Raspberry Pi.

(c) Write a short note on Linux and its distributions.

(4+8+3)

6.

(a) What is the difference between Normal computer and Raspberry Pi.

(b) What is IoT and how it is useful for us.

(7+8)

7.

(a) Explain why Raspberry Pi is used in IoT applications.

(b) How IoT can be useful in agriculture sector?

(7+8)

8

(a) Briefly explain the different type connectivity available on raspberry pi.

(b) How can we make IoT based Weather Monitoring Station?

(c) Draw and explain Home automation System using Raspberry Pi.

(5+5+5)

9. Briefly explain the following (Any three):

(a) GPIO

(b) Internet of Things

(c) Compiler and Interpreter

(d) Operating System

(e) USART

(5*3=15)

3.17. Module: A9.5-R5 – Artificial Intelligence Concepts and R Programming

3.17.1. Practical Assignments

i. Use the function paste to create the following character vectors of length 30.

"label 1", "label 2", ..., "label 30"

ii. Store the string "The quick brown fox jumps over the lazy dog" into a variable. a) In the string, replace the word "brown" with "red"

iii. Use substr() function to pick the word "fox" from the string

iv. Assume that you are interested in cone-shaped structures, and have measured the height and radius of 6 cones. Make vectors with these values as follows:

R <- c(2.27, 1.98, 1.69, 1.88, 1.64, 2.14)
H <- c(8.28, 8.04, 9.06, 8.70, 7.58, 8.34)
Make a vector with the volumes of the 6 cones. (Volume=1/3 pi R2 H)
Round the values to 2 decimal points and store into a vector
Find out the minimum and maximum volumes

v. Create a vector, marks (out of 50) of 10 students. Compute the following.

(a) Mean of these marks and store into a variable p1
(b) Median of these marks and store into a variable p2

vi. Create a vector N of 10 random numbers between 1 & 20. Print the numbers in N which are divisible by 2

vii. Assume that we have registered the height and weight for four people: Heights in cm are 180, 165, 160, 193; weights in kg are 87, 58, 65, 100. Make two vectors, height and weight, with the data. The body mass index (BMI) is defined as (weight in kg/ (height in m) 2).

a) Make a vector with the BMI values for the four people.
b) Also make a vector with the weights for those people who have a BMI > 25.
c) Find the average BMI Value

viii. Create a List named student with the following data. Give the names Name, RollNo, Gender & Marks for the items

a) Name
b) Roll No
c) Gender
d) Marks for 5 subjects.

ix. Create a 2X2 matrix A with some sample data.

a) Calculate B= 2A

b) Construct C by binding the rows of A & B
c) Construct D by binding the columns of A & B

x. Create a List named student with the following data. Give the names Name, RollNo, Gender & Marks for the items

a) Name
b) Roll No
c) Gender
d) Marks for 5 subjects.

From the above list
a) Compute the average of marks
b) Store the Roll No and Marks to another list.
c) Modify the mark for the 5th subject as 100
d) Prepare a new vector with the names of the 5 subjects
e) Attach it as the last item in the list

xi. From the mtcars data frame, extract the mpg, cyl and hp to prepare a new data frame.Combine the first 5 rows and last 5 rows of mtcars to a new data frame

1) Create the following data frame.

	Age	Height	Weight	Sex
Alex	25	177	57	F
Lilly	31	163	69	F
Mark	23	190	83	M

Create another data frame with the following data

	Working
Alex	Yes
Lilly	No
Mark	No

Add this data frame as new column to the previous one.
a) What class of data is in each column?
b) Calculate the mean of heights of the people
c) Obtain the BMI of all and add it as a new column to the data frame.
d) Add another column which shows whether the person is healthy based on the BMI (greater than 25 = False, else True)

xii. Five children aged 2, 3, 5, 7 and 8 years old weigh 14, 20, 32, 42 and 44 kilograms respectively.

