Information Booklet cum Syllabus

of

IT Application Engineer (B Level - IT)

Under DOEACC Scheme

Revision-V

JANUARY 2023

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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Section 1

About NIELIT and IT Application Engineer (B Level - IT) under DOEACC (Department of Electronics Accredited Computer Courses) Scheme

1.1. About the Revised Syllabus

The fourth revised version of IT Application Engineer (B Level - IT) 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 from both the views of industry and academy. 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 'B' Level (IT) course.

This document presents the **fifth revised version of DOEACC IT Application Engineer (B Level - IT)** syllabus **(hereafter called as B Level)** which becomes effective for teaching from the date of its notification. The syllabus of 'B' 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, 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 (IT) –NSQF aligned course at Level 4
- 'A' Level - NSQF aligned course at Level 5
- 'B' Level - NSQF aligned course at Level 6
- 'C' 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)
    - Expert Computer Course

At present, NIELIT is operating from offices located at Itanagar, Pasighat, Tezu, Guwahati, Jorhat, Dibrugarh, Silchar, Kokrajhar, Majuli, Tezpur, Patna "Alawalpur (Saksharta Kendra)", "Lakhanpur (Saksharta Kendra)", Chandigarh, Delhi, Daman, Kurukshetra, Shimla, Mandi, Srinagar, Jammu, Leh, Kargil, Ranchi, Calicut, Aurangabad, Imphal, Churachandpur, Senapati, Shillong, Tura, Aizawl, Lunglei, Kohima, Chuchuyimlang, Dimapur, Bhubaneswar, Ropar, Ajmer, Pali, Gangtok, Chennai, Agartala, Gorakhpur, Lucknow, Haridwar, Kolkata 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 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 & IT 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 functions of the DOEACC Scheme are:

i. Accreditation

ii. Registration

iii. Examination & Certification

1.5. 'B' Level under DOEACC Scheme

1.5.1. Objective of IT Application Engineer (B Level - IT)

The objective of 'B' Level is to develop capability to analyse, develop and manage software project. The course has been designed to give the students sound background in computing, business functions and mathematics relevant to information technology. During the course, a student will learn Computer Programming Languages, Compilers, Software packages, database systems, Network Management & Information Security etc.

The course will 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/Developer
v. Business Intelligence Analyst
vi. Information Security Analyst
vii. Training Faculty
viii. R & D Scientist
ix. Senior Software Developer
x. Consultant
xi. Solution Architect

1.5.2. Structure of IT Application Engineer (B Level - IT) under DOEACC Scheme

The revised syllabus (Revision V) of IT Application Engineer (B Level - IT) consists of following components.

- 13 Compulsory modules
- 3 Practical
- 2 Elective modules out of 9 modules
- One Major Project.

Semester	Module Code	Module Name
Bridge Course	B0.1-R5	Basic Mathematics
I	B1.1-R5	Management Fundamentals & Information Systems
	B1.2-R5	Discrete Structures
	B1.3-R5	Software Engineering
	B1.4-R5	Operating Systems
	B1.5-R5	Data Communications and Computer Networks
	B-PR-1-R5	Practical Based on B1.1-R5 to B1.5-R5
II	B2.1-R5	Computer based Statistical &Numerical Methods
	B2.2-R5	Professional & Business Communication
	B2.3-R5	Advance Database Technologies
	B2.4-R5	Computer Graphics & Multimedia
	B2.5-R5	Cloud Computing and IoT
	B-PR-2-R5	Practical Based on B2.1-R5 to B2.5-R5

III	B3.1-R5	Software Project Management
	B3.2-R5	Artificial Intelligence and Machine Learning
	B3.3-R5	Web Technologies
	B3.E1-R5	Digital Marketing
	B3.E2-R5	System Modelling & Computer Simulation
	B3.E3-R5	Distributed and Parallel Computing
	B3.E4-R5	Data Warehouse and Data Mining
	B3.E5-R5	Software Testing and Quality Assurance
	B3.E6-R5	Digital Image Processing
	B3.E7-R5	Accounting& Financial Management
	B3.E8-R5	Wireless & Mobile Communication
	B3.E9-R5	Blockchain Technology
	B-PR-3-R5	Practical Based on B3.1-R5 to B3.3-R5 and all elective modules. The candidate has to attempt practical exam related to electives depending upon his/her choice.
IV	B-PJ-R5	Major Project
	B-ES-R5	Employability Skills

1.5.3. Sequence of Modules Training

The suggestive sequence to cover all the modules of IT Application Engineer (B Level - IT) along with learning hours is listed below.

Module Code	**Module**	**Learning Hours (Theory)**	**Learning Hours (Practical/ Tutorials/ Project)**	**Total Learning Hours**
Semester I (600 hours)				
B1.1-R5	Management Fundamentals & Information Systems	45	75	120
B1.2-R5	Discrete Structures	45	75	120
B1.3-R5	Software Engineering	45	75	120
B1.4-R5	Operating Systems	45	75	120
B1.5-R5	Data Communications and Computer Networks	45	75	120
Semester II (600 hours)				

B2.1-R5	Computer Based Statistical & Numerical Methods	45	75	120
B2.2-R5	Professional & Business Communication	30	90	120
B2.3-R5	Advance Database Technologies	45	75	120
B2.4-R5	Computer Graphics & Multimedia	45	75	120
B2.5-R5	Cloud Computing and IoT	45	75	120
Semester III (600 hours)				
B3.1-R5	Software Project Management	45	75	120
B3.2-R5	Artificial Intelligence and Machine Learning	45	75	120
B3.3-R5	Web Technologies	45	75	120
B3.E?-R5	Elective I	45	75	120
B3.E?-R5	Elective II	45	75	120
? -Means Elective papers will be from 1 to 9				
Semester IV (600 hours)				
B-PJ-R5	Major Project			600
B-ES-R5	Employability Skills			120
Total Learning Hours				2520

The candidate without Mathematics background at 10+2 level will have to clear Bridge Course before start of Semester II. The summary of semester wise learning hours is as under:

Semester	**No. of Modules**	**Theory Learning Hours**	**Practical Learning Hours**	**Project Learning Hours**	**Employability Skills**	**Total Learning Hours**
I	5	225	375	0	0	600
II	5	210	390	0	0	600
III	5	225	375	0	0	600
IV	0	0	0	600	120	720
Total	**15**	**660**	**1140**	**600**		**2520**

1.5.4. Duration of the Course

The duration of IT Application Engineer (B Level - IT) is 2520 hours including 600 hours of project. The minimum period to cover contents of IT Application Engineer (B Level - IT) is two years.

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. Project

The candidate registered in 'B' Level (IT) under DOEACC Scheme is required to submit one project.

1.9. About Major Project

NIELIT curriculum has a Major project as an important component of IT Application Engineer (B Level - IT). 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 'B' Level (IT) should be a person with DOEACC 'B' level/M.C.A./B.Tech/MSC(IT/Electronics) 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 Project

The student undergoing course IT Application Engineer (B Level - IT) has to submit one project in order to be 'B' 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 certificates in the prescribed format from the head of the institute running the accredited course or the organization of which the learner is an employee or from organization head where the candidate has complete project successfully as intern.

Student can develop a project of any type like browser based, mobile based or client-server architecture base application. However, one project 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. There are no restrictions on second major project.

1.9.4. Time of Submission of Project for IT Application Engineer (B Level - IT)

'B' Level (IT) student can submit the project as per criteria mentioned below.

Project	Semester	Criteria	Marks
Major Project in any area	IV	After clearing/appearing all the modules of IT Application Engineer (B Level - IT)	Project carries a total of 500 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 'B' 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.

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 IT Application Engineer (B Level - IT) 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

1.10. Credit Scheme for IT Application Engineer (B Level - IT)

1.10.1. About Credit System

A credit system based on the NCVET 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

Module Code	Module	Learning Hours (Theory)	Learning Hours (Practical/ Tutorials/ Project)	Total Learning Hours	Total Credit (1 credit = 30 hours)
Semester I (20 credit)					
B1.1-R5	Management Fundamentals & Information Systems	45	75	120	4
B1.2-R5	Discrete Structures	45	75	120	4
B1.3-R5	Software Engineering	45	75	120	4
B1.4-R5	Operating Systems	45	75	120	4
B1.5-R5	Data Communications and Computer Networks	45	75	120	4
Semester II (20 credits)					
B2.1-R5	Computer Based Statistical & Numerical Methods	45	75	120	4
B2.2-R5	Professional & Business Communication	30	90	120	4
B2.3-R5	Advance Database Technologies	45	75	120	4
B2.4-R5	Computer Graphics & Multimedia	45	75	120	4
B2.5-R5	Cloud Computing and IoT	45	75	120	4
Semester III (20 credit)					

B3.1-R5	Software Project Management	45	75	120	4
B3.2-R5	Artificial Intelligence and Machine Learning	45	75	120	4
B3.3-R5	Web Technologies	45	75	120	4
B3.E?-R5	Elective I	45	75	120	4
B3.E?-R5	Elective II	45	75	120	4
Semester IV (20)					
B-PJ-R5	Major Project			600	20
	Employability Skills			120	-
B-ES-R5	Total Learning	660	1150	2520	80

Notes

1. One credit is given for 30 hours of learning including theory, practical, tutorial and project Credits gained by passing Bridge Course are not added in final certificate.

1.11. Examination Pattern

Candidate without mathematics at 10+2 level will have to undergo Bridge Course comprising one module on Basic Mathematics and appear in the examination. The candidate will have to clear it with/before semester –I. This is qualifying module for B Level.

The examination of each paper/module of 'B' Level will be comprised of theory and practical examinations. the examination pattern of IT Application Engineer (B Level - IT) is as under.

<table>
<tr><td>Theory Examination</td><td>15</td></tr>
<tr><td>Practical Examination</td><td>3 (one per semesters)</td></tr>
<tr><td>Mode of Examination – Theory</td><td>Subjective paper</td></tr>
<tr><td>Mode of Examination – Practical</td><td>Each Practical examination of three-hours duration and 100 marks would be conducted. Each practical will cover the modules of semesters as given below:
<table>
<tr><th>Practical Examination</th><th>Modules coverage</th></tr>
<tr><td>B-PR1-R5</td><td>B1.1-R5 to B1.5 –R5</td></tr>
<tr><td>B-PR2-R5</td><td>B2.1-R5 to B2.5 –R5</td></tr>
<tr><td>B-PR3-R5</td><td>B3.1-R5 to B3.3 –R5 + 2 From Elective Papers</td></tr>
</table></td></tr>
</table>

	The emphasis is on the practical demonstration of skills & knowledge based on the performance criteria. Practical exam carrying 100 marks, out of which 80 marks shall be for the Practical/Hands-on and 20 marks for Viva Voce. Laboratory/ Practical work may be conducted at Institutions / organizations, which are running the course along with other facilities having sufficient resources to conduct practical examinations. Efforts shall be made to make practical examinations completely online and remote proctor based to avoid dependency on the practical examination centres.
Mode of Submission of Major Project – B-PJ-1	The Project is to be carried out after completing all the training of the modules by the student. The project is to be done under guidance and support of faculty and management of the respective Institute/ Organization). The project B-PJ-1 will carry 500 marks. The marks distribution for project are 80% for the project evaluation and 20% for the viva-voce.

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. Total Marks

Semester wise maximum marks are given in following table.

Semester	**No. of Theory Modules**	**Max. Marks per Module**	**Total Theory Marks**	**No. of Practical Module**	**Max. Marks of Practical Marks**	**Project Marks**	**Employability Skills**
I	5	100	500	1	100		
II	5	100	500	1	100		
III	5	100	500	1	100		
IV						500	Module is qualifying in nature , marks will not be counted in pass

							percentage calculation
Total			1500		300	500	-
Total Aggregate Marks		**2300**					

1.11.2. Pass Percentage

To qualify for a pass in a module, a candidate must have obtained at least 50% in each theory and practical examination each. 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

The same examination pattern is applicable for Bridge Course, however, the candidate has to pass it. A certificate will be issued separately. But marks of this course will not be added in final certificate issued by NIELIT on successfully completion of B Level (IT).

1.11.3. Award of Certificates

The students would be eligible for the award of IT Application Engineer (B Level - IT) under DOEACC Scheme certificate on successfully qualifying the eligibility criteria along with Theory Examinations of all modules, Practical Examination and the Project. The IT Application Engineer (B Level - IT) was recognized as equivalent to MCA for the purpose of employment under Central Government by Government of India vide Ministry of Human Resources Development, Govt. of India's notification F.2/697–TS.IIIa dated 26th September, 2000 and is currently aligned at NSQF (National Skill Qualifications Framework) level 7.

1.11.4. Registration

Registration is a pre-requisite for appearing in 'B' 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 through Direct candidate or through NIELIT accredited institute for 'B' Level.

1.11.5. Eligibility Criteria

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

(i) Students Registered through B-Level Accredited Institutes:

NIELIT 'A' Level DOEACC Scheme with graduation

Or
Government recognized PGDCA/ BCA/ B.Sc. (IT)/ B.Sc. (Computer Science)

(ii) Direct Candidate:

As mentioned in point 1.11.5(i) above.

1.11.6. Schedule of Registration of IT Application Engineer (B Level - IT)

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 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 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, 2023, he would be eligible for this facility in case he wishes to appear for IT Application Engineer (‘B’ Level –IT) Examinations in July, 2023 through Accredited Institute. If, however, he had passed ‘A’ Level prior to Jan., 2023 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 'B' 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. Hardware Requirement

1.12.1. 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

1.13. 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++, Java
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
9.	Framework	Spring,
10.	IDE	Netbeans, eclipse, RStudio

In addition to above, additional software tools would be required as mentioned in syllabus of each module.

1.14. Parity Table Between Revision IV and Revision V of 'B' Level

The Parity Table between B Level Revision IV and Revision V is as under.

Sr. No.	Previous Syllabus		Revised Syllabus	
	Module Code (Revision IV)	**Revision IV (Module)**	**Module Code (Revision V)**	**Revision V (Module)**
1.	B0.0-R4	Basic Mathematics	B0.1-R5	Basic Mathematics (As Bridge Course)
2.	B3.1-R4	Management Fundamentals Information System	B1.1-R5	Management Fundamentals & Information Systems
3.	B3.2-R4	Discrete Structure	B1.2-R5	Discrete Structures
4.	B3.3-R4	Software Engineering and CASE Tools	B1.3-R5	Software Engineering
5.	B3.4-R4	Operating Systems	B1.4-R5	Operating Systems
6.	B3.5-R4	Visual Programming	B3.5-R5	Web Technologies
7.	B4.1-R4	Computer based Statistical & Numerical Methods	B2.1-R5	Computer based Statistical &Numerical Methods
8.	B4.2-R4	Professional & Business Communication	B2.2-R5	Professional & Business Communication
9.	B4.3-R4	Object Oriented Database Management Systems	B2.3-R5	Advance Database Technologies
10.	B4.4-R4	Computer Graphics & Multimedia	B2.4-R5	Computer Graphics & Multimedia
11.	B4.5-R4	Internet Technology and Web Services	No direct Exemption. However, exemption can be given as per Note 2 of this section.	
12.	B5.1-R4	Software Project Management	B3.1-R5	Software Project Management

13.	B5.2-R4	Automata Theory & Compiler Design	No direct Exemption. However, exemption can be given as per Note 2 of this section.	
14.	B5.3-R4	Network Management & Information Security	B1.5-R5	Data Communications and Computer Networks
15.	BE1-R4	Embedded Systems	B2.5-R5	Cloud Computing and IoT
16.	BE2-R4	Artificial Intelligence and Neural Networks	No direct Exemption. However, exemption can be given as per Note 2 of this section.	
17.	BE3-R4	E-Business	B3.E1-R5	Digital Marketing
18.	BE4-R4	System Modelling and Computer Simulation	B3.E2-R5	System Modelling & Computer Simulation
19.	BE5-R4	Parallel Computing	B3.E3-R5	Distributed and Parallel Computing
20.	BE6-R4	Data Warehouse and Data Mining	B3.E4-R5	Data Warehouse and Data Mining
21.	BE6-R4	Software Testing and Quality Management	B3.E5-R5	Software Testing and Quality Assurance
22.	BE8-R4	Digital Image Processing	B3.E6-R5	Digital Image Processing
23.	BE9-R4	Accounting & Financial Management System	B3.E7-R5	Accounting & Financial Management
24.	BE10-R4	Applied Operations Research	No direct Exemption. However, exemption can be given as per Note 2 of this section.	
25.	BE11-R4	Wireless & Mobile Communication	B3.E8-R5	Wireless & Mobile Communication
26.	BE12-R4	Information Storage & Management	No direct Exemption. However, exemption can be given as per Note 2 of this section.	