a. Find the equation of the regression line of age on weight.
b. Based on this data, what is the approximate weight of a six year old child?
c. Plot the regression line (hint: abline(lm(y~x)))
d. Also plot the points (hint: plot(x,y))

xiii. The success of a shopping center can be represented as a function of the distance (in miles) from the center of the population and the number of clients (in hundreds of people) who will visit. The data is given in the table below:

No. Customer (x)	8	7	6	4	2	1
Distance (y)	15	19	25	23	34	40

a) Calculate the linear correlation coefficient.
b) If the mall is located 2 miles from the center of the population, how many customers should the shopping center expect?
c) To receive 5 customers, at what distance from the center of the population should the shopping centre be located?

xiv. The grades of five students in mathematics and chemistry classes are:

Mathematics	6	4	8	5	3. 5
Chemistry	6. 5	4. 5	7	5	4

Determine the regression lines and calculate the expected grade in chemistry for a student who has a 7.5 in mathematics.

xv. Declare a vector variable having 4 numbers to indicate the count of movies released this year in Comedy, Action, Romance, Science Fiction categories. Prepare a Pie chart to visualize the data.

a. Show the pie slices in 4 attractive colors
b. Give count against the slices
c. Movie type in legend
d. Order the pie slices in clockwise direction.
e. Give Heading.

xvi. Draw a bar chart for the above data. Provide Main Heading, labels for X Axis and Y Axis

xvii. ABC corporation manufactures and sales 3 products A, B & C. Draw a stacked bar chart to show the annual product sales of the company. The sales for the 4 quarters are to be displayed in the X axis. Use proper legends to show the sales of the 3 products.

xviii. Draw a histogram showing the Miles/gallon value distributions among the various car models in the mtcars data (Motor Trend Car Road Tests) results.

xix. Create a graph using the basic steps

a. plot.new()
b. Draw x axis and y axis
c. Mark 5 random points (declare them as X and Y vectors)
d. Draw line joining them
e. Draw a horizontal line touching the topmost point
f. Draw a vertical line touching the rightmost point

xx. Let the following be the response of the usage of 2 drugs A & B against dosage. Draw Line chart showing the responses, with both data in the same graph

```
drugA<- c(16, 20, 27, 40, 60)
drugB<- c(15, 18, 25, 31, 40)
```

hint: use plot function to plot the response of drugA and lines function to plot drug B in the same graph.

xxi. Prepare an ML model using KNN Classifier to predict the Species information for a given iris flower using Sepal Length, Sepal Width, Petal Length & Petal Width. Use the complete iris dataset for training. Use it to predict the species of an iris flower.

xxii. Print the Accuracy Score and Confusion matrix for KNN Classifier using iris data. (Split iris dataset to train and test sets)

xxiii. Prepare an ML model using KMeans algorithm to cluster some sample input generated using make_blob function. Plot the clusters.

xxiv. Identify a suitable dataset from your area of interest for a classification problem. Develop an ML model to do prediction. Print confusion matrix and accuracy score.

3.17.2. Sample Question Paper

Note

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.
3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS TOTAL MARKS: 100

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one.**

1.1. State which of these is the application of Artificial Intelligence

(a) Planning and Scheduling

(b) Game Playing

(c) Robotics

(d) All of these

1.2. Which instruments are used for perceiving and acting upon the environment?

(a) Sensors and Actuators

(b) Sensors

(c) Perceiver

(d) None of these

1.3.Which of the following is not an example of an agent?

a) Model based
b) Goal Based
c) Utility based
d) Role based

1.4.Data used for building a machine learning model

(a) Training data
(b) Testing Data
(c) Validation Data
(d) Hidden Data

1.5.Which of the following is not a task performed by a Machine Learning algorithm?

(a) Regression
(b) Classification
(c) Clustering
(d) Streaming

1.6.Which of the following is an R data Structure?

(a) Vector
(b) List
(c) Data Frame
(d) All of these

1.7.Which of the following R data structure is suitable for storing tabular data?

(a) Vector
(b) Factor
(c) List
(d) Data Frame

1.8. Which of the following is a probability distribution function?

(a) Normal Distribution

(b) Binomial Distribution

(c) Poisson Distribution

(d) All of these

1.9. Which of the following machine learning algorithm is more suitable for classification problem?

(a) Regression

(b) K Nearest Neighbor

(c) K Means

(d) None of these

1.10. Which of the following machine learning algorithm is to be used when the objective of the algorithm is to predict the numeric value of a variable?

(a) K Nearest neighbor

(b) Linear Regression

(c) K Means

(d) None of these.

2 Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

2.1. AI can be used for disease diagnosis if enough data about the disease and past history is available.

2.2. AI can be used for identifying fraudulent credit card transactions.

2.3. K Means algorithm is used for clustering data

2.4. Accuracy score is a performance metric used for evaluation machine learning algorithms

2.5. R Programming is used for statistical data analysis.

2.6. In R programming, a vector can store different types of data into a variable.

2.7. In R programming, a list stores only same type of data.

2.8. Correlation coefficient is used to measure the strength of relationship between two sets of data.

2.9. Confusion Matrix is used to evaluate the performance of classification algorithms.

2.10. The plot of a normally distributed data follows a bell shared curve.

2. Match the words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1. Data Cleaning	1) R Programming
3.2. Classification	2) Linear Regression
3.3. Probability Distribution	3) K Nearest Neighbor
3.4. Clustering	4) Removing Null Values
3.5. Data Mining	5) K Means
3.6. Agent	6) Two dimensional Vector
3.7. Matrix	7) Structured Data
3.8. Regression	8) Poisson Distribution
3.9. Statistical Data Analysis Tool	9) Bar Plot
3.10. Data Visualization	10) Goal Based Agent
	11) OLAP

3. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

(a) Computer Vision	(b) Histogram	(c) Unstructured Data
(d) Structured Data	(e) OLAP	(f) K Nearest Neighbor
(g) Supervised learning	(h) Data Warehousing	(i) Agent
(j) Root Mean Square	(k) Pie Chart	(l) Unsupervised Learning

4.1	If the data is well organized in the form of rows and columns, it is called _____.
4.2	While developing machine learning models, when the training data includes the outcomes of the past input data, the learning method is called _____
4.3	Autonomous vehicles make use of _____ technique to identify the objects in front of them.
4.4	_____ is a computer system that is situated in some environment, and that is capable of autonomous action in this environment in order to meet its design objectives.
4.5	_____ is a powerful technology for data discovery, including capabilities for report viewing, complex analytical calculations, and predictive analytics
4.6	_____ is a metric used for evaluating the performance of regression algorithm.
4.7	Careful selection of the value of k is very important for the best performance of _____ algorithm.
4.8	The visualization of frequency distributions can be done with the help _____
4.9	_____ is defined as a technique for collecting and managing data from varied sources to provide meaningful business insights.
4.10	The data obtained through social media posts can be considered as _____

PART TWO

(Answer any FOUR questions)

5.

(a) Describe the structure of Agents.

(b) List the different types of agent-based systems.

(c) Differentiate between OLAP and OLTP.

(5+5+5)

6.

(e) List some application of AI.

(f) Illustrate how AI can be useful in i) health care sector ii) automobile sector.

(5+10)

7.

(c) Explain in detail the Bookmark and Hyperlinks feature.

(d) What are the advantages of presentation package? Give example of one such package. How can we create a transition and animation in a presentation?

(7+8)

8

(f) Briefly explain the different types of instant messaging services available.

(g) What are the different types of charts options available? Briefly explain the procedure to create a pie chart.

(h) Define e-mail. Explain the advantages and disadvantages of e-mail.

(5+5+5)

9. Briefly explain the following (Any three):

(i) Cache Memory

(j) Internet of Things

(k) Compiler and Interpreter

(l) Internet Banking

(m) Netiquette

(5*3=15)

3.18. Module: A10.5-R5 –Machine Learning using Python

3.18.1. Practical Assignments

i. Write a program to count the number of strings in a given list.
   a. Count number of strings with length more than 3 characters
   b. Count number of strings having first and last characters as same.

ii. Write a program to generate all permutations of a list in Python.

iii. Write a program to flatten a shallow list.