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

Note:

1. Candidate who has cleared 15 modules in B Level Revision IV (after 'A' Level) shall be exempted from n modules in B Level Revision V subject to maximum of 15 modules in all in B Level Revision V, however employability skill module is required to be passed.
2. Candidate who has cleared Modules, BE2-R4, B4.5-R4, B5.2-R4, BE10-R4 and BE12-R4 under B Level Revision IV will not be entitled for any exemption provided he has already cleared all the 15 required modules under Revision V. However, if candidate, while shifting from Revision IV to Revision V, has availed maximum exemption as mention in Parity Table and has less than 15 passed modules shall be eligible for exemption against any modules, BE2-R4, B4.5-R4, B5.2-R4, BE10-R4 and BE12-R4, in Revision V subject to maximum 15 cleared modules. The following table illustrates the criteria

Total modules passed as per BE2-R4, **B4.5-R4, B5.2-R4, BE10-R4 and BE12-R4**	**Total modules passed, after exemption as per Parity Table under Revision V**	**Exemption**
4	12	Candidate can claim exemption in any 3 modules under Revision V for which either he/she has not cleared examination or not availed exemption
2	12	Candidate can claim exemption in any 2 modules under Revision V for which either he/she has not cleared examination or not availed exemption. Candidate will have to pass 1 more module as per R-V.
4	15	No Exemption
3	12	Candidate can claim exemption in any 3 modules under Revision V for which either he/she has not cleared examination or not availed exemption

3. 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.

4. Candidates will have to pass 15 theory papers, one project and employability skills module in order to qualify 'B' Level (IT) in Revision V syllabus.

5. 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.

Section 2

Detailed Syllabus of Modules of IT Application Engineer (B Level - IT)

2.0. Module: B0.1-R5- Basic Mathematics

2.0.1. Introduction

The aim of this module is to make students aware about mathematics skills, which are necessary for understanding essential topics in computer science. The module is developed as a bridge course for students of non-mathematical background. The module is framed in such a way that the students get exposure to basic topics in mathematics that would prepare the students to learn the advance level courses in the domain of computer science such as discrete structure, computer graphics, computer and communication networks, data analytics, simulation, operations research etc.

2.0.2. Objectives

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

i. Understand concepts of basic mathematics used in Computer Science.

ii. Solve various basic mathematical problems.

2.0.3. Duration

120 Hours - (Theory: 45 hrs + Tutorial: 75 hrs)

2.0.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Tutorial) in Hours	Learning Objectives
1. Sequences & Series	5	10	After completion of this unit of module, the Learner will be able to i. Understand concepts of Sequences & Series
2. Matrices and Determinant	5	10	After completion of this unit of module, the Learner will be able to i. Understand Matrices & Determinant and solve System of Equations
3. Analytical Geometry	6	9	After completion of this unit of module, the Learner will be able to

			i. Understand Concepts of Coordinates and solve various problems related to it.
4. Vectors	4	6	After completion of this unit of module, the Learner will be able to i. Understand Concepts of Vectors and solve various problems related to Vector.
5. Differential Calculus	10	15	After completion of this unit of module, the Learner will be able to i. Understand Concepts of Functions, Limits and Continuity ii. Understand Concepts of Differential Calculus and solve various problems based on it.
6. Integral Calculus	15	25	After completion of this unit of module, the Learner will be able to i. Understand Concepts of Integral Calculus and solve various problems based on it.
Total	45	75	

2.0.5.Marks Distribution

Module Unit	Written Marks (Max.)
1. Sequences & Series	12
2. Matrices and Determinant	13
3. Analytical Geometry	13
4. Vectors	08
5. Differential Calculus	27
6. Integral Calculus	27
Total	100

2.0.6.Detailed Syllabus

(i) **Sequences & Series**

Introduction to Sequences and Series, Arithmetic and Geometric Series, Harmonic Series, Infinite Series, Sandwich theorem. Ratio test, comparison test, integral test. Alternating series, Introduction to Power Series,Properties of Power Series,Convergence of Power Series, Taylor & McLaurin's series

(ii) Matrices & Determinants

Notion of matrices, Algebra of Matrices, Square Matrix, Determinants, properties of determinants, triangular, diagonal, identity matrices, transpose of a matrix, symmetric and skew - symmetric matrices, orthogonal matrices, rank of a matrix, inverse of a square matrix, Eigenvalues & eigenvectors of a matrix, characteristic roots and characteristic vectors of a matrix, Hermitian and skew Hermitian matrices, consistent and inconsistent system of linear equations, Cramer's rule, Gauss elimination method.

(iii) Analytical Geometry

Introduction to Coordinates, Coordinates of points, Polar coordinates, Straight Line, Pair of Straight Line, Circle, Introduction to Conic Section, Tangent and Normal to a Circle.

(iv) Vectors

Vectors, Introduction to Vector Analysis and Vector Calculus, dot & cross product of vectors, projections parametric equations of lines, planes in 3 -space.

(v) Differential Calculus

Fundamental Theorem of Calculus, Functions and their graph. Domain & ranges of functions. Real numbers, exponential & logarithmic functions. Limits & continuity of functions. Hospital's rule, Definition of the Derivative, Product and Quotient Rules, Rates of Change, Successive Differentiation, The Chain Rule, Implicit Differentiation, Derivatives of General Exponential and Logarithmic Functions, Application of Derivatives, Mean Value theorem. Maxima & minima, asymptotes.

(vi) Integral Calculus

Introduction to Integration, Indefinite Integral, Integration by substitution, Integration by parts, Definite integral, Elementary Knowledge of Curve Tracing, Area between two curves.

2.0.7.Recommended Books

Main Reading

1. H Anton, I. Bivens, S. Davis, "Calculus", John Wiley and Sons.
2. E. Kreysig, "Advanced Engineering Mathematics", 8th Edition. Wiley, 2002, McGraw Hill
3. G.B. Thomas, Jr. R.L. Finney, "Calculus and Analytic Geometry", Pearson Education Asia, Ninth Edition, 2002
4. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publisher

Supplementary Reading

1. S.T.Tan, Applied "Calculus" , Kent Publishing Company.

2.1. Module: B1.1-R5- Management Fundamentals and Information Systems

2.1.1. Introduction

This module is concerned with the strategic importance of Management concepts and its processes in a business organization. This module provides a broad review of the field of Information system development, integration and managing security of such information systems in the modern business environment. It recognizes that many organizations employ information Technology (IT) Professionals, they have a key role to play in as the information provider that adds significant value to the ever-increasing volume of data processed for management decision making

2.1.2. Objectives

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

i. Develop an understanding of general management and information system concepts and practices.

ii. Understand the technological environment of the contemporary organization and to apply a systematic approach to the use of information technology in organizations.

iii. Appraise the technological environment in order to support the practical aspects of information development, integration, usage and understand security holes and its security controls to prevent information from various frauds.

iv. Gain application ability of necessary controls and standards in computerized Information system.

2.1.3. Duration

120 Hours - (Theory: 45hrs + Practical: 75 hrs)

2.1.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives
1. Process of Management	8	12	After completion of this unit of module, the Learner will be able to understand the various processes involving in managing business. Further, learner will be able to learn how to plan, control and manage project.

2. Information Systems Concepts	9	16	After completion of this unit of module, the Learner will be able to learn the commonly used information systems in any organization like financial, inventory etc.
3. Enterprise Systems	8	12	After completion of this unit of module, the Learner will be able to learn the enterprise level information system like ERP
4. System Development Process	11	19	After completion of this unit of module, the Learner will be able to learn the processes involved in developing the information systems at enterprise levels
5. Information Systems Security	5	10	After completion of this unit of module, the Learner will be able to learn the security risks in developing, deploying and implementing information systems. Further, the learner will be able to know the process to avoid or mitigate the risks.
6. Overview of Project Management	2	3	After completion of this unit of module, the Learner will be able to learn the basics of Project Management, its life cycle and different kind of management that are done during project execution.
7. Case Studies	2	3	After completion of this unit of the module, learner will be able to learn through case studies.
Total	45	75	

2.1.5.Marks Distribution

Module Unit	Written Marks (Max.)
1. Management Basics	20
2. Information Systems	25
3. Enterprise Systems	15
4. System Development Process	25
5. Information Systems security, overview of Project Management and Case Studies	15
Total	100

2.1.6.Detailed Syllabus

(i) **Management Basiscs**

Functions of Management Business Organization, Levels of Management, the classical organizational theory, the Behavioral Approach, the Management Science Approach**.**

Types of Management like strategic management, sale/Marketing Management, Operation Management, HR, Purchase etc.

Planning- Mission, Vision and goal setting; and SWOT Analysis;

Organizing -Types of Organizational Structures, Power, Authority, Delegation, Centralization and Decentralization, Formal and informal organizations, Functions and Design of an organization;

Leading - Motivation, Theories of Motivation;

Controlling: Control Process. Relevance of Computer applications in different functional areas of Management.

(ii) **Information Systems**

Definition of system, Types of systems: Physical and Abstract Systems, Deterministic and Probabilistic systems, Open and Closed systems. Need of an efficient information system. Major types of systems in organizations on the basis of organizational levels. Components of Information Systems: hardware, software, network, people & databases.

Examples and role of Information Systems in organization: Finance and Accounting Information systems, order processing, Inventory control Accounts receivable system Accounts Payable System, Payroll System, General ledger, Billing System, Purchase system. Marketing and Sales, Manufacturing and Productions, and Human Resources Information Systems. OAS, TPS, MIS, DSS, GDSS EIS, and ES.

(iii) **Enterprise Information Systems**

Evolution of Enterprise Information Systems, Redesigning the organization with information systems, Enterprise Resource Planning and management, Enterprise System Architecture, Integration of business functions. ERP: Meaning and Characteristics, Benefits, Limitations, Risks in ERP implementations. ERP Market,

Supply Chain Management, Customer Relationship Management, Business Analytics based Enterprise Information Systems, Emerging technologies

(iv) **Systems Development Processes**

Introduction to SDLC/Basics of SDLC; Requirements analysis and systems design techniques; Strategic considerations: -Acquisition decisions and approaches; Software evaluation and selection/ development; Hardware evaluation and selection; Systems operations and organization of systems resources; Systems documentation and operation manuals; User procedures, training and end user computing; System testing,

Assessment, conversion and start-up; Hardware contracts and software licenses System implementation; Post-implementation review; System maintenance.

Alternate development methodologies- RAD, Prototype, agile, scaled Agile, Scaled Agile Framework (SAF), SAF Implementation Roadmap, DevOp

(v) **Information System Security**

System Vulnerability, Computer frauds, computer abuse, preventing computer frauds, Ensuring System Quality, Information Security – Need, Contents of information security plan, Principles of information security, Best approach to implement information security, tools for information security: Authentication, access control, encryption, password, backups, firewalls, Security policy

(vi) **Project Management**

Overview of Project Management, Project Life Cycle, Scope, management, time management, quality Management, risk management, Integration Management.

(vii) **Case Studies**

Case Studies: Case study of Insurance sector in CRM, Educational Institute in ERP, Retail industry in Supply Chain Management.

2.1.7.Recommended Books

1) Management Information System by James O'Brien and other, 2017
2) Management Information System by Kenneth C Laudon, Jane Laudon, 2019, Pearson
3) Principles and Practices of Management, L. M. Prashad, 2021
4) Fundamental of Management, Stephen Robbins, Mary Coulter, David Ce Cenzo
5) Management Principles and Practices, CB Gupta, 2016
6) Software Engineering, A Practitioner's Approach, 2017
7) Fundamentals of Software Engineering, Rajib Mall, 5th Edition

2.2. Module: B1.2-R5-Discrete Structure

2.2.1. Introduction

Discrete Structure is the backbone of Computer Science and IT. Concepts and notations from discrete mathematics are useful in studying and describing objects and problems in all branches of computer science, such as computer algorithms, programming languages, cryptography, decision theory, Designing Data Analytics and Machine Learning Algorithms, automated theorem proving, and software development. It also plays a significant role in Big Data Analytics. Discrete Structure produces a significant collection of powerful methods, including mathematical tools for understanding and managing very high-dimensional data, inference systems for drawing sound conclusions from large and noisy data sets, and algorithms for scaling computations up to very large sizes. Discrete Structure may be termed as mathematical language of data science, and as such, its importance has increased dramatically in recent decades.

In this module candidate will learn various concepts of discrete structure used in various domain and its implementation using Python.

2.2.2. Objectives

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

i. Understand various concepts of discrete structure used in different domains of Computer Science.
ii. Find best algorithms among the available for a problem.
iii. Implement different algorithms used in Graphs and Tress in a given scenario.
iv. Understand and solve recurrence relations.
v. Solve a problem using Dynamic problems.

2.2.3. Duration

120 Hours - (Theory: 45hrs + Practical: 75hrs)

2.2.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives
1. Sets & Functions	04	06	After completion of this unit of module, the Learner will be able to i. Understand concepts of Sets.

			ii. Implement Sets on given data.
2. Formal Logic	04	06	After completion of this unit of module, the Learner will be able to i. Understand and implement the concept of mathematical logic.
3. Analysis of Algorithms	07	13	After completion of this unit of module, the Learner will be able to i. Understand the mathematical foundation in analysis of algorithms. ii. Analyze the efficiency of algorithms using time and space complexity theory.
4. Storage and Feature Extraction of Graphs and fTrees	11	19	After completion of this unit of module, the Learner will be able to i. Understand the concept of storage and feature extraction of Graphs and Trees. ii. Implement various related algorithms.
5. Counting and Combinatorics	11	19	After completion of this unit of module, the Learner will be able to

			i. Understand fundamentals of combinatory. ii. Formulate and solve recurrence relations.
6. Dynamic Programming	08	12	After completion of this unit of module, the Learner will be able to i. Examine the different dynamic programs. ii. Apply the dynamic programs to solve any scenarios.
Total	45	75	

2.2.5.Marks Distribution

Module Unit	Written Marks (Max.)
1. Sets & Functions	08
2. Formal Logic	08
3. Analysis of Algorithms	17
4. Storage and Feature Extraction of Graphs and Trees	25
5. Counting and Combinatorics	25
6. Dynamic Programming	17
Total	100

2.2.6.Detailed Syllabus

(i) Sets & Functions

Sets, Subsets, Relations and their properties. Representing relations, Equivalencerelation, partial orderings, maximal & minimal elements of a poset ,functions , inversefunctions. Composition of functions and recursive functions

(ii) Formal Logic

Logic operators, proposition equivalence involving tautologies contradiction , predicate &quantifiers, computer representations of sets.

(iii) Analysis of Algorithims

Algorithms and programs, efficiency of algorithms,Understanding Big 'O' notation, comparison ofalgorithm, sorting algorithm, Searching Algorithms,Complexity of Sorting and Searching Algorithms,UnderstandingPython Library for analysis of algorithims and its implementation.

(iv) Storage and Feature Extraction of Graphs and Trees

Introduction to Graph Theory, Understanding Paths and Cycles, understanding graphs, trees, Multi graph and weighted graphs, paths & circuits, Euclidian paths and circuits, the traveling salesman problem, planer graphs, trees, spanning trees, cut sets, minimum spanning tree using graphs, trees, and networks, Storage of graphs and networks, Feature extraction of graphs, Searching Graph and Tree data structures, Depth-first search (DFS),the shortest path problem and variations of the problem, Finding Shortest Paths with Brute Force, Dijkstra's Algorithm for Finding Shortest Paths and its implementation.

(v) Counting and Combinatory

The fundamental counting rule, Basics of counting, the Pigeonhole principle, permutation and combination, Discrete Probability generating functions, recurrence relation, Divide and conquer relation, Inclusion and exclusion with applications.

(vi) Dynamic Programming

Basic Concepts of Dynamic Programming, How Dynamic Programming Works, Recursion vs. Dynamic Programming, Greedy Algorithms vs. Dynamic Programming,
Sub problems and overlapping sub problems, optimal sub structure, Backtracking, Memorization, understanding state in dynamic programming, constructing a DP solution using Python, Understanding Iterative vs. recursive approach, Applications of Dynamic Programming Approach: Matrix Chain Multiplication, Longest Common Subsequence, Travelling Salesman Problem and its implementation.

2.2.7.Recommended Books

Main Reading

1. Kenneth N. Rosen, "Discrete Mathematics and its applications", Tata McGraw Hill, 08th Edition
2. C.L. Liu, "Elements of Discrete mathematics" Tata McGraw Hill., 4th Edition
3. Norman L. Biggs "Discrete Mathematics Oxford University Press", 2nd Edition
4. Trembling, J.P. & Manohar P, "Discrete mathematical structure with applications, Tata McGraw Hill., 3rd Edition
5. Vinay Kumar, Discrete Mathematics, BPB, India, 5th Edition
6. Dynamic Programming: A Computational Tool Author: Authors: Holger Mauch, Art Lew, 1st Edition
7. Python Programming: Using Problem Solving Approach Paperback by Reema Thareja (Author), 1st Edition

Supplementary Readings

1. Practical Discrete Mathematics by Ryan T. White, Archana Tikayat Ray, 1st Edition
2. John Truss, "Discrete mathematics for computer scientists, Addison – Wesley", 2nd Edition
3. M. Lipson and Lipchitz, "Discrete Mathematics, Schaum's Outline series.", 3rd Edition

2.3. Module: B3.3-R5- Software Engineering

2.3.1. Introduction

In this course, students will study the various topics relevant to development of modern quality software system. The course will deal with the methodologies involved in the development and maintenance of software over its entire life cycle and make aware of different life cycle models, requirement dictation process, implementation and testing strategies and planning and management of software. This course is also aims to impart knowledge on different architectural patterns & some case studies that use design practices.

2.3.2. Objectives

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

- To provide knowledge on life cycle models of a software
- To measures the software complexities
- To analyze, design software.
- To develop models as per the user requirements using available UML diagrams
- To test the software using testing strategies
- To impart knowledge on different architectural patterns

2.3.3. Duration

120 Hours - (Theory: 45 hrs + Practical/ Tutorial: 75 hrs)

2.3.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical/ Tutorial) in Hours	Learning Objectives
1. Software Engineering Fundamentals	2	3	After completion of this unit of module, the Learner will be able to understand the concept of the Software Engineering fundamentals
2. Software Requirements Analysis & Specification	4	6	Familiarize with the i. Software requirements specification standards, methods, and tools

			ii. Analysis Modelling using models -Data, Dataflow, Control Flow etc.
3. CASE diagrams and Tools	4	6	Practice on preparing i. User story on given scenarios ii. Use Cases using UML diagrams of [Structural diagrams & Behavioural diagrams
4. Software Design	7	13	Familiarize with i. Design Concepts and Principles, Design Process, Design Methods ii. Design thinking, functional design, prototype design iii. Theories on UI/UX, Dashboard iv. Design of documents- Business Requirements Document, Statement of work, High Level Design Document, Technical Detailed Design Specifications, Requirements Traceability Matrix
5. Development of Use cases and UML diagrams	7	13	Familiarize with i. Design Concepts and Principles, Design Process, Design Methods ii. Design documents- Business Requirements Document, Statement of work, High Level Design Document, Technical Detailed Design Specifications, Requirements Traceability Matrix

6. Coding and Software Testing	5	10	Familiarize the i. Coding standards ii. Testing driven design, Domain testing iii. Practice to Software Testing activities iv. Dynamic and pyramid testing v. Test result analysis
7. Software Quality and Metrics	4	6	Familiarize the Software Quality Assurance, ISO9000 and 9001, CMM Levels and SIX sigma etc.
8. Software Maintenance and Configuration management	2	3	i. Can do hands-on Software Maintenance Process & Models, ii. Familiarize on the Configuration Management, Process
9. Object-Oriented Software Engineering	4	6	Familiarize with the OO Concepts and Approach, OO Analysis
10. Advanced Software Engineering Topics	6	9	Understand the concept of i. Advanced Software Engineering Topics Clean room approach and strategy, Component-based software engineering process, Reusability and Reengineering process. Agile and Scrum practices ii. Introduction to Software architecture: Architectural Styles, Pipes, and filters, MVC etc.
Total	45	75	

2.3.5.Marks Distribution

Module Unit		Written Marks (Max.)
1.	Software Engineering Fundamentals	05
2.	Software Requirements Analysis & Specification	15
3.	CASE diagrams and Tools	06
4.	Software Design	20
5.	Development of Use cases and UML diagrams	15
6.	Coding and Software Testing	15
7.	Software Quality and Metrics	06
8.	Software Maintenance and Configuration management	05
9.	Object-Oriented Software Engineering	05
10.	Advanced Software Engineering Topics	08
Total		100

2.3.6.Detailed Syllabus

(i)**Software Engineering Fundamentals**

Definition of software product and process, Software Characteristics, Components, Applications, Layered Technologies, Processes and Product, Methods and Tools, Generic View of Software Engineering, Software Crisis, Software development paradigms, Techniques of Process Modelling, Software lifecycle. Models -Waterfall, Prototyping, Iterative, Evolutionary Development, Incremental, Spiral, Agile etc

(ii)**Software Requirements Analysis & Specification**

System specification, Software requirements specification (SRS) standards, methods, Specification tools, Requirement' svalidation, and management. Problem Recognition, Evaluation and Synthesis, Modelling, Specifications and Review Techniques. Software Prototyping. Analysis Modelling: Data Modelling, Functional Modelling, Dataflow Model, Control Flow Model, Control and Process Specification, Data Dictionary.

(iii)**CASE diagrams and Tools**

Computer-aided software engineering, Introduction to CASE, Building Blocks of CASE, Relevance of CASE tools, High-end and low-end CASE tools, DFD, ER diagrams, Integrated Case Environment and CASE workbenches.

(iv)**Software Design**

Design Concepts and Principles, Design Process, Design Methods- Architectural Design, Modular, Process-oriented, Data-oriented, User-interface, Real-time software, Architectural, Interface, Procedural, Object Oriented. Design Process: -Abstraction, Architecture, patterns, Modularity, Information Hiding, Functional Independence,

Refinement etc. Design Model: Data, Architectural. Design thinking, functional design, and proto type design. Theories on UI/UX, Dashboard, Internal and External Design, Evaluation, Interaction, and Information Display. Design of Knowledge based systems. Design of documents-Business Requirements Document, Statement of work, High Level Design Document, Technical Detailed Design Specifications, Requirements Traceability Matrix

(v)**Development of Use cases and UML diagrams**

User story and Use Cases, Noun / Verb approach, UML diagrams –[a] Structural diagrams -Class, object, Component, Package, Composite Structure, Deployment, Profile. [b] Behavioural diagrams -Use Case, Activity, Sequence, State Machine, Communication, Interaction Overview, Timing

(vi)**Coding and Software Testing**

Choice of Programming languages, coding standards. Software Testing: Software Testing Fundamentals, White Box Testing, Basis Path Testing, Unit testing, Control Structure Testing, Black Box Testing, Integration & System Testing etc. Testing driven design, Domain testing. Examples of Dynamic and pyramid testing. Test planning, Test case design, Test Criteria, Test Design, Test Strategy, Test Stub, Test Suite, Execution of test cases, Test result analysis. Testing tools and workbenches.

(vii)Software Quality and Metrics

SQA-Software Quality Assurance, Debugging and reliability analysis, Program complexity analysis, Software quality and metrics, Software Measures, Quality Control, Approaches to SQA, Reliability, ISO9000 and 9001, CMM Levels and SIX sigma.

(viii)Software Maintenance and Configuration management

Software Maintenance Process & Models, Reverse Engineering, Software re-engineering, Configuration Management issues and concept, Configuration planning & techniques, Software versions and change control process, Documentation, Concepts
in Configuration Management, Process: Planning and Setting up Configuration Management, Perform Configuration Control, Status Monitoring and Audits.

(ix)**Object-Oriented Software Engineering**

OO Concepts and Approach, OO Analysis, Domain Analysis, OOA Process and Object Models, OO Design, System Design process and Models, UML, and diagrams

(x)**Advanced Software Engineering Topics**

Clean room approach and strategy, Component-based software engineering process, Reusability and Reengineering process. Agile and Scrum practices.
Introduction to Software architecture: Architectural Styles, Pipes and filters, Black board, Distributed system, Adaptive system; Patterns and View handler. Introduction to Event Handling Patterns, Reactor, Proctor, Acceptor, Connector, Synchronization Patterns, MVC etc.

2.3.7.Recommended Books

Main Reading

1. Ian Sommerville, Software Engineering, Addison-Wesley, 2009 [9thEdn]
2. Roger S. Pressman, Software Engineering - A Practitioners Approach, McGraw Hill, 2010 [7thEdn]
3. W.S. Jawadekar, Software Engineering – A Primer, TMH-2008
4. Bob Hughes and Mike Cotterell, *Software Project Management* (5th Edition), McGraw-Hill,

Supplementary Reading

5. IEEE PMBOK
6. RINCE2 materials
7. Shari Ptleeger, “Software Engineering”, 2001, Pearson Education.
8. Stephen Schach, Software Engineering, TMH, 2007
9. Sommerville I., Software Engineering, Addision-Wesley

2.4. Module: B1.4-R5- Operating System

2.4.1. Introduction

Operating Systems are an essential part of any computer system. The field is undergoing rapid change, as OS is integral to laptops, embedded devices and mobiles. An operating system is the program that manages all of the other application programs in a computer. The applications interact with the hardware without knowing any details about the hardware. An operating system handles the launch and management of every application.

The fundamental roles of an operating system are the same but many operating systems serve a wide range of hardware and user needs. Common desktop operating systems are Microsoft Windows; Mac OS for Apple, Open source OS like UNIX and Linux.

Mobile operating systems are designed to accommodate the unique needs of mobile computing and communication-centric devices, such as smart phones and tablets. Apple iOS and Google Android are examples of mobile operating systems. Embedded operating system is present in dedicated devices like home digital assistants, ATMs, POS terminals and IoT devices.

2.4.2. Objectives

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

- Understand the significance and working of Operating Systems
- Dive into the operating systems concepts such as processes, inter-process communication, storage systems, virtual memory, file systems and security.
- Learn into depth the concepts, structure and mechanism of modern day operating systems.
- Relate to contemporary design issues in the development of operating systems.
- Learn the OS principles through Linux/ Ubuntu / Windows like operating systems.
- Learn the concept of Virtualization and work on Virtual Machines.
- Write and simulate various OS algorithms for scheduling and Management.
- Learn about the Timesharing, Distributed, Embedded and Real Time OS.
- Practice the commands and programming on OS.

2.4.3. Duration

120 Hours - (Theory: 45hrs + Practical: 75 hrs)

2.4.4.Outline of Module

Module Unit	Duration(Theory) in Hours	Duration (Practical) in Hours	Learning Objectives
1. Operating System Structures	2	3	i. Learn the OS structures
2. File System	4	6	i. Learn about the File System techniques in OS
3. Process Management	5	10	i. Learn about the concept of process. ii. Simulate communication between the processes.
4. Process Synchronization	5	10	i. Learn the synchronization concept among processes. ii. Simulate tools for synchronization iii. Understand Deadlock Handling and learn the algorithms
5. Memory Management	5	10	i. Learn how OS manages memory ii. Learn how OS may improve the utilization of the RAM iii. Understand Memory Management Schemes
6. Storage Management	6	9	i. Learn how mass storage and I/o are handled in OS ii. Understand I/O System Design and Interfaces iii. Work on Performance issues with I/O devices
7. Protection and Security	4	6	i. Learn about authorization to operate in memory, CPU and files. ii. Controls an enforcement for security from unauthorized access, malicious destruction or alteration, and inconsistency
8. Virtualization	4	6	i. Learn about creating Virtual Machines

			ii. Learn types of VM's and their implementation iii. Create Virtual Machines
9. Distributed, Networks and Embedded OS	4	6	i. Know about Distributed, Network and Embedded OS ii. Learn their Network and Communication structure iii. Learn the Distributed File System and Remote File Access. iv. Know various Real Time OS
10. Case Study: Linux and Microsoft Windows	6	9	i. Learn the difference between Windows, and Linux Architecture ii. Learn Process Management and Scheduling iii. Learn about Memory and File Management iv. Learn the various commands of Linux and windows.
Total	45	75	

2.4.5. Marks Distribution

Module Unit	Written Marks (Max.)
1) Operating System Structures	8
2) File System	10
3) Process Management	10
4) Process Synchronization	10
5) Memory Management	10
6) Storage Management	10
7) Protection and Security	10
8) Virtualization	8
9) Distributed, Networks Systems and Embedded OS	8

10) Case Study: Linux and Microsoft Windows	16
Total	100

2.4.6. Detailed Syllabus

i) Operating System Structures

Introduction to Operating System, Computer System Organization and Architecture, OS Components, Layered Structure of OS, System Services, System Calls, Booting and OS, Resource allocation and management, Security and Protection, Distributed Systems, Network System, Kernel Concept and Kernel Architecture, Different Operating System, Proprietary and Open Source OS.

ii) File System

Files and Access Methods, Directory Structure, Protection, Partitions, Simple Volumes, Shadow Volumes, Virtual Disks, Memory-Mapped Files.
File-System Structure, Directory, Protection, File System Structure and Operations, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery, UNIX File System. File System Mounting, Partitions, File Sharing, Virtual file Systems, Remote File Systems, Network File Systems

iii) Process Management

Processes: Process Concept, its states and characteristics, Process Scheduling, Operation on Processes, Cooperating Processes, Interposes Communication, IPC in message-passing and shared system, Symmetric vs. asymmetric multiprocessing, Background Processes

CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Context Switching, Multiple Processor Scheduling, Real Time Scheduling, Algorithm Evaluation, Threading, Multithreading models, Thread Scheduling, Threading issues.

iv) Process Synchronisation

The Critical Section Problem, Peterson's solution, Synchronization Hardware, Mutex Locks, Semaphores, , Critical Regions, Monitors, Likeness, Classical Problems of Synchronization, Bounded-Buffer, Dining Philosophers Problem, The Readers Writers Problem

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Deletion, Recovery from Deadlock, Deadlock in Multithreaded environment, lock free programming.

v) Memory Management

Logical versus Physical Address Space, Contiguous Allocation, paging, Swapping, Page Table, Segmentation, Segmentation with paging.
Virtual Memory: Demand Paging, Performance of Demand Paging, Copy-on-Write, Page Replacement Algorithms, Allocation of Frames, Thrashing, Demand Segmentation, Memory Compression, Allocating Kernel Memory.

vi) Storage Management

Mass Storage Structure, Disk Management, Swap Space Management, RAID Structure, Disk Structure, HDD Scheduling, NVM Scheduling, Error Detection, Error Correction, Swap Space Management, RAID.

vii) Security and Protection
Program Threats, System Threats, Network Threats, Threat Monitoring, and Crypto graphy for Encryption, VPN, Protocol security, Access Checks (ACL, DACLs), Auditing, Policy Management, and User Account Controls (UAC).

Goals of Protection, Domain of Protection, Protection Rings, Access Matrix, Implementation of Access Matrix, Revocation of Access Rights, Role Based Access Control, Mandatory Access Control (MAC), Security-Enhanced Linux (SE Linux).

viii) Virtualisation
Introduction, Benefits, Characteristics, Types of Virtual Machines, Implementing VM's, Virtualization and OS Components, VMware, Virtualization Security, Types of Hypervisors, Cloud Computing Concepts, Introduction to Docker Containers.

ix) Distributed, Networks and Embedded Systems

Network and Distributed OS: Design issues in Distributed OS, Network Structure, Distributed File System, Naming and Transparency, Remote File Access, Stateful versus Stateless Service, File Replication.
Distributed Coordination: Event Ordering, Mutual Exclusion, Atomicity, Concurrency Control, Deadlock Handling, Election Algorithms, Reaching Agreement
Embedded OS: Types of Embedded OS, Characteristics, Advantages and Disadvantages, Tasks in Real time Systems, Goals of RTOS, Hard, Soft and Firm RTOS, Working with RTOS, examples of RTOS, ARM based Embedded Systems, OS in Hand held devices, Android, Vx Works, Windows for IoT.

x) Case Study: Linux System and Microsoft Windows

Linux Case Study: Linux history, its architecture, System Calls with examples, Process Management and its commands, Scheduling algorithms used in Linux, Memory Management in Linux, File System components, File and directory

manipulation commands, Security through ACL and its commands, Password and Shadow files, their structure and various commands, Device management in Linux and its commands, System administrator roles and commands, other Linux commands.

Windows Case Study: Evolution, Design Principles, System Components, File System, Virtual and Physical memory in Windows, Networking, Terminal and Remote Desktop Server, Process Control, File Management and Device Management in Windows, Multitasking OS, Plug and Play, Multiple accounts, Cortana Assistant, Windows Security, Windows Control Panel.

2.4.7.Recommended Books

1. Silberschatz, Galvin, Gagne "Operating System Concepts", Willey
2. Andrew S. Tanenbaum, Albert S. Woodhull, "Operating Systems: Design & Implementation", 2002, Pearson Education Asia.
4. Real Time Embedded Components and Systems with Linux and RTOS by Sam Siewert and John Pratt
5. D.M. Dhamdhere, "Operating Systems: A Concept Based Approach", Tata McGraw Hill Publishing Company.
6. A.S. God bole, "Operating Systems", Tata McGraw Hill
7. Richard L.Petersen, "LINUX: The Complete Reference "fifth edition, Tata McGraw Hill

Note:

1. For All units, explanation must carry case study of either UNIX family or Windows family or both and the last topic can be covered with features of the case study studied throughout.

2. The algorithms may be implemented using Python or Java.

2.5. B1.5-R5: DATA COMMUNICATIONSAND COMPUTER NETWORKS

2.5.1. Introduction

This course will allow students to develop background knowledge as well as core expertise in data communication and networking 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 Data Communications and Computer Networks play an important role in designing any modern telecom infrastructure. Networking technology have evolved significantly over the years as demands on Ethernet and Wi FI have tremendous increased. Apart from supporting a range of devices Local area networks require to manage traffic getting generated from many other sources such as live streaming video, Voice over IP (VoIP), virtualization, Cloud and IoT devices and services have generated demand for additional bandwidth. The world of networking is thriving with technology trends such as cloud, telecommuting, IoT, IPv6.Software Define Network etc.

The students will be exposed to communication principles, different types of media, modulation techniques, multiplexing, switched networks, the Internet, ISO OSI Reference Model, TCP/IP suite, streaming protocols in multimedia, Protocols used in IoT, Software Defined Networks(SDN), Network Function Virtualization (NFV), Intent-based networking (IBN), High-Speed Networks, QoS in Data Networks.