Input - [[2,5,8],[4,2,5],[7,9]]

Output - [2,5,8,4,2,5,7,9]

iv. Using List comprehensions, find sum and product of two lists

vec1 = [2,4,6]

vec2 = [4,3,-9]

v. Write a program to check whether list contains a sublist.
   a. Input -check_sublist([2,5,8,4,2,5,7,9] , [4,2])
   b. Output - True
   c. Input -check_sublist([2,5,8,4,2,5,7,9] , [4,9])
   d. Output - False

vi. Write a python program to concatenate dictionaries into one.

vii. Write a function histogram which accepts a string and returns the count of characters.

viii. Referring to Q9, write a function convert_to_dict which takes count as key and list as the characters which have the same count, eg.

ix. From the given 1d array arr, generate a 2d matrix using strides, with a window length of 4 and strides of 2, like [[0,1,2,3], [2,3,4,5], [4,5,6,7].]

x. Replace all odd numbers in arr with -1 without changing arr

Input:

arr = np.array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])

Desired Output:

out

```
#> array([ 0, -1,  2, -1,  4, -1,  6, -1,  8, -1])
arr
#> array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

xi. Import the iris dataset keeping the text intact. Find the mean, median, standard deviation of iris's sepal length

```
iris = np.genfromtxt(url, delimiter=',', dtype='object')
```

xii. Create a pandas series from each of the items below: a list, numpy and a dictionary

```
Input
mylist = list('abcedfghijklmnopqrstuvwxyz')
myarr = np.arange(26)
mydict = dict(zip(mylist, myarr))
```

xiii. Give two solutions to combine ser1 and ser2 to form a dataframe.

```
ser1 = pd.Series(list('abcedfghijkl(mnopqrstuvwxyz'))
ser2 = pd.Series(np.arange(26))
```

xiv. Import the boston housing dataset from https://raw.githubusercontent.com/selva86/datasets/master/BostonHousing.csv, but while importing change the 'medv'(median house value) column so that values < 25 becomes 'Low' and > 25 becomes 'High'.

xv. Read into pandas the csv file downloaded from https://raw.githubusercontent.com/selva86/datasets/master/Cars93_miss.csv

xvi. Get the number of rows, columns, datatype and summary statistics of each column of the Cars93 dataset. Also get the numpy array and list equivalent of the dataframe.

xvii. In df, Replace NaNs with 'missing' in columns 'Manufacturer', 'Model'and 'Type' and create a index as a combination of these three columns and check if the index is a primary key.

xviii. Rename the column Type as CarType in df and replace the '.' in column names with '_'.

xix. Which manufacturer, model and type has the highest Price? What is the row and column number of the cell with the highest Price value?

a. Replace missing values in Min.Price and Max.Price columns with their respective mean.

b. In df, use apply method to replace the missing values in Min.Price with the column's mean and those in Max.Price with the column's median.

xx. The following three-dimensional numpy array holds the earnings of a company of two years, 2016 and year 2017 divided into quarterly earnings.

earnings = [[[500,505,490], [810,450,678], [234,897,430], [560,1023,640]], [[600,605,490], [345,900,1000], [780,730,710], [670,540,324]]]

Retrieve the earnings of January of year 2016

Retrieve earnings of January for all years

Using slicing, Retrieve first quarter earnings from both years

xxi. Using OpenCV and Cascades, write a function that detects faces within a picture. The function returns a list of rectangles in which faces are found. Loop over where it thinks it found something. Display the image and wait for the user to press a key.

xxii. Using OpenCV and Webcam, grab each frame from the webcam, and detect faces by processing each frame.

xxiii. Using NLTK, make files for positive comments given for various movies and for negative comments for various movies. Do the necessary text analysis and train the data. Input some new reviews to the model and predict the review.

xxiv. Download the mnist data of hand written digits. Train the data with appropriate model. Write a tkinter program to capture a digit drawn by user in a window. Then predict the digit using the model.

xxv. Do the same question with Deep Learning algorithms.

3.18.2. Sample Question Paper

NOTE:

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TOTAL TIME: 3 HOURS TOTAL MARKS: 100

(PART ONE: 40; PART TWO: 60)

PART ONE

(Answer all the questions; each question carries ONE mark)

1. Each question below gives a multiple choice of answers. Choose the most appropriate one.

1.1.If a is a python list, then a[:] will result in

(a) True

(b) False

(c) []

(d) IndexError

1.2.How to create identity matrix in python using numpy package

(a) npeye(3)

(b) eye(3)

(c) identity(3)

(d) np.identity(3)

1.3. Given two lists a = [1,2,3,4,5] and b = [6,7,8,9], how to create a list which has all the elements of a and b in one dimension like [1,2,3,4,5,6,7,8,9]

(a) a.append(b)

(b) a.extend(b)

(c) a.concat(b)

(d) None of the above

1.4. Which of the following command will be used to freeze your machine learning model using Pickle library

(a) push(model, "file")

(b) save(model, "file")

(c) demp(model, "file")

(d) freeze(model, "file")

1.5 train_set = np.array([1, 2, 3]) test_set = np.array([[0, 1, 2], [1, 2, 3]])

Choose the option to join the train set and test set into a resulting array

resulting_set --> [[1, 2, 3], [0, 1, 2], [1, 2, 3]]

(a) resulting_set = train_set.append(test_set)

(b) resulting_set = np.vstack([train_set, test_set])

(c) resulting_set = np.concatenate([train_set, test_set])

(d) None of the above

1.6. For tuning hyperparameters of a random forest classifier, which of the following value of seed is best while applying random_state(seed):

(a) np.random.seed(1)

(b) np.random.seed(40)

(c) np.random.seed(32

(d) Cant Say

1.7. How would you import a decision tree classifier in sklearn?

(a) from sklearn.decision_tree import DecisionTreeClassifier

(b) from sklearn.ensemble import DecisionTreeClassifier

(c) from sklearn.tree import DecisionTreeClassifier

(d) None of these

1.8. The data series given below are different referring to the dataframe