2.5.2. Objective

At the end of the course the students would understand:

- Evolution of data communication, networking paradigms and its components.
- Principles of data communication, channel characteristics,signaling, modulation and encoding, and multiplexing
- Various transmission media, their comparative study, fibre optics and wireless media
- Identify the different types of network topologies and protocols.
- Layered architecture (OSI and TCP/IP), protocol suites and functions of the layers
- Channel error detection and correction, MAC protocols, Ethernet and Wireless LAN.
- Details of IPv4 and IPv6 and associated routing principles
- Operations of ARP, ICMP, TCP/UDP, FTP, HTTP, SMTP, SNMP, DNS, DHCP etc.
- Multimedia traffic and protocols in data communication.
- Network Programming using Python.

- The principles behind the Modern Network approaches such as SDN, NFV and IBN
- The differences between traditional networks and software defined networks
- Various High-Speed Networks
- QoS in Data Networks

2.5.3. Duration

120 Hours - (Theory: 45 hrs + Practical: 75 hrs)

2.5.4. Outline of Module

S. No	Module Unit	Duration (Theory) in Hours	Duration (Practical /Tutorials) in Hour	Learning Objectives
1.	Introduction to Data Communications	2	3	After completion of this unit the candidate will be able to i. Various modes of Data communication ii. Components of data communications iii. Transmission modes
2.	Introduction to Computer Networks	6	10	After completion of this unit the candidate will be able to i. Understand the concept of networking, various terminologies used in Networking ii. Understand various types of Networks, Network topologies iii. Network layers' concepts and its merits and de-merits iv. Basics of OSI model and TCP-IP protocol suite
3.	Physical Layer	3	4	After completion of this unit the candidate will be able to Understand how data travels physically and understand

				concepts of signals, modulation, multiplexing etc.
4.	Data Link Layer	3	6	After completion of this unit the candidate will be able to i. Understand function of Data link layer, data framing, Addressing, error detecting codes ii. DLL-sublayers, Physical layer protocols iii. IEEE standards for wired and Wireless LAN
5.	Network Layer	6	10	After completion of this unit the candidate will be able to Understand IP addressing (IPV4, IPV6) i. Understand Network layer protocols ii. Understand Routing Protocols
6.	Transport Layer	4	7	After completion of this unit the candidate will be able to i. Understand function of transport layer and port addressing ii. Understand Transport layer protocols. iii. Understand basics of congestion in network and various congestion control techniques
7.	Application Layer	3	6	After completion of this unit the candidate will be able to Understand function of application layer and various protocols of this layer.
8.	Multimedia in Data Communication	3	4	After completion of this unit the candidate will be able to Understand Multimedia in data communication and streaming protocols.
9.	Communication Protocols in IoT	2	4	After completion of this unit the candidate will be able to: i. Explore data protocols for IoT

				ii. Explore Network Protocols for IoT.
10.	Network Programming using Python	4	11	After completion of this unit the candidate will be able to: i. Work with TCP/UDP Sockets ii. Write Simple TCP/UDP Client and Server Program using Python iii. Handle Received Client Data over TCP Socket using Python. iv. Perform Operation on Data in Client-Server Program.
11.	High Speed Networks	3	2	After completion of this unit the candidate will be able to Understand Packet Switching, Gigabit Ethernet, MPLS over IP , IP over SONET or SDH, IP over WDM , IP over DWDM, IP over fiber, GPON
12.	QoS in Data Networks	3	4	After completion of this unit the candidate will be able to: i. Understand Integrated and Differential Services: ii. Understand protocols for QOS Support:
13.	Introduction to Software Defined Networking	3	4	After completion of this unit the candidate will be able to: i. Understand SDN (Software Defined Networking). ii. Understand Software-Defined Wide Area Networking (SD-WAN) iii. Understand Network Function Virtualization (NFV).
	Total	**45**	**75**	

2.5.5. Marks Distribution

Unit	Module Name	Written Marks (Max.)
1.	Introduction to Data Communications	03
2.	Introduction to Computer Networks	10
3.	Physical Layer	05
4.	Data Link Layer	06
5.	Network Layer	15
6.	Transport Layer	15
7.	Application Layer	08
8.	Multimedia in Data Communication	07
9.	Communication Protocols in IoT	05
10.	Network Programming using Python	12
11.	High Speed Networks	04
12.	QoS in Data Networks	05
13.	Introduction to Software Defined Networking	05
Total		**100**

2.5.6.Detailed Syllabus

i. Introduction to Data Communications

Introduction, Data Communication Systems, Signal and data, Synchronous and asynchronous transmission mode, Simplex, Half Duplex, Full Duplex communication, Concept of Channel, Circuits, and multi channeling, Signaling, Switching techniques: Datagram, Virtual circuit and Permanent Virtual Circuit, Connectionless and connection-oriented communication.

ii.Introduction to Computer Networks

What is Networking, Benefits, Components, Client/Server vs Peer to Peer Model, Classification of networks; Local Area Networks(LANs), Metropolitan Area Networks (MANs), Wide Area Networks(WANs), Network topologies, Linear Bus, Ring, Star, Mesh Hierarchical or Tree Topology, Internetwork, Network Segmentation, Collision and Broadcast Domains, Repeaters, Switch, Hub, Bridge, Router, L3 Switch, optical submarine telecommunication link SEA-ME-WE3.

Classification of Transmission Media, Coaxial Cable, Twisted-pair cables, STP and UTP cables, Categories of Twisted cable, Cabling types, UTP Categories,

Exploring UTP, Categories of Ethernet Cable, Fiber Optics Cable, OFC Connectors, Types of Fiber Optics Cable, Single vs Multi-Mode Fiber, Ethernet Cabling, Straight-Through Cable, Crossover Cable, Rolled over Cable, Causes of Transmission Impairment, Unguided Media (Radio, VHF, microwave, satellite, Infrared).

Protocol hierarchy, Design issues for the layers, Merits and De-merits of Layered Architecture, Service Primitives: Reference models; The OSI Reference Model, Layers and functions of the OSI Reference Model, OSI PDU Term, Devices at OSI layer,

TCP/IP Protocol Suite, The roots of the internet, Some important TCP/IP milestones Comparison of the OSI Reference Model & the TCP/IP Protocol Models:

TCP/IP Troubleshooting utilities, hostname, ipconfig/ ifconfig , arp, ICMP Protocol, ICMP Protocol -Type, Ping, TTL, Default TTL Values, Changing the TTL On Popular Operating Systems, Ping Command Error Messages ,tracert/traceroute, Pathping, route, netstat, the Possible Session States in netstat output, getmac, nslookup, DNS Resource Records. Maximum transmission unit Checking with MTU, Changing the MTU size in Operating System, Path MTU Discovery (PMTUD), Maximum Segment Size (MSS)

Role of ITU, IETF, ISOC, IAB, IRTF, W3C, IEEE, Request For Comments (RFC), Regional Internet Registry (RIR), Internet Exchange Point, IANA , Number Resources , Root Zone Database, Root Servers(A-M).

iii. Physical Layer

Introduction: 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: Nyquist Bit Rate, Noisy Channel: Shannon capacity, Performance: Bandwidth, Throughput, Latency (Delay), Bandwidth-Delay Product, Jitter. Serial and Parallel transmission, switching; Circuit switching, Message switching, Packet switching, Virtual Switching, Multiplexing; FDM, WDM, TDM: Synchronous and Statistical, Spread Spectrum techniques, CDMA, DSSS, FHSS; PSTN, Modems, Concept of Modulation, Baseband versus Broadband; Pulse Code Modulation (PCM), Shift Keying [ASK, FSK, PSK, QPSK, DPSK]; Encoding techniques and CODEC, DSL and other standards, Cable Networks: HFC, CM, CMTS. Access Techniques (STDM, FDMA, TDMA).

iv. Data Link Layer

Introduction, functions of Data Link Layer (LLC and MAC Sublayers):MAC Addressing, Ethernet Frame Header Format ,CRC, Checksum, Protocols: Stop and Wait, Go- Back-N, Selective Repeat, Piggybacking, HDLC, Point to Point, Multiple Access: Random Access :ALOHA,CSMA / CA, CSMA / CD, Controlled Access: Reservation, Polling, Token Passing, Link Control and MAC Protocols, Framing, Error Detection and Correction; Window-based Flow Control; Logical

Link Control, HDLC Protocol, Point-to-Point Protocol (PPP), X.25 CCITT standard for packet data transmission; Media access control, Random Access Techniques, Scheduling Mechanisms.

v. **Network Layer**

Introduction, functions of Network Layer, IPv4 Addressing, IPv4 Classes , Public & Private IP Addresses ,Special and Reserved IP Address IP Packet Format, Subnet Masks ,Subnetting: CIDR, , NAT, ARP, RARP, ARP Header Format, BOOTP, DHCP, ICMP ,ICMP Codes and types ,ICMP Header and IGMP, Routing, Static and dynamic routing, Distributed routing, Hierarchical Routing; Distance Vector Protocol, Link State protocol, Open Shortest Path First (OSPF), Unicast, Broadcast, Multicast ,Anycast Routing Protocols, Intra Domain Routing Protocols, Inter Domain Routing Protocols, Border Gateway Protocol(BGP), Autonomous system , BGP Neighbors ,External and Internal BGP,

IPv6 Addressing, Representation, Unicast, Multicast, Anycast IPv6 Address, Address Space, Address Space Allocation, Auto configuration, IPv6 Packet Format, Extension Header ICMPv6 protocol, Error-Reporting Messages, Informational Messages, Neighbor-Discovery Messages, Transition mechanism for IPv4 to IPv6

vi. **Transport Layer**

Introduction, Functions, TCP& UDP Ports, socket, Connectionless and Connection Oriented, delivery in Transport Layer: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP Segment Header Format, UDP datagram Header Format, congestion control, Reliable Communication with TCP, 3-Way Handshake, TCP Sliding Window, Congestion Control, Flow control, Open-Loop, Closed-Loop, Quality of Service, Introduction to Stream Control Transmission Protocol (SCTP).

vii. **Application Layer**

Introduction, Function of Application Layer, Namespace and DNS, Remote Logging (telnet and ssh), E-mail: Architecture, SMTP, POP3, IMAP protocols, File Transfer: FTP, Anonymous FTP and TFTP, www, http, https protocols, Network Management System: SNMP protocol, Network File System (NFS), Dynamic Host Configuration Protocol (DHCP).

viii. **Multimedia in Data Communication**

Multimedia Application Services type (Conversational, Retrieval, Messaging , Distribution), Multimedia Application Requirements: Reliability, Delay, Bandwidth, Delay Variation, Multimedia Networking Communication Protocols, Multimedia, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video ,Real-Time Interactive Protocols, RTP ,RTCP , Voice Over IP(VOIP),VoIP Protocols : H.323,Session Initiation Protocol (SIP),Session Description Protocol (SDP),Media Gateway Control Protocol (MGCP),Real-time Transport Protocol (RTP) Content Delivery Network(CDN), Types of CDN: Peer to Peer CDN, Push CDN, Origin Pull CDNs ,Content

networking techniques: Web caches, Server-load balancing, Request routing, Anycast Network Address.

ix. Communication Protocols in IoT

Overview of IoT, IoT data protocols (Presentation / Application layers), Network protocols for IoT (Datalink / Physical layers) , IoT data protocols: MQTT (Message Queuing Telemetry Transport) ,CoAP (Constrained Application Protocol), AMQP (Advanced Message Queuing Protocol) ,DDS (Data Distribution Service) ,HTTP(Hyper Text Transfer Protocol),WebSocket , IoT protocols. Network Protocols for IoT, WiFi, Bluetooth, ZigBee, Z-Wave, LoRa ,LoRaWan, etc.

x. Network Programming using Python

Introduction To Network Programming,- Levels of access to network services, Low Level Access ,High Level Access, What is Sockets?, Python Socket Methods, socket(),Socket Family, Socket type and protocol - SOCK_STREAM and SOCK_DGRAM, Socket Module in Python, Client Socket Methods, Server Socket Methods ,bind( ), listen(backlog), accept( ), General TCP/UDP Socket Methods, recv(),send(),sendto(),recvfrom() Socket Methods close() , gethostname() ,gethostbyname() ,Working with TCP Sockets, Writing a Simple TCP Client and Server Program, Working with UDP Sockets, Writing a Simple UDP Client and Server Program, Handling Received Client Data over TCP Socket, Performing Operation on Data in Client-Server Program.

xi. High Speed Networks

Need of High-Speed Networks, Cell Switching ATM (Asynchronous Transfer Mode). Frame Relay Networks - Asynchronous transfer mode - ATM Protocol Architecture, ATM logical Connection, ATM Cell - ATM Service Categories.
Packet Switching, Gigabit Ethernet, MPLS over IP, IP over SONET or SDH, IP over WDM, IP over DWDM, IP over fiber, Gigabit Passive Optical Networks (GPON).

xii. QoS in Data Networks

Introduction to QoS, QoS frameworks for IP internets, Integrated Service(IntServ) Differential Services(DiffServ): Integrated Services Architecture - Approach, Components, Services Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ - Random Early Detection,
Protocols for QoS Support: RSVP - Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms -Multiprotocol Label Switching - Operations, Label Stacking, Protocol details - RTP - Protocol Architecture, Data Transfer Protocol, Real-time Transport Control Protocol(RTCP).

xiii. Introduction to Software Defined Networking

Introducing SDN: SDN Origins and Evolution, Introduction, Centralized and Distributed Controller and Data Planes, Traditional Networking, Control Plane, Data Plane, Management Plane, Limitations of traditional networking, SDN (Software Defined Networking), Southbound Interface, Northbound Interface,

Models of SDN: Open SDN, SDN by APIs, SDN Overlay Model, Hybrid SDN Software-Defined Wide Area Networking (SD-WAN) Network Function Virtualization (NFV) , NFV architecture. Intent-based networking (IBN).

2.5.7.Recommended books

1. Behrouz A Forouzan, "Data Communication and Networking", Tata McGraw-Hill,06th Edition ,2021
2. William Stallings, "Data and Computer Communications", Pearson Education.
3. A. S. Tanenbaum, "Computer Networks", Fourth Edition, Pearson Education.
4. William Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud, 2016, Addison-Wesley Professional

2.6. B2.1-R5: Computer Based Statistical and Numerical Methods

2.6.1. Introduction

There is a vast amount of data being generated in all the fields of human activity. In order to use this data, one needs to organize and analyze it. The analysis of data is a scientific endeavor which needs knowledge of numerical techniques, probability and statistical methods. The numerical techniques offer computational frameworks to solve real-life problems. Probability theory provides a rational framework to deal with uncertainty which is ubiquitous. Further, probability theory also provides a foundational basis for statistical techniques.

This module attempts to familiarize students with much needed concepts from numerical analysis, probability and statistics. A good grounding of these concepts is essential for better understanding of topics such as Data Analytics, Artificial Intelligence, Machine Learning, Mobile Communications, Performance Modeling of Computer Networks, Soft Computing, Pattern Recognition, Image Processing, Data Mining.

2.6.2. Objectives

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

- Apply understand various statistical techniques used in different domains.
- Design Statistical Model to solve a problem.
- Use statistical tests on different problems.
- Recognize modern statistical methods and software to solve different problems.
- Interpret the statistical results.
- Understand the ways of solving complicated mathematical problems numerically.
- Obtain numerical solutions to problems of mathematics.
- Describe and understand several errors and approximation in numerical methods.

2.6.3. Duration

120 Hours - (Theory: 45hrs. + Practical: 75 hrs.)

2.6.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives
1. Introduction to Statistics & Probability	08	12	After completion of this unit of module, the Learner will be able to : i. Understand basic concepts of probability & Statistics ii. Solve basic Statistical problems.
2. Distribution Functions	04	06	After completion of this unit of module, the Learner will be able to Understand and implement discrete and continuous distribution functions like Binomial, Poisson and Normal.
3. Statistical Inference	07	13	After completion of this unit of module, the Learner will be able to i. Understand the concepts of Testing of Hypothesis and its various terms. ii. Test various hypotheses on given data.
4. Regression Analysis	07	13	After completion of this unit of module, the Learner will be able to Understand concept of different types of Regression Analysis and its implementation.
5. Computer Arithmetic and Errors	04	06	After completion of this unit of module, the Learner will be able to Understand and implement the concept of Number representation and errors.

6. Algebraic and Transcendental Equations	04	06	After completion of this unit of module, the Learner will be able to i. Understand Algebraic and Transcendental Equation, ii. Implement Bisection Method, Iteration Method, and Newton – Rap son Method.
7. System of Linear Equations	04	06	After completion of this unit of module, the Learner will be able to i. Understand various concepts in System of Linear Equations. ii. Solve System of Linear Equations using different methods.
8. Numerical differentiation & Integration	07	13	After completion of this unit of module, the Learner will be able to i. Understand various concepts in numerical differentiation and integration. ii. Apply different techniques related ND and NI.

2.6.5.Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction to Statistics & Probability	17
2. Distribution Functions	08
3. Statistical Inference	17
4. Regression Analysis	18
5. Representation of Numbers	08
6. Algebraic and Transcendental Equations	08
7. System of Linear Equations	08

8. Numerical differentiation & Integration	16
Total	100

2.6.6. Detailed Syllabus

(A) Statistical Methods

(i) Introduction to Statistics & Probability

Introduction to Statistics, Statistic (Descriptive & Inferential), Random Variable (RV), Sample Space, Events and Probability, Introduction, Discrete and continuous Random Variables, Distribution Function, Probability Mass function, probability density function, Expectations, Descriptive Statistics, Correlation, Measure of Variability and Moments, jointly distributed RVs, Independent RVs, Using Statistical library for implementation in Python.

(ii) Distribution Functions (Discrete and Continuous)

Binomial, Poisson, Normal Distribution, Central Limit Theorem and its application, Distribution Fitting using Python/R.

(iii) Statistical Inference

Testing of Hypothesis: Introduction to Testing of Hypothesis (ToH), Understanding Null and Alternative hypothesis, Critical Region: Level of Significance, P Value, T Test, Z Test, Goodness of fit Test: Chi Square Test, Implementing ToH using Python/R.

(iv) Regression Analysis

Introduction, Least squares regression curve, Understanding Scatter Plot, Working with Linear Regression, Generalized Linear Regression, Logistic Regression, Multiple regressions, Poisson Regression. Constructing Training and Test Data and regression analysis using Python/R.

(B) Numerical Techniques

(v) Computer Arithmetic and Errors

Base-N and Binary, Floating Point Numbers,Errors and their computation using Python/R, Round-off Errors, Round-off error by floating-point arithmetic, Representation of error,Accumulation of round-off error,Error in Series Approximation,Approximations with Taylor Series and its implementation.

(vi) Algebraic and Transcendental Equations

Understanding Algebraic and Transcedental Equation, Understanding Bisection Method, Iteration Method, Solution of Polynomial and Transcendal Equations by Bisection Method, False Position Method/Regula Falsi Method, Secant Method, Newton – Raphson Method,

(vii) System of Linear Equations

Basics of Linear Algebra, System of Linear Equations, Solutions to Systems of Linear Equations,Jacobi Method, Gauss EliminationMethod and Iterative Methods(Gauss-Joldan and Gauss-Seidel)

(viii) Numerical differentiation & Integration

Introduction to Numerical Differentiation, Finite Difference Operators, Approximation of Derivatives using Finite Difference, Approximating Derivatives with Taylor Series, Introduction to Numerical integration, Riemann's Integral, Approximating Integral using Trapezoidal and Simpson's rule and its implementation.

2.6.7.Recommended Books

Main Readings

1. Sastry, S.S, "Introductory Methods of Numerical Analysis", 5th Edition.
2. Curtis F. Gerald and Patrick O. Wheatley, "Applied Numerical Analysis", 7th Edition
3. Ross, S.M, "A First Course in Probability"., 8th Edition
4. Trivedi, K.S., "Probability & Statistics with Reliability, Queuing, and Computer Science Applications", 2nd Edition
5. Python Programming: Using Problem Solving Approach Paperback by Reema Thareja (Author), 1st Edition

Supplementary Reading

1. Ross, S.M, "Probability and Statistics for engineers and Scientists", 4th ed., Elsevier.
2. Pal, S, "Numerical Methods- Principles, Analyses and Algorithms", Oxford University Press., 1st Edition

2.7. B2.2-R5: Professional & Business Communication

2.7.1. Introduction

This module encompasses various communication techniques and skills required by the learners for effective business communication especially in digital age. Technical business communication is a pivotal tool in productivity and performance of an organization. Strong interpersonal skills allow the learners to be proficient in various area of expertise and thereby contribute towards the success of the organization they work for.

2.7.2. Objectives

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

- Learn Communication skills for effective communication.
- Prepare Technical Reports and Presentations.
- Build Interpersonal Networks.
- Use of Collaborative Tools.

2.7.3. Duration

120 hours - (Theory: 30 hrs + Case Study/Seminars/Presentations: 90 hrs)

2.7.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives
1. Basics of Communication	3	7	After completion of this unit of module, the Learner will be able to i. Understand the need of good communication skill ii. Learn Basics of Communication
2. Communication Techniques	3	7	After completion of this unit of module, the Learner will be able to learn i. Speaking skills ii. Negotiating Skills, Etiquettes

			iii. Comprehension Skills
3. Listening Practices	3	7	After completion of this unit of module, the Learner will be able to know i. Importance of listening ii. Good Body Language iii. Effective Listening
4. Communication in Groups and Teams	3	7	After completion of this unit of module, the Learner will be able to i. Performing Effectively in Teams; ii. Communication in meetings
5. Technical Communication	3	7	After completion of this unit of module, the Learner will be able to i. Write Technical Reports ii. Write letters, Memos, emails etc.
6. Interpersonal Communication Skills	4	11	After completion of this unit of module, the Learner will be able to i. Build Interpersonal Skills in the Workplace. ii. Communicate in official environment
7. Resumes and Interviews	4	11	After completion of this unit of module, the Learner will be able to i. Write resume, cover letters etc. ii. Learn how to face Employment and Appraisal interviews etc.

8. Presentation Skills	3	7	After completion of this unit of module, the Learner will be able to learn i. Facets of Presentation ii. Extempore Speech, Public Speaking etc.
9. Technology in Communication	4	11	After completion of this unit of module, the Learner will be able to learn i. Role of communication technology in office. ii. Concept of virtual office
10. Collaborative Technology	4	11	After completion of this unit of module, the Learner will be able to i. Use groupware ii. Learn Collaborative Computing

2.7.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Basics of Communication	10
2. Communication Techniques	10
3. Listening Practices	8
4. Communication in Groups and Teams	10
5. Technical Communication	12
6. Interpersonal Communication Skills	12
7. Resumes and Interviews	8
8. Presentation Skills	12
9. Technology in Communication	10
10. Collaborative Technology	8
Total	**100**

2.7.6.Detailed Syllabus

(i) Basics of Communication

Introduction to Communication. Objective of Communication, Role of communication in successful Business. Types of Communication. Communication competence.

(ii) Communication Techniques

Verbal Communication; Speaking in Public; Negotiating Skills; facilitator and Participant skills in meetings; Proper Business Writing; Email Etiquettes; Reading and Comprehension skills.

(iii) Listening Practices

Importance of listening in communication, Types of listening, Benefits, Hearing versus Listening; A Model of Listening; Assessing Differences and Listening, Improving Your Listening Skills; How to talk so that Others will Listen; Body language

(iv) Communication in Groups and Teams

The Elements of Successful Group Communication; Types of Small Groups Operating in an Organization; Demographic Variables that affect Group Life; The Group Decision Making Process; Tools for Effective Problem Solving; Performing Effectively in Teams; managing Meeting mania; probing skills, Voice Characteristics in Articulate Speaking, Tone, Pitch, Rate of Speech and Volume; Self Communication;

(v) Technical Communication

Framing of Technical Reports; Forms, Memos, Letters and emails; Graphics; Reports; White Papers.

(vi) Interpersonal Communication Skills

Defining Interpersonal Communication; The Impact of Conversations on Relationships; Formal and Informal Communication; Vertical versus Horizontal Organizations; Communication Styles; Communication Climate; Job Productivity and Satisfaction at Work Place; Building Interpersonal Skills in the Workplace, Etiquettes

(vii) Resumes and Interviews

Introduction to Resumes; Cover Letters; The Employment Interview; Surviving the Group Employment Interview; The Informational interview; Mock Interviews, The Performance Appraisal Interview.

(viii) Presentation Skills

Facets of Professional Presentations; Understanding Your Audience and the Speaking Occasion; Time Management; Presentation Goals; Selecting the Best Format for your Presentation. Brainstorming; Developing Logical Sequences for Your Messages; Supporting Ideas; Generating Appeals and gathering evidence; Setting and Achieving your Image Goals; Optimizing; your PERC-Quotient, Being spontaneous – Capturing and holding your audience's attention

(ix) Technology in Communication

Communication Technology Today; Use of Technological tools in Business Communication, Etiquettes, Changing Role of Communication Technology in the

Workplace; Conducting Webinars, Video conferencing, Concept of Virtual Office; Mobile Communication and social media;

(x) Collaborative Technology

Collaborative tools, Innovations, Legal Issues & Electronic Business communications.

2.7.7.Recommended Books

Main Reading

1 Business Communication Today | Fourteenth Edition | By Pearson by Courtland L. Bovee, John V. Thill, et al. 2018
2 Fundamentals of Business Communication, 1e by Mukesh Chaturvedi ,2012
3 Business Correspondence and Report Writing - A Practical Approach to Business and Technical Communication | 6th Edition by R C Sharma, Krishna Mohan, et al. 2020

Supplementary Reading

1 J. Penrose ET. “Advanced Business Communication”, Thomson Asia Ltd., 2002.

2.8. B2.3-R5: Advanced Databased Technologies

2.8.1. Introduction

In this course, students will study the various topics to implement simple and multi-user business applications using database technologies. It also introduced several advanced concepts –Distributed Database, Object-oriented databases, Image, multimedia and spatial databases and Indexing techniques. It aims to Implement the possible ACID operations and transaction properties using Oracle/SQL/DB2 or similar tools

2.8.2. Objectives

After completing the module, the incumbent will bibelot:

- Explain how relational views achieve logical data independence using schema, E-R Models, normalizations.
- Explain and describe the Database architecture, Open source databases, DBMS properties, database securities, transaction management, concurrency control, and recovery.
- Implementation of possible operations: transaction management, concurrency and recovery.
- Explain how a distributed database system maintains transaction integrity.
- Describe the purpose, architecture, and operations of a typical data warehouse system.
- Implement the possible ACID operations and transaction properties using Oracle/SQL/DB2 or similar tools
- Introduction to several advanced Topic-Distributed Database, Temporal databases, Object-oriented databases, Image, multimedia, and spatial databases and Indexing techniques

2.8.3. Duration

120 Hours - (Theory: 45 hrs + Practical/Tutorial: 75 hrs)

2.8.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical /Tutorial) in Hours	Learning Objectives
1. Recap1 on Relational model and relational algebra	2	3	After completion of this unit, the Learner will be able to understands the concept of Relational

			model and relational algebra, and related topics
2. Recap2 on E-R models and Normalization	4	6	To Familiarize with the E-R models and Normalization process etc
3. Database Architectures and Open source databases	5	10	To Understand the application Architectures, Database Schema, Concept of Open source databases such as Maria DB and Mongo DB, Database-as-a-service (DBaaS);
4. Database Properties and Database securities	5	10	Familiarize with Database Properties, Database Consistency, Constraints and Data Integrity, Database Transactions, The concept of Database securities, Common threats, Security Levels, some possible solutions
5. Query languages-SQL/Non-SQLs	5	10	Develop use cases using the Procedural or Non-Procedural Query Language /SQLs/Non-SQLs
6. Transactions and Concurrency	6	9	Familiarize with the Transactions and Schedule, Concurrency Control and Develop use cases using Queries
7. Durability	4	6	Familiarize with the Durability process and Checkpoint facilities and Develop use cases using Queries
8. Recovery manager	4	6	Familiarize with the Recovery manager and its process and Developed use cases using Queries

9. Data Warehouses and OLAP	4	6	Familiarize with the Steps to develop a Data Warehouse and ETL process
10. Advance topics	6	9	Understand the advanced Topic-Distributed Database, Object-oriented databases, Temporal databases, Image, multimedia, and spatial databases and Indexing techniques
Total	45	75	

2.8.5.Marks Distribution

Module Unit		Written Marks (Max.)
1.	Recap1 on Relational model and relational algebra	04
2.	Recap2 on E-R models and Normalization process	10
3.	Database Architectures and Open-source databases	10
4.	Database Properties and Database securities	11
5.	Queries Languages/ SQL	12
6.	Transactions and Concurrency	10
7.	Durability	10
8.	Recovery manager	08
9.	Concept of Data Warehouses and OLAP	10
10.	Advance topics	15
Total		100

2.8.6.Detailed Syllabus

(i) Recap1 on Relational model and relational algebra

Relational model and relational algebra, relational calculus and relational calculus, Relational model concepts, relational databases and schemas; Relational algebra operations, queries in relational algebra; overview of relational calculus;

(ii) Recap2 on E-R models and Normalization process

E-R model, E-R diagrams, design of E-R model, Transformation of ER model to relational schema, Normalization process -1NF, 2NF, 3NF, BCNF, 4 NF, etc.

(iii) Database Architectures and Open source databases
Database application Architectures, Database Schema, DML, DDL, and DCL
Concept of Open source databases such as Maria DB and Mongo DB, Database-as-a-service (DBaaS); examples of SQL databases and No SQL databases

(iv) Database Properties and concept of Database securities
Database Consistency, Constraints and Data Integrity, Database Transactions-
ACID properties (Atomicity, Consistency, Isolation, Durability), Data Quality Problems

The concept of Database securities:
Common threats and challenges: Insider threats, Human error, SQL/NoSQL injection attacks, Buffer overflow exploitations, possible attacks, Data Security Risks, Data Tampering, Data Theft, Password-Related Threats, Unauthorized Access etc.

Security Levels: Physical, Human, Operating System, Network, Database System
Some possible solutions: -Security log and audit trails, Encryption, SQL-based data control languages, Mitigation of SQL Injection, Internet-based Database securities methods, Certification authorities, Laws and standards requiring controls on access, disclosure, and modification of sensitive data, etc.

(v) Procedural or Non- Procedural Query Language SQL

PL/SQL-Block Structure, Declare Section, Execution Section, Loop Statement, Exception Section, etc,
Stored Procedure, Exception Handling, Triggers
Views, Indexes, Synonyms, sequence, Data Dictionary Queries
Query Optimization

(vi) Transactions and Concurrency
Transactions and Schedule, Concurrency Control-Pessimistic and Optimistic, and related Policies and technology, Dirty Read & Write, Locking Policies, Deadlock and Locking, Isolation Levels, Multiversioning, etc.

(vii) Durability
Process Architecture-Database Writer, Log Writer, Check pointer, Transaction Processing-Logging facilities, Checkpoint facility, Database writer, Database Buffer, Rollback Segment, Log records, and Buffer

(viii) Recovery manager
Log files Principles, System failure and Recovery mechanism, Media Failure

(ix) Concept of Data Warehouses and OLAP
Steps to develop a Data Warehouse, Dimension and fact table, Data cleaning process, ETL process, Data Cube, and Basic analysis using OLAP operations

(x) Advance topics
Distributed Database-Fragmentation, Design aspects, Distributed Transactions, Distributed Deadlock Management, Distributed DB Recovery, 2-Phase Commit, Example of Distributed Query Processing,

Object-oriented databases: the concepts, Standards, languages, and design; Object relational database systems.

Overview of the Temporal databases
Image, multimedia, and spatial databases: Concepts of Image, multimedia, and spatial databases; Content-based indexing and retrieval
Indexing techniques and Tress- R trees, R+ trees, KD trees, FP tree, etc
Note: Lab work/Assignment: Using MariaDB/ Mongo DB/ DB2/Oracle/ SQL or similar tools to implement the possible ACID operations and transaction properties

2.8.7.Recommended Books

1. Bales, Beginning PL/SQL: From Novice to Professional; Springer 2007
2. Connolly T, Begg C, Database Systems, Fourth Ed, Addison/Wesley 2008
3. Connolly T, Begg C, Holowczak R, Business Database Systems. Pearson/Addison-Wesley, 2008
4. Kifer et al. Database Systems
5. Oracle 9iR2 data warehousing Boston, MA: Digital Press, 2003.
6. Kimball, Ralph, the data warehouse ETL toolkit practical techniques for extracting, cleaning, conforming, and delivering data Indianapolis, Ind.: Wiley, c2004
7. Kimball, Ralph & Ross, Margy, The data warehouse toolkit the complete guide to dimensional modeling, second edition New York: Wiley, c2002.
8. Hobbs, Lillian, et al., Oracle 9iR2 data warehousing Boston, MA: Digital Press, 2003

2.9. B2.4-R5: Computer Graphics and Multimedia Systems

2.9.1. Introduction

This course aims to impart fundamental concepts of computer graphics and multimedia so that students are able to understand the basic concept of computer graphics. Further this module will help to use algorithms to draw various graphics primitives, use of 2D, 3D transformations and Multimedia concepts and various I/O technologies and to enable the students to develop their creativity.

2.9.2. Objectives

The purpose of the Computer Graphics and Multimedia programme is to teach students about computer graphics and multimedia theory, technology, methods, and abilities. Graduates plan to work in research and development of systems that use computers to manipulate visuals and sound.