```
df = pd.DataFrame(['ff', 'gg', 'hh', 'yy'],
    [24, 12, 48, 30],
    columns = ['Name', 'Age'])
```

df ['Name'] and

df.loc[: , 'Name']

(a) 1 is view of original dataframe and 2 is a copy of original dataframe.

(b) 2 is view of original dataframe and 1 is a copy of original dataframe.

(c) Both are copies of original dataframe.

(d) Both are views of original dataframe.

1.9. Given a dataframe df:

df=pd.DataFrame({'Click_Id':['A','B','C','D','E'],'Count':[100,200,300,400,250]})

To change the column 'Count' in df to 'Click_Count', the following command has been given :df.rename(columns = {'Count':'Click_Count'}), What will be the output of print df.columns:

(a) ['Click_Id', 'Click_Count']

(b) ['Click_Id', 'Count'].

(c) Error

(d) None of these

1.10. How would you read data from the file using pandas by skipping the first three lines?

2.1.read_csv('email.csv', skiprows=3)

2.2.read_csv('email.csv', skip=3).

2.3.read_csv('email.csv', skip_rows=3)

2.4.None of These

2. Each statement below is either TRUE or FALSE. Identify and mark them accordingly in the answer book.

1.1 In a python list, given object cannot appear more than once.

1.2 We can get multiple local optimum solutions if we solve a linear regression problem by minimizing the sum of squared errors using gradient descent.

1.3 When the hypothesis space is richer, over fitting is more likely

1.4 As the number of training examples goes to infinity, your model trained on that data will have same bias

1.5 When a decision tree is grown to full depth, it is more likely to fit the noise in the data.

1.6 When we check "john" in d in a dictionary d, which is d={"john":30,"Peter":20}, it returns False.

1.7 A tuple is similar to list but it is immutable.

1.8 If a=[1,2,3,4,5], print(a[3:0:-1]) will print [4,3].

1.9 Tuples are homogeneous but lists are heterogeneous.

1.10 Quantizing an image will reduce the amount of memory required for storage.

3. Match words and phrases in column X with the nearest in meaning in column Y.

X	Y
3.1. x = [10, [15, 20, [30, 'ram', 3.141]], 'sita'] output of x[1][2][1]	1) Deep Learning
3.2. A subtask of Speech Recognition.	2) KNN
3.3. Collection of algorithms in the hierarchy apply a nonlinear transformation on its input	3) Pickle Module
3.4. The module in python which supports regular expressions	4) Speech segmentation

3.5. Serializing and Deserializing a Python object structure	5) Ram
3.6. The type of each element in sys.argv	6) regex
3.7. Function which returns the dictionary of the module namespace	7) Natural Language Processing
3.8. A supervised learning algorithm used for classification and regression problem	8) Locals()
3.9. Empty Dictionary	9) Tuple
3.10. Returns list elements from 4 to 5	10) List
	11) Globals()
	12) String
	13) K-means
	14) Re
	15) {}
	16) l[4:6]

4. Fill in the blanks in 4.1 to 4.10 below, by choosing appropriate words and phrases given in the list below:

a) Mutable	b) append	c) F1 Score Metric	d) Naïve Bayes
e) 80,000	f) Identity matrix	g) 8,00,000	h) k-NN
i) Immutable	j) Confusion matrix	k) extend	l) False Positive
m) False Negative	n) Deep Learning	o) Lemmatization	p) Stemming
q) Recall Score Metric			

4.1	A characteristic of a list data structure.
4.2	Consider and image with width and height as 100×100. Each pixel in the image can have a color from Grayscale, i.e. values. How much space would this image require for storing?
4.3	The method of lists which adds the specified list elements to the end of the current list.
4.4	The String data structure is _____
4.5	Which algorithm does more computation on test time rather than train time.
4.6	A technique for summarizing the performance of a classification algorithm.
4.7	An outcome where the model incorrectly predicts the positive class.
4.8	A model where computer learns to perform classification tasks directly from images, text or sound.

4.9	The technique in NLP which generates root form of a word which may not be an actual word.
4.10	An evaluation metric of Machine Learning which is the harmonic mean of recall and precision.

PART TWO

(Answer any FOUR questions)

5.

(a) What are lists? Explain the difference between list and tuple, with example(s).

(b) Explain the output of the following