2.9.3. Duration

120 Hours - (Theory: 45hrs + Practical: 75hrs)

2.9.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives
1. Graphics Hardware – Primitives	05	05	After completion of this unit of module, the Learner will be able to Understand the basic hardware primitives used in Computer Graphics.
2. Basic Mathematical Concepts for Computer Graphics	05	02	After completion of this unit of module, the Learner will be able to Understand the Mathematics behind the implementation of Computer Graphics
3. Graphics Operations – Clipping, Filling	05	15	After completion of this unit of module, the Learner will be able to Understand the various algorithms for clipping and filling of various shapes.
4. Transformation 2D – 3D &	09	16	After completion of this unit of module, the Learner will be able to

Projections			Understand the transformations of 2D and 3D. Further, learner will learn the Parallel, Perspective and Isometric projections are illustrated in this unit.
5. Object Representation	09	16	After completion of this unit of module, the Learner will be able to i. Understand the representation of various surfaces. ii. Understand the Hermit curve, Bezier curve and B-spine curve. iii. Understand the Shading Algorithms.
6. Multimedia Systems	12	21	After completion of this unit of module, the Learner will be able to i. Learn Basics of Multimedia. ii. Basic editing in Image. Editing Software. iii. Concepts of Audio. Basic Video Editing.
Total	45	75	

2.9.5. Marks Distribution

Module Unit	**Written Marks (Max.)**
1. Graphics Hardware – Primitives	15
2. Basic Mathematical Concepts for Computer Graphics	15
3. Graphics Operations –Clipping, Filling	15
4. Transformation 2D – 3D & Projections	20
5. Object Representation	15

6. Multimedia Systems	20
Total	**100**

2.9.6.Detailed Syllabus

Unit 1. Graphics Hardware – Primitives

Display devices – Refresh Cathode Ray Tube, Raster Scan Display, Plasma Display, Liquid Crystal Display, Plotters, Printers, PCI / PCIe Graphics Cards.

Input Devices – Keyboard, Trackball, Joystick, Mouse, Pen Tablet Digitizer and Digital Camera.

Unit 2Basic Mathematical Concepts for Computer Graphics

Matrices and Determinants. Operations related to Matrices and Determinants.

Vectors: Definition, Vectors and Co-ordinate System

Drawing algorithms – DDA algorithm Breshenham's Line algorithm, Breshenham's Circle generation algorithm.

Unit 3. Graphics Operations –Clipping, Filling

Clipping – Point Clipping, Line Clipping, Polygon Clipping Sutherland-Cohen line clipping algorithm. Midpoint Sub-division algorithm

Filling – Flood fill algorithm, Boundary fill algorithm and scan-line polygon fill algorithm.

Unit 4. Transformation 2D – 3D & Projections

2D Geometrical transformation -translation, scaling, rotation, reflection and shear transformation matrix representation and homogenous co-ordinates, composite transformations, transformation between co-ordinates.

3D Geometrical transformation – Representation of points, 3D scaling, shearing, rotation, reflection, translation, multiple transformation, rotation about and axis parallel to a coordinate axis.

Projections: Parallel, Perspective and Isometric. Viewpoints

Unit 5. Object Representation

Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curve. Bezier and B-Spline surfaces. Basic illumination models, shading algorithms

Unit 6. Multimedia Systems

Introduction to Multimedia: Definition of Multimedia, Multimedia objects: Text, Graphics, Animation, Audio, Images, Video. Definition of Hypertext and Hypermedia. Components of a Multimedia System.

Image and Graphics:

Vector vs. Bitmap. Creating Basic Shapes and Layers, setting up the document, painting, drawing lines and curves, Transforming Objects using the free transform tool, changing the perspective, making multiple transformations. Blending Shapes and Colors by creating a gradient fill. Creating layers. Adjusting Levels, auto levels. Clone Stamp. Healing Brush. Feather Effect. Crop & Resize image.
Audio: Audio software and hardware. Sound Card, Stereo/Mono, Types of Audible Sounds, Basics of Acoustics, and Digitization of sound, frequency and bandwidth, decibel system, data rate, audio file format, MIDI Files, Synthesis of MIDI Sounds.

Video and Animation: Video Basics, How Video Works, Introduction to MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21. Basic Video Editing. Basic Animation Techniques (Frame by Frame, Twining), Morphing.

2.9.7.Recommended Books

1. David F. Rogers and J. Alan Adams "Mathematical Elements for Computer Graphics"(Paperback) McGraw-Hill Science/Engineering/Math; 2nd edition (July 17 Edition)
2. Schaum's Outline of "Theory and Problems of Computer Graphics" (Paperback) by Zhigang Xiang & Roy A. Plastic McGraw-Hill; 2nd edition (Jan 2015 Edition)
3. Prabhat K Andleigh and Kiran Thakrar, "Multimedia Systems and Design", PHI, 2003
4. Mark J. Bunzel and Sandra K. Morris "Multimedia Application Development" Mcgraw-Hill Osborne Media; 2nd edition (September 1993)
5. Donald Hearn and M. Pauline Baker, "Computer Graphics C Version", (Papaerback) 3rd Edition Prentice Hall (2002)
6. Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill, 2017
7. Prawal& B. B Tiwari, "Multimedia Systems", Excel Publication, New Delhi, 2007.
8. "Multimedia Demystified" – by Jennifer Coleman, Dowling; McGraw Hill.

2.10. B2.5-R5: Cloud Computing and Internet of Things (IoT)

2.10.1. Introduction

The objective of this module is to impart comprehensive understanding and knowledge of Cloud Computing and Internet of Things (IoT). Furthermore, course comprehends the uses of Cloud Computing along with the design and implementation of typical IoT based system. The course gives insight into various Cloud services and its usage in current ITES ecosystem. The course also aims at providing competent, and innovative with a strong cognizance in the area of sensors, IoT, data science.

The course introduces low power microcontrollers and feasibility to develop the skillset required for programming low power sensing applications. The course focuses discussion on IoT reference layer model and protocols at different levels.

The course aims at providing technical skills in building and using Cloud Services and designing secured and trustable IoT systems with various sensor interfaces.

2.10.2. Objectives

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

- Configure and Deploy applications on public Cloud platforms
- Different Cloud Computing architecture
- Identify and analyze the applications in different areas of IoT ecosystem
- Understand and apply techniques for using sensors and actuators to solve different aspects of industry
- Understand the architecture of Industry standard low power ARM Cortex Microcontroller.
- Built real world problem in areas of IoT and cloud-based solutions.
- Gain ability to build and operationalize and IoT end-to-end system.
- Know the working of different network infrastructure equipment and their role in securing network.
- Understand the various network protocols used in IoT
- Open-source IoT framework vs Commercially available IoT frameworks.
- Issues related with Identity and access management, while developing end-to-end IoT products
- Understand the core issues of IoT such as privacy, security and interoperability

2.10.3. Duration

120 Hours - (Theory: 45 hrs + Practical: 75 hrs)

2.10.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives
1. Cloud Computing	12	18	After completion of this unit of module, the Learner will be able to understand i. Cloud Computing Architecture, Models ii. Virtualization iii. Security aspects
2. IoT Hardware Platform, Sensors & Actuators	8	10	After completion of this unit of module, the Learner will be able to i. Hardware platform for IoT ii. Low power microcontrollers-ARM cortex M Series iii. Hardware for prototyping IoT Gateway
3. IoT Connectivity & Cloud Platform	11	19	After completion of this unit of module, the Learner will be able to i. IoT connectivity standards ii. IoT layered architecture & Protocols iii. Network Topologies iv. IoT Cloud Platform
4. IoT Framework	09	17	After completion of this unit of module, the Learner will be able to i. IoT architecture reference model ii. Identity and Access management iii. IoT open-source framework, commercial framework
5. Use Cases – IoT & Cloud Services	5	11	After completion of this unit of module, the Learner will be able to

			IoT Case studies in Agriculture, Healthcare, Manufacturing
Total	45	75	

2.10.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Cloud Computing	25
2. IoT Hardware Platform, Sensors & Actuators	15
3. IoT Connectivity & Cloud Platform	25
4. IoT Frameworks	20
5. Use Cases – IoT and Cloud Services	15
6. **Total**	100

2.10.6. Detailed Syllabus

Cloud Computing

Cloud Computing concepts and their usage.

Concept of Virtualization, hypervisor and Load Balancing, Cloud computing platforms

Cloud Architecture- Layers and Models- IaaS, SaaS, PaaS

Cloud Deployment Models- public, private, hybrid

Security and privacy issues in Cloud Computing

IoT Hardware Platform, Sensors & Actuators

Introduction to IoT devices node, gateway, selection criteria for Hardware platform for IoT, Low power microcontrollers for IoT node

Introduction to ARM cortex M series, different low power techniques, Microcontroller peripherals (timer, GPIO, ADC, PWM, DAC) interfacing sensors and actuators to Cortex M series controllers

Hardware for prototyping IoT Gateway -ARM Cortex Application processor series, overview of Multicore architecture

Hardware requirements for EDGE & FOG computing.

Overview of open-source hardware platforms for IoT.

IoT Connectivity & Cloud Platform

IoT connectivity standards: Zigbee, Zwave, Bluetooth, BLE, different Bluetooth generations, NBIoT, LoRa, LoRaWAN, WiFi for IoT

IoT layered architecture & Protocols:

- Application Layer Protocols: MQTT, CoAP, AMQP,
- Transport Layer Protocols: Embed TLS, REST Full services, webservers, IPv6 standards, 6lowPAN

Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting

Network Topologies referred with Web, Introduction to Web Servers

IoT cloud platforms: Opensource cloud platforms of IoT, Commercial IoT cloud platforms and services.

IoT Framework

IoT components and Technologies, IoT Architecture, IoT Analytics Life cycle, IoT Application domain.

IoT architecture reference model – requirement, connectivity and communication, device management, data collection, analysis, and actuation, scalability and security

Identity and Access Management – OAuth2, LDAP, access control

IoT open-source frameworks vs IoT commercial frameworks

IoT dashboard solutions – open-source vs commercial

IoT security fundamentals, security threats etc.

Use Cases – IoT and Cloud Services

- Agriculture -
    - Crop monitoring, irrigation scheduling, plant disease detection, soil texture mapping, health assessment, crop yield mapping, livestock applications, Food supply chain tracking
- Manufacturing -
    - Industry 4.0, Remote Monitoring, Supply Chain Management & Optimization, Predictive maintenance, Fleet Management, Digital Twins, Industrial IoT
- Healthcare -

- Model for IoT Healthcare systems, Wearable Devices and medical sensor, Communication between devices

- Role of Cloud, Bigdata and Security

2.10.7. Recommended Books

1. Cloud Computing: A Hands-on Approach, Arshdeep Bahga, Vijay Medisetti,
2. The Definitive Guide to the ARM Cortex-M3, Joseph Yiu, Second Edition, Elsevier Inc.
3. The Internet of Things: Key Applications and Protocols, David Boswarthick, Olivier Hersent, and Omar Elloumi, Wiley
4. Building the Internet of Things with IPv6 and MIPv6, Daniel Minoli, Wiley.
5. Cloud Computing: A Hands-on Approach, Arshdeep Bahga and Vijay K. Madisetti
6. Enabling Things Talk, Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Springer Open

2.11. B3.1-R5: Software Project Management

2.11.1. Introduction

The purpose of this module is t expose candidates to the range of project management practices that are used in software development project

2.11.2. Objectives

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

- Identify and classify project activities
- Describe a project in terms of scope, time, cost, and quality on for a given project scenario
- Estimate duration and schedule project activities using planning techniques
- Measure the size, the complexity of code, and use these measures to identify the defects
- Identify the risk and prioritise risks based on the impact and probabilities to manage these risks
- Use and describe techniques for tracking the progress and status of a project
- Use the possible CASE tools for developing and managing the projects
- Adoption of Agile practice -Team management and Leadership, Scrum practices

2.11.3. Duration

120 Hours - (Theory: 45 hrs + Practical/Tutorial: 75hrs)

2.11.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical/Tutorial) in Hours	Learning Objectives
1. The recap on Software Project and Introduction to Project Management	4	6	After completion of this unit, the Learner will be able to i. Understand the concept of Software Engineering, its Process and Models etc. ii. The concept of a project, its principles, project

			life cycle, and CMM model
2. Project Management Issues	4	6	Familiarize with the Basic project management functions and forces of a project. Product and service management, Knowledge management
3. Project Planning and Project Estimation	5	10	Practice the Project Planning and Project Estimation using the available methods and algorithms models and tools
4. Project Scheduling	4	6	Familiarize with Project Scheduling activities, sequencing using available techniques and tools
5. Risk Analysis and management	5	10	Can do the identification of risk, assessment and tracking for better Risk Mitigation and Management
6. Software measures and metrics	4	6	Practice to measure the software details using available metrics
7. Quality Management	4	6	Can do hands-on practice on quality management of a project using the models and can generate review reports- defect and quality etc.
8. Project Tracking Techniques and Monitoring	7	13	Can do hands-on practice on Tracking and Monitoring of a project using available Chart and graphical tools
9. Configuration Management, and	4	6	Familiarize with the activities in the

Project Closure			Configuration Management and planning, Change management and Version Control System etc. and familiarize with Defect Collection, Audit and Project Closure analysis
10. Agile Management	4	6	Understand the concept of Agile Management-Team members and Leadership together with Scrum practices
Total	45	75	

2.11.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. The recap on Software Project and Introduction to Project Management	06
2. Project Management Issues	10
3. Project Planning and Project Estimation	15
4. Project Scheduling	10
5. Risk Analysis and management	10
6. Software measures and metrics	10
7. Quality Management	15
8. Project Tracking Techniques and Monitoring	10
9. Configuration Management, and Project Closure	08
10. Agile Management	06
Total	100

2.11.6. Detailed Syllabus

The recap on Software Project and Introduction to Project Management
Principles of software engineering, Software Process and Models, Product, Tools, and techniques of process modelling. The concept of a project, project specification and parameters, Principles of Project management, Project management life cycle, Capability Maturity Model

Project Management Issues
Basic Management Functions: Scoping, Planning, Organization, Staffing, Directing, Monitoring (Controlling). The project forces-Scope, Time, Cost, Quality etc. Product and service management, Knowledge management

Project Planning and Project Estimation
Planning-Project activities and Techniques-Work Breakdown Structure (WBS) etc. Project Estimation-Time and Effort, Ideal Time vs Ideal Effort.Project Costing, Estimation Techniques, Effort Estimation Techniques, Velocity, Decomposition Techniques, Algorithms models, Automated Estimation Tools, COCOMO and functional points etc

Project Scheduling
Milestones and Deliverables of a project. Task Network and activity sequencing-inter-dependences. Scheduling types- Time-boxed, activity based, other Techniques-Critical path, PERT, Gantt chart etc.

Risk Analysis and management
Common categories of project Risk, risk identification, Risk Assessment and Control, components of Rick, and Risk Drivers-KoST. Risk prioritisation, Risk Tracking and Monitoring, Risk Mitigation and Management

Software measures and metrics
Measures of software- (direct, indirect), metrics and indicators, Size and complexity metrics, Statistical Metrics and Process Monitoring, Function-point and project management Metrics tools, Relationships between defects and metrics, Standards-CMMI, ISO etc

Quality Management
Software Quality and its attributes, Quantitative Quality Models**.** Defect classification, defect tracking tools, Defect isolation, Quality reviews, Defect reporting, Change logs

Project Tracking Techniques and Monitoring
Tracking-Setting check points, Data collection, 3-Point time tracking, Monitoring using -Burn down chart, Graphical Reporting Tools, Progress Report and Risk reporting

Configuration Management, and Project Closure
Activities in Configuration Management and planning, Change management, Change requests, change impact analysis, Version Control System (VCS), Repository

browsing tools. Defect Collection and Audit, Causal and Pareto Analysis, Project Closure Analysis

Agile Management
Team management and Leadership, Agile and fishbowl technique, Scrum practices

2.11.7. Recommended Books

1. Ian Sommerville, Software Engineering, Addison-Wesley, 2009 [9thEdn]
2. Roger S. Pressman, Software Engineering - A Practitioners Approach, McGraw Hill, 2010 [7thEdn]
3. Pankaj Jalote, Software Project Management in Practice, Addison-Wesley, 2002
4. Bob Hughes and Mike Cotterell, Software Project Management, McGraw-Hill, 2017 [6th Edn]
5. Robert K. Winsock, Effective Project Management: Traditional, Adaptive, Extreme Wiley, 2007 (4th Edn)
6. Ken Schwaber, Agile Project Management with Scrum, Microsoft Press, 2004.
7. Kent Beck, Martin Fowler, Planning Extreme Programming, Addison-Wesley, 2001
8. Ben Collins- Sussman et al., Version Control with Subversion, 2002
9. IEEE PMBOK
10. PRINCE2 materials

2.12. B3.2-R5: Artificial Intelligence and Machine Learning

2.12.1. 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 reacts like humans. There are different dimensions for artificial intelligence, in which the decision taking capacity is most important. The course would cover the spectrum of Artificial Intelligence, data analytics, machine learning, deep learning, and natural language processing and computer vision. The student would dive straight into data analytics and mathematics behind applied machine learning algorithms and deep learning algorithms. They will also be able to develop AI Model using python programming.

2.12.2. Objective

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

- Identify the scope and limits of the Artificial Intelligence (AI) field.
- Analyze the application areas of Artificial Intelligence.
- Explore data, process it and make it ready for developing AI based systems.
- Solve real world problems through machine learning implementation leading to predictions.
- Understand various learning models, methods and applications under supervised and unsupervised learning.
- Understand unsupervised machine learning problems such as clustering.
- Understand mathematics behind machine learning algorithms.
- Understand computer vision, face recognition and detection using Open CV.
- Understand deep learning, artificial neural network, feed forward neural network and neural network using tensor flow.
- Understand basics of text processing and use NLTK Library which helps in text analytic.

2.12.3. Duration

120 Hours - (Theory: 45 hrs + Practical/Tutorial: 75hrs)

2.12.4. Outline of Course

Module Unit	Duration(Theory) in Hours	Duration (Practical) in Hours	Learning Objectives(Learner will learn after completion of unit)
1. Introduction to Artificial Intelligence	5	10	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. Applications of AI	2	3	Identify the suitability of applying AI as a solution, based on context of applications.
3. Advanced Python (Numpy, Pandas, Matplotlib)	7	13	i. Understand Numpyndarray and various functions of numpy ii. Importing Data from various sources (csv, txt, excel) iii. Reading and manipulate csv files iv. Use Pandas for data science, Performing EDA, Data Wrangling, Combining Datasets-Merge and Join, Grouping Data. v. Make various types of Graphs and Plots using Python Graphical libraries.
4. Machine Learning	13	22	i. Machine Learning Introduction, Supervised and

			Unsupervised Learning. ii. Tasks performed by Machine Learning Algorithms – Classification, Regression, Clustering iii. Concept of Training and Testing Data, Splitting the data using python modules iv. Solving a Regression Problem using Python: Data Preparation, Apply Machine Learning Algorithm: Linear Regression, Decision Tree Regress or etc., use of Sklearn package v. Solving a Classification Problem using Python: Data Preparation, Apply Machine Learning Algorithm: Logistic Regression, Decision Tree Classifier, K-Nearest Neighbour Classifier etc. vi. Understanding Mathematics behind Machine Learning Algorithm vii. Solving a Clustering problem by applying K-Means Algorithm in Python. viii. Performance evaluation metrics of machine learning algorithms-Accuracy

			Score, Confusion Matrix, Root Mean Squared Error etc. ix. Over fitting, under fitting. x. Cross Validation, Optimizing Model Hyper parameters.
5. Deep Learning	6	9	i. Learn basics of deep learning concepts. ii. Learn to train and implement deep learning algorithms. iii. Understand the implementation of AI through real world examples of images. iv. Learn neural network using tensor flow. v. Making Deep Learning model using Image Data: Digit Recognition Model.
6. Computer Vision	6	9	i. Introduction to Computer Vision ii. Image Representation and Analysis iii. Write programs using machine learning algorithms in Open CV for detection and recognition of images. iv. Learn Face recognizers. v. Training image data and prediction.
7. Natural Language Processing	4	6	i. Understand the basics of text processing. ii. Working with Text Data, Count Victimization, and sparse matrix.

			iii. Learn application of natural language processing. iv. Understand the concepts of NLP and process linguistic data using the popular algorithms.
8. Case Study	2	3	Case Study of use of Machine Learning in Real Life Applications

2.12.5. Detailed Syllabus

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.

Applications of AI

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

Advanced Python

Modules and Packages, Numpy Library, Numpy Basics, Subset, slice and index, Broadcasting and numpy functions. Pandas Library, Pandas Series, Indexing and selecting data, working with data frames, grouping and summarizing data frame, loading csv, reading data from various sources, manipulating data frames, Aggregation functions, Analysis, Visualization using mat plot lib, functionalities of plots, sub plots,

Machine Learning

Basics of Machine Learning (ML), Need for Machine Learning, Machine Learning Definitions, Type of Machine Learning Problems. Data Pre-processing, Why Data Pre-processing, Data, Pre-processing Process, Independent and Dependent Variables, Missing Data in Dataset, Checking Missing Values, replacing missing values, Data Imputation, imputing numerical values, Imputing Categorical values, Encoding Categorical Data, Label encoding, One Hot encoding, Feature Scaling, Training data and Testing data, train_test_split.

Machine Learning (Regression), Kind of Machine Learning Regression Problems, Applying Linear Regression Algorithm, Score of the applied model, Predicting the x_test on the model, Performance Evaluation of Regression ML Model, Deployment of model. Machine Learning (Classification Problem), Classification: Use Cases, Applying Classification Algorithms: Logistic Regression, Support Vector Machines, Decision Tree Classifier, Gaussian NB, Neighbors Classifier etc., Performance evaluation: Confusion Matrix, Deployment of Classification Model. Introduction to Clustering, Use of clustering in ML, Applications of clustering, clustering v/s classification, Types of clustering, Types of clustering algorithms, features of good clustering, Clustering Problem in Machine Learning, Applying K-Means Clustering Algorithm. Mathematics behind Regression Algorithms, Mathematics behind Classification Algorithms, Purity metric, Gini and Entropy. Overfitting, under fitting, Cross Validation, features engineering.

Deep Learning
Deep Learning Concepts, Reinforcement Learning, Artificial Neural Networks and Model, ANN structure, Feed Forward Neural network, Back Propagation, Convolution Neural Network (CNN), Neural Network using Tensor Flow. Learning Algorithms, Error correction and Gradient Descent Rules, Perception Learning Algorithm. Making Deep Learning model using Image Data: Digit Recognition Model

Computer Vision
Introduction to Computer Vision, Image Representation and Analysis, Face Recognition and Detection with Open CV, Face Recognizers, Training data, Prediction.

Natural Language Processing
Natural Language Processing, Working with Text Data, Count Victimization, sparse matrix, NLTK, Basics of text processing, Lexical processing, NLP tasks in syntax, semantics, and pragmatics. Applications like Automatic Summarization, Sentiment Analysis and Text Classification. Solving Text Classification Problem, Making Model, Model Evaluation and confusion matrix.

2.12.6. Recommended Books

1. Introduction to Artificial Intelligence and Experts System, by Patterson Dan, W., PHI
2. Artificial Intelligence a Modern Approach, by Peter Novig, S. J. Russel, Pearson
3. Machine Learning an algorithmic Perspective by Stephen Marshland
4. Learning Python By Mark Lutz, David Ascher
5. Introduction to Machine Learning with python by Andreas C Muller, Sarah Guido
6. Open CV Essentials by Oscar Deniz Suarez, NoeliaVallezEnano by Packt Publishers
7. Deep Learning with Python by Francois Chollet.

2.13. Module: B5.3-R5- Web Technologies

2.13.1. Introduction

Java is a language and J2EE is a platform, which implements Java language. J2EE is a standard for Java 2 Enterprise Edition. Core Java and advanced java are the standard editions of Java whereas `J2EE is the enterprise edition, which is a combination of both Core & Advanced Java. It is used for creating enterprise web applications. This course is designed to meet the needs of Java programmers who want to be professional in building enterprise applications and web portal using Java Technologies.

2.13.2. Objective

The course is designed to impart knowledge and develop skills required to solve real world problems using object oriented approach, Java Language. After the completion of the course the student is expected to understand:

- Basics of Object Oriented Programming.
- Various Object Oriented programming concepts - Abstraction, Objects and Classes, Inheritance, Polymorphism and how to achieve reusability using these concepts.
- Concrete collection implementations and apply sorting and searching through collections
- Knowledge of Server Side programming by implementing JSP. Understand and write the deployment descriptor and enterprise application deployment. Design and implement components like: Session, Java Beans, JSTL, Tag Extension and Filter.
- Frameworks such as Spring Architecture and Hibernate Architecture, Distinguish JDBC and Hibernate.
- Design and Develop various application by Integrating any of JSP, spring, Hibernate by analyzing requirements and evaluating existing system.

2.13.3. Duration

120 Hours - (Theory: 45 hrs + Practical: 75 hrs)

2.13.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives
1. Introduction to Java and OOPs concepts	2	3	After completion of this unit of module, the candidate will be familiar to i. OOPs Concept ii. Java Execution Model
2. Java Concept	12	18	After completion of this unit, candidate will have in depth knowledge of i. Use of variables, literals, data types and arrays. ii. Working with each data item iii. Java operations, loops, conditional & jump statements
3. Database Concept and JDBC Connectivity	6	9	After completion of this unit, candidate will be will be familiar with the i. JDBC Architecture ii. JDBC APIs that provide various classes and interfaces to develop a JDBC application using SQL Transactions
4. Servlet API	6	9	After learning this unit, candidate will be able to: i. Understand role of Java Servlets in the overall Java 2 Enterprise Edition architecture, and as the best Java solution to HTTP application development ii. Use request and response objects provided to a servlet

			to read parameters and to produce an HTML response iii. Develop interactive web applications using HTML forms and servlets
5. JSP and database connectivity	5	10	After learning this unit, candidate will be able to: i. Design and build robust and maintainable web applications ii. Create dynamic HTML content with Servlets and Java Server Pages, using the JSP Standard Tag Library (JSTL) iii. Use JSTL and other Custom Tag Libraries to separate Java and HTML code iv. Access databases with JDBC
6. Hibernate Framework	7	13	After completion of this unit, candidate will have in depth knowledge of i. Understand the concepts of object/relational mappings ii. Create Hibernate mappings iii. Retrieve and update persistent objects using Hibernate iv. Use HQL (Hibernate Query Language) and criteria queries
7. Java Web Frameworks: Spring MVC	7	13	After completion of this unit, candidate will be able to i. Use the Spring MVC web framework and form tag library to

			develop flexible web applications ii. Understand the need for the Spring framework iii. Use inversion of control to increase flexibility and testability of applications iv. Integrate Spring with the Hibernate ORM framework

2.13.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction to Java and OOPs concepts	5
2. Java Concept	15
3. Database Concept and JDBC Connectivity	15
4. Servlet API	10
5. JSP and database connectivity	15
6. Hibernate Framework	20
7. Java Web Frameworks: Spring MVC	20
Total	100

2.13.6. Detailed Syllabus

Introduction to Java and OOPs concepts

Introduction to Java, Java Programming Features, Object Oriented Programming, OOPS concepts and terminology, Advantages of OOPS, Fundamentals of OOPS, Concept of Classes and Objects, Encapsulation, Abstraction , Polymorphism , Overloading, Execution Model of Java, Byte code, Compiling and Interpreting Java program

Java Concept

Data Types, Variables, Arrays, Operators, Control Statements, Java Classes and Objects, Methods and lambda expression, Inheritance, Packages and Interfaces, Exception Handling, String Handling, Introduction to Java Collections and Stream API

Database Concept and JDBC Connectivity

Introduction to JDBC, JDBC Architecture, Types of JDBC Drivers, Common JDBC Components, Registering JDBC Drivers, Opening Connection, connecting a Java program to a Database, Executing Query, Statement Class & Objects, Getting Information from Database, Obtaining Result Set Information and DML Operations through JDBC

Servlet API

Overview of Servelt, Servelt Life Cycle, HTTP Methods Structure and Deployment Descriptor Servlet Context and Servelt Config interface, Attributes in Servelt, Request Dispatched renter face, Cookies and Session Management: Understanding state and session, Understanding Session Timeout and Session Tracking, URL Rewriting

JSP and database connectivity

Introduction to JSP, JSP Architecture, JSP Life Cycle, JSP Scripting Elements, JSP Directives, JSP Action, JSP Implicit Objects, JSP Expression Language, JSP Standard Tag Libraries, JSP Session Management, JSP Exception Handling, Form validation and CRUD Application

Hibernate

Introduction to Hibernate, Exploring Architecture of Hibernate, O/R Mapping with Hibernate, Hibernate Annotation, Hibernate Query Language, CRUD Operation using Hibernate API.

Java Web Frameworks: Spring MVC

Spring Introduction, Spring Architecture, Spring MVC Module, Life Cycle of Bean Factory, explore: Constructor Injection, Dependency Injection, Inner Beans, Aliases in Bean, Bean Scopes, Spring Annotations, Spring AOP Module, Spring DAO, Database Transaction Management, CRUD Operation using DAO and Spring API

2.13.7. Recommended Books

1. Java - The Complete Reference by H. Schildt, Tata McGraw-Hill.
2. OCA Java SE Programmer I Certification Guide by Mala Gupta, Dramatic Press
3. Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest Wiley Publication

4. Spring in Action 3rd edition, Craig walls, Manning Publication
5. Hibernate 2nd edition, Jeff Linwood and Dave Minter, Beginning Après publication

2.14. Module: B3. E1-R5- Digital Marketing

2.14.1. Introduction

In the modern days, consumers are being influenced by various popularly increasing online trends viz online shopping, audio and video streaming, education, banking, tours & travels and e-Governance services. With the increasing number of netizens, the Digital Marketing has emerged as one of the most cost-efficient and also one of the most effective ways for a business to market itself.

The curriculum of the course has been designed with an objective to develop professionals who not only possess theoretical knowledge of the subject but also have practical hands-on of the best practices prevalent in the field of Digital Marketing. The Fundamentals of Digital Marketing lays the foundation for understanding how to exploit the different digital marketing tools and gradually it moves towards the advanced techniques and best practices in the field of digital marketing that ensures businesses deliver better and integrated consumer experiences.

2.14.2. Objective

At the end of the course, the student will be able to:

- Identify the scope and limits of the Digital Marketing (DM)field
- Apply techniques of Search Engine Optimization (SEO) and Search Engine Marketing (SEM)
- Effective Content Writing and Ad campaigns
- Learning the best practices to tap the potential of social media for marketing purpose
- Understand strategies involved in marketing of products and services digitally

2.14.3. Duration

120 Hours - (Theory: 45 hrs + Practical: 75 hrs)

2.14.4. Outline of Course

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives(Learner will learn after completion of unit)
1. Fundamentals of Digital Marketing	5	10	i. Understand the concept of marketing the products and services digitally ii. Understand the definition and origin of Digital Marketing iii. Identify the benefits and difference of Digital Marketing vs. Traditional Marketing iv. Describe the phases and approaches in Digital Marketing
2. Search Engine Optimization (SEO)	5	10	i. Understand the concept of Search Engine Optimization ii. Describe the types of SEO iii. Understanding SEO Myth busters iv. Optimizing the site structure
3. Search Engine Marketing (SEM)	4	6	i. Understand the concept and importance of Search Engine Marketing ii. Learn Ad writing techniques iii. Identify and strategizing PPC (Pay-per-click) campaigns iv. Learn Link Building
4. Social Media Marketing (SMM)	6	9	i. Learn the concept and importance of Social Media Marketing (SMM) ii. Building successful Social Media Strategy iii. Setting SMM goals and bookmarking

			iv. Marketing on Social Media platforms such as Facebook, LinkedIn and Instagram v. Understanding Trends in Digital Marketing and Advertising
5. Content and E-mail Marketing	7	13	i. Learning Content writing techniques ii. Understanding the concept of Blogging, creating effective Blogs and Posts iii. Building blogging strategies powered by SEO iv. Micro-blogging using Koo and Twitter v. Creating Vlogs, uploading on media streaming websites vi. Learning fundamentals and best practices of e-mail marketing vii. Developing e-mail strategies viii. Building and importing e-mail lists ix. Using segmentation strategy and segmentation lists
6.Affiliate Marketing	4	6	i. Understanding concept and importance of Affiliate Marketing ii. Understanding the difference between referral and Affiliate Marketing iii. Accessing and using Affiliate Marketing platforms
7. Web Analytics	6	9	i. Learning Web Analytics ii. Dashboard Preview& Customization iii. Real-Time Report

			iv. Audience Demographics v. UTM Parameters vi. Social Referrals and Referral Traffic vii. Google Search Console viii. Campaigns, Analysing Landing & Exit Pages ix. Event Tracking
8. Keyword Planning and Social Media Ad Campaigns	6	9	i. Define Keyword planning and its importance ii. Keyword Research iii. Learning Keyword Planning Tools, Goals and bidding Creating and running Social Media Ad Campaigns iv. Boosting techniques on social media channels v. Using Social Media Ad Campaign analytics vi. Online Reputation Management (ORM)
9. Lead Generation and Marketing Automation	2	3	i. Understanding Lead generation strategy ii. Capturing leads from sources iii. Understanding Marketing automation tools iv. Setting up email and SMS auto responders, Virtual Assistants
Total	45	75	

2.14.5. Detailed Syllabus

Fundamentals of Digital Marketing

Definition and origin of Digital Marketing; 4 P's; Evolution of Digital Marketing from Traditional to modern era; Role of Internet; Benefits of Digital Marketing and its scope; Digital Marketing Platforms, Basic terminologies in Digital Marketing, building a digital presence for your business, Types of Digital Touch-points, Defining an online presence strategy, Understanding your business and brand, Understanding your consumer, Understanding your competition

Search Engine Optimization

Introduction of Search Engine Optimization (SEO); Need for SEO; SEO Techniques – White Hat, Black Hat and Grey Hat; Meta Tags and Meta Description; Search Engine Success Factors; Website Content Optimization; Back Link strategies; internal and external links; On Page and Off Page Optimization; SEO Tool Kit; Search Engine Result Pages (SERP); Page Rank and Myth Busters

Search Engine Marketing
Search Engine Marketing Overview; Pay-per-click overview; Strategizing PPC campaigns; Market Analysis; Ad writing Techniques; Campaign Management; Bid Management Plan; Performance Measurement and Matrices; Identifying Target Groups