```
a =[1,2,3,4,5]
b =lambda x: (b (x[1:]) + x[:1]if x else[])
print(b (a))
```

(c) What is broadcasting in numpy? How is it useful?

(5+5+5)

6.

(a) What is a Python module? How are they imported?

(b) Write a Python program to check whether a given string is a palindrome or not, without using an iterative method. Note: A palindrome is a word, phrase, or sequence that reads the same backward as forward, e.g., madam, nurses run, etc.

(c) Write a program to find the maximum value in each row of a numpy array 2d?

(7+5+3)

7.

(a) How do you handle missing or corrupted data in a dataset? Explain various functions.

(b) Given the following csv file "Patient.csv" having 2 lakh records:

Name calcium protein nutrients

(i) Load the csv into pandas.

(ii) Remove all the rows having null value in any of fields.

(iii)Create a new column result and populate with :

1. 'Y' if the average of all three columns > 100 else N

(iv) Train the model using K-neighbours classifier after splitting into test data and train data.

(v) Use functions to check the accuracy on test data with different values of n_neighbours.

(vi) Now predict for new values.

(5+10)

8. (a) What is the difference between supervised and unsupervised machine learning? Explain one algorithm under each category.

(a) How is KNN different from k-means clustering? Explain the algorithms.

(8+7)

9. Briefly explain the following (Any three):

(a) Difference between probability and likelihood

(b) Convolutional Neural Network

(c) Sentiment Analysis with example

(d) Fancy Indexing in Numpy (5+5+5)