Social Media Marketing (SMM)
Introduction to Social Media and Social Media Marketing (SMM); Need of SMM; Building successful SMM strategy; Goal setting and bookmarking; Customizing SMM campaign based on potential customers; Marketing on Social Media platforms such as Facebook, LinkedIn and Integra; niche research; reverse engineering; Case study

Content and E-mail Marketing
Introduction of content writing techniques; concept of Blogging, creating effective Blogs and quality Posts; Building blogging strategies powered by SEO; Guest Blogging; Page clicks and impressions; Micro-blogging using Koo and Twitter; Creating Vlogs; Uploading on media streaming websites; Creating and managing Channels; Creating Video Libraries and Playlists; Monetizing contents; Channel Analytics

Email marketing an overview: Fundamentals of Email Marketing, Advanced Email Marketing, Email Best Practices and Myths, Bulk Email concept; Elements of marketing emails: Advantages of the different text formats (HTML or Plain Text), Permissions & E-permissions, Frequency & Ethics of Newsletters, Defining your Goals, Email Marketing Strategies; Build your email list: Building email list through a website subscribe form, Segmentation, Active Users; Measuring your email campaigns success: Open rates, click-through-rates, unsubscribe rates, conversion rates, and bounce rates

Affiliate Marketing
Affiliate Marketing basics and fundamentals; Difference between referral and affiliate marketing; Partnership with affiliate networks, Generating affiliate links, setting up website for promoting affiliate links; compensation methods; Customizing Affiliate campaigns; Strategy/planning & case studies; Ad Sense & Ad Words

Web Analytics
Introduction to Google Analytics, How Google Analytics works, Account Setup & Hierarchy, Dashboard Preview, Real-Time Report, Audience Demographics, Audience Behavior, UTM Parameters, Referral Traffic, Google Ads, Google Search Console, Social Referrals, Campaigns, Analyzing Landing & Exit Pages, Analyzing Site Speed, Site Search, Event Tracking, Tracking Goals, Customizing Dashboard, Custom and Saved Reports, Setting Up Custom Alerts

Keyword Planning and Social Media Ad Campaigns

Discover new keywords related to your products, services, or website; Traffic Analysis on keywords; Determine cost and bidding on advertisement campaign; Select and organize keywords to fit into different categories related to your brand; Use of keyword plan to create new campaigns cantered on in-depth keyword research;

How to market on different social media channels; Content Marketing for social channels; Brand Building on Social Media; Social Media Advertising; Social Media Analytics; Managing a social media community; Online Reputation Management (ORM)

Lead Generation and Marketing Automation

Lead generation strategy, Lead and list management; CRM integration, sales integration, product integration; Capturing leads from sources; Lead source link building and lead tracking features; business reporting; web hooks and connector; Marketing Automation Tools; Email Auto responder; SMS Auto Responder; Virtual Assistants; Creating Landing Page; Landing Page –CTA; Website Widgets

2.14.6. Recommended Books

1. Digital Marketing, Second Edition by Seema Gupta, McGraw Hill
2. Fundamentals of Digital Marketing, Second Edition by Puneet Singh Bhatia, Pearson
3. Digital Marketing, by Vandana Ahuja, Oxford University Press

Reference Books

1. Marketing Without Money: An Essential Guide by Jessie Paul, Bloomsbury India
2. Social Media Marketing 2021 by Michael Branding, Notion Press

2.15. Module: B3.E2-R5- System Modelling & Computing Simulation

2.15.1. Introduction

This course provides an introduction to the process of designing models of existing or proposed real-world systems, and how to use the models to perform simulations that allow for predictions about the future behavior of the system. The system could be something as mundane as a cricket match, to something more complex, such as a communication network, or transportation system. Most systems of interest will require the development of one or more statistical models. Thus, modeling and simulation has a significant overlap with probability and statistics. The course topics will include a review of concepts from probability and statistics that are relevant to modeling and simulation, algorithms for random-variable sampling, modeling and analysis of basic queuing systems, variance-reduction techniques, statistical-validation techniques, Programming assignments will be provided throughout the semester. In addition, each student will complete an end-of-term project that centres on the modeling and simulation of a system of interest.

2.15.2. Objective

- Introduce computer simulation technologies and techniques, provides the foundations for the student to understand computer simulation needs, and to implement and test a variety of simulation and data analysis libraries and programs. This course focuses what is needed to build simulation software environments, and not just building simulations using pre-existing packages.
- Introduce concepts of modeling layers of society's critical infrastructure networks.
- Build tools to view and control simulations and their results.

2.15.3. Duration

120 Hours - (Theory: 45 hrs + Practical: 75 hrs)

2.15.4. Outline of Course

Module Unit	Duration(Theory) in Hours	Duration (Practical) in Hours	Learning Objectives(Learner will learn after completion of unit)
1. Introduction	09	16	i. Basics of simulations ii. Advantages & disadvantages

2. Statistical Models in Simulation	7	13	i. Able to model deterministic systems and differentiate between nonlinear and linear models. ii. Understand the numerically simulate ordinary differential equations and deterministic systems.
3. Random-Number Generation	7	13	i. Numerical Techniques Sources and Propagation of Error
4. Input Modelling	8	12	Understanding of building model
5. Estimation of Absolute Performance	6	9	Able to estimate and validate a model based upon input and output data.
6. Measures of performance and their estimation 7. (Verification, Calibration and Validation)	8	12	Be able to model and simulate stochastic and discrete event systems. Able to estimate and validate a model based upon input and output data.
Total	45	75	

2.15.5. Detailed Syllabus

Introduction:

Simulation Basics, when simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation examples: Simulation of queuing systems. **General Principles, Simulation Software:** Concepts in Discrete-Event Simulation. The Event-Scheduling / Time-Advance Algorithm, Manual simulation Using Event Scheduling

Statistical Models in Simulation

Review of terminology and concepts, Useful statistical models, discrete distributions. Continuous distributions, Poisson process, Empirical distributions. **Dynamical, Finite State,**

and Complex Model Simulations: Graph or Network Transitions Based Simulations Actor Based Simulations Mesh Based Simulations Hybrid Simulations **Queuing Models:** Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems cont…, Steady-state behaviour of M/G/1 queue, Networks of queues,

Random-Number Generation

Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers,

Random-Variant Generation: Inverse transforms technique Acceptance-Rejection technique.

Input Modelling:

Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, fitting a non-stationary Poisson process, selecting input models without data, Multivariate and Time-Series input models. Birth Death Process

Estimation of Absolute Performance:

Types of simulations with respect to output analysis, stochastic nature of output data, Measures of performance and their estimation, Coned... Measures of performance and their estimation, Output analysis for terminating simulations Continued., Output analysis for steady-state simulations. Markov Process

Verification, Calibration and Validation:

Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models, Calibration and validation of models, Optimization via Simulation. Simulations Results Analysis and Viewing Tools: Display Forms: Tables, Graphs, and Multidimensional Visualization, Terminals, X and MS Windows, and Web Interfaces, Validation of Model Results

2.15.6. Recommended Books

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicola: Discrete-Event System Simulation, 5th Edition, Pearson Education, 2010.

2. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
3. Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw-Hill, 2007
4. Introduction to Dynamic Systems: Theory, Models, and Applications. D. G. Luenberger, 1979.
5. Numerical Analysis, R. L. Burden and J. D. Faires, 1993.

2.16. Module: B3.E3-R5- Distributed and Parallel Computing

2.16.1. Introduction

The purpose of Distributed and Parallel Computing is to design and develop hardware and software that helps to process large volume of data with high rate of performance. Different computing models are designed to meet this objective. Such computing models are Cloud, Grid, Parallel, Distributed and Edge. In this module, these computing models are covered.

The purpose of Cloud computing is the delivery of on-demand computing services over network to any end-user and the purpose of Grid computing is a group of networked computers which work together as a virtual supercomputer to perform large tasks.

The purpose of distributed computing is to make a network of computers that works as a single computer. Distributed systems have benefits over centralized system in terms of scalability and replication.

The purpose of parallel computing is to use multiple processing elements simultaneously to process data or to solve a problem. There are many advantages of use of parallel computing over conventional computing like time saving, solving large problem by splitting it, resource utilization etc.

Edge Computing brings computation and data storage closer to the sources of data, exploring topics such as developing scalable architectures, moving from closed systems to open systems, and ethical issues rising from data sensing, this timely book addresses both the challenges and opportunities that Edge computing presents. Contributions from leading IoT experts discuss federating Edge resources, middleware design issues, data management and predictive analysis, smart transportation and surveillance applications, and more. A coordinated and integrated presentation of topics helps readers gain thorough knowledge of the foundations, applications, and issues that are central to Edge computing.

2.16.2. Objectives

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

- Understand the evolution and paradigm of Computing technologies
- Know the Architecture of Distributed and Parallel Computing systems
- Understand the components of Distributed and Parallel Computing and their working
- Understand the working of virtualization and its role in Cloud computing
- Understand the working of Grid computing

- Understand the working of Distributed and Parallel computing
- Understand the working of Edge computing and its benefits

2.16.3. Duration

120 Hours - (Theory: 45hrs + Practical/Tutorials: 75 hrs)

2.16.4. Outline of Module

Module/Unit	Duration (Theory) in Hours	Duration (Practical/ Tutorials) in Hours	Learning Objectives
1. Introduction to Distributed and Parallel Computing Technologies	7	13	After completion of this unit of module, the Learner will be able to i. Know the basics of Distributed and Parallel Computing technologies. i. Know the benefits of Distributed and Parallel Computing technologies.
2. Distributed Computing	18	32	After completion of this unit of module, the Learner will be able to • Know the evolution of Distributed systems • Know the Distributed File systems (DFS) • Understand the role of transaction and concurrency controls in Distributed Systems • Gain knowledge of mutual exclusion algorithms • Know the basics of edge computing • Know the Challenges in Federating Edge Resources • Know the method Data Management in Edge Computing

3. Parallel Computing	20	30	After completion of this unit of module, the Learner will be able to • Know the parallel computing and its architecture • Know working of OPENMP • Know PRAM and its model
Total	45	75	

2.16.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction to Distributed and Parallel Computing Technologies	20
2. Distributed Computing and Edge Computing	55
3. Parallel Computing	25
Total	100

2.16.6. Detailed Syllabus

(i) Introduction to Distributed and Parallel Computing Technologies

Introduction to Distributed and Parallel Computing Technologies: Introduction to Soft Computing, Introduction to Parallel Computing, Introduction to Ditributed Computing, Introduction to Edge Computing, benefits; Understanding Soft and HPC.

(ii) Distributed Computing

Evolution of Distributed Computing, various issues involved in designing a distributed system, the Challenges faced. Distributed computing models like Minicomputer, Workstation, Workstation-Server model, Processor – pool. Emerging trends in distributed systems

System models: Physical, Architectural and Fundamental models

Inter-process Communication (IPC): characteristics, group communication, Multicast Communication, Remote Procedure call, Network virtualization. Methods in IPC, Pipes, messaging queues, semaphores, shared memory, sockets

Distributed File System: File service architecture, Network file system

Transactional Concurrency Control:- Transactions, Nested transactions, Locks-Optimistic concurrency control

Distributed mutual exclusion – purpose of disrtibuted mutualexclusion, central server algorithm, ring based algorithm, Bully algorithm

Edge Computing

Introduction, Relevant Technologies, Advantages of FEC: SCALE, Hierarchy, Business Models, Opportunities and Challenges; Challenges: Networking, Management and Miscellaneous Challenges;

Edge Computing: Introduction, Relevant Technologies, Advantages of FEC: SCALE, Advantages: SCANC, Hierarchy, Business Models, Opportunities and Challenges.

Addressing the Challenges: Introduction, Networking Challenge, Management Challenge, Miscellaneous Challenges.

Middlewares: Introduction, Need, Design Goals, State-of-the-Art Middleware Infrastructures.

Data Management in Fog Computing: Introduction, Background, Data Management.

Case Studies: Big Data Analytics, Health Monitoring, Smart Transportation and IoT Applications.

(iii)**Parallel Computing**

Introduction to parallel Computing, parallel computing paradigm, parallel architecture, shared memory systems, cache coherence, distributed memory system

Shared address space system: OpenMP

Parallel random access machine (PRAM), PRAM Models, shared memory models

2.16.7. Recommended Books

1. Parallel & Distributed Computing by I. A. Dhotre, Technical Publications, 2021.
2. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, Pearson Ed.

3. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, John Wiley & Sons, 2019.

2.17. Module: B3.E4-R5- Data Warehousing and Data Mining

2.17.1. Introduction

The main purpose of the course is to develop and gain an understanding of the principles, concepts, functions and uses of data warehouses, data modeling and data mining in business. In this course, students will study the various topics on Data warehousing and data mining are the essential components of decision support systems for the modern-day industry and business. These techniques `enable the knowledge worker (analysis, manager, executive) to make better and faster decisions. The objective of this course is to introduce the student to various Data Warehousing and Data Mining concepts and Techniques. A database perspective must be used throughout the course to introduce principles, algorithm, architecture, design and implementation of data mining and data warehousing techniques.

2.17.2. Objectives

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

- Design a Data warehouse system
- Implement the designed model of the warehouse system
- Data Modeling as per requirements of a business
- Design and implementation of several Data Mining algorithms
- Evaluate a warehouse system using Data Mining algorithms.
- Describe the mining of web and Spatial data

2.17.3. Duration

120 Hours - (Theory: 45 hrs + Practical/Tutorial: 75 hrs)

2.17.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical/ Tutorial) in Hours	Learning Objectives
1. Introduction	4	6	After completion of this unit, the Learner will be able to uunderstand the basics concept of Dara warehouse and Data mining

2. Data Warehousing	5	10	Familiarize with the Data warehouse, multidimensional database and Building steps of a Data Warehouse etc.
3. ETL processes	6	9	Implement the building of warehouse and possible process of ETL
4. Data Mining Primitives	4	6	Familiarize with the basis of data mining and Knowledge Discovery Database
5. OLAP engines and OLAP operations	6	9	Familiarize with the OLAP Engines and Develop use cases on Data Modeling using OLAP operations
6. Supervised and un-supervised techniques	4	6	Development of applications using Supervised techniques - Classification techniques
7. Association algorithms	4	6	Development of applications using Association Analysis, A priori algorithme etc.
8. Un-supervised algorithms	4	6	Development of applications using Un-supervised algorithms- Clustering Techniques etc.
9. Advanced Mining Concepts	4	6	Familiarize with the Data Mining attributes, and other topics- object oriented databases, spatial databases and multimedia databases, time series databases, Graph mining
10. Applications	6	9	Understand the advanced Topic- i. Exploration of related applications. ii. Mining-Pattern, opinion, Social media and crowd-sourcing data mining iii. Uses of data mining packages iv. Web content Mining, Bioinformatics v. Temporal and Spatial Data Mining:

2.17.5. Marks Distribution

Module Unit	Written Marks (Max.)

1. Introduction	06
2. Data Warehousing	10
3. ETL processes	15
4. Data Mining Primitives	10
5. OLAP engines and OLAP operations	15
6. Supervised and un-supervised techniques	10
7. Association algorithms	10
8. Un-supervised algorithms	08
9. Advanced Mining Concepts	06
10. Applications	10
Total	100

2.17.6. Detailed Syllabus

Introduction
An introduction to multidisciplinary filed of Dara warehouse, Data mining. Issues in Dara warehousing and Data mining, Stress on important of its application potential etc.

Data Warehousing
Concepts of Data warehouse, deference between operational database system and data Ware house, Multidimensional Data Model: data cube, Stars – Snowflakes – Fact Schemas for multidimensional database, measures, concept hierarchies

Building of a Data Warehouse, Fact and dimension tables, Data Marts, Metadata, data quality problems

ETL processes
Extraction, Loading, Transformation techniques, Error event table, change data capture, Data-cubes, dimensions, and measures .ETL and ELT processes.

Data Mining Primitives
Data Preprocessing including Data cleaning - Data integration - Data transformation, Discretization and concept Hierarchy generation, Definition and Specification of a generic data miming task, Description of Data mining query language with few example queries. Knowledge Discovery Database (KDD)

OLAP engines and OLAP operations
Multi-dimensional data model, OLAP Engines, Data Modeling (Cube), Operation on multidimensional Data Model, Data Warehouse architecture, Types of OLAP (MOLAP and ROLAP) servers, Life cycle of data warehouse implementation, Relationship between data warehouse and data mining. Concept of non-structure Databases, operations using NoSQL

Supervised and un-supervised techniques

Supervised -Classification techniques, Decision trees, Bayesian classifier and Predictions, Issues regarding classification and predication, Different classification methods in cluding Decision tree induction – Bayesian Classification, Neural network technology, K- Nearest Neighbor Classifier- Case-based Reasoning - Fuzzy set theory - genetic algorithm, Prediction: Linear and Multiple Regression – Nonlinear Regression – Other Regression Models, Classifier Accuracy etc.

Association Algorithms

Association Analysis, A priori algorithme, Association rule mining, Mining Single Dimensional Boolean Association rule in truncation database, mining multilevel association rule, Discussion on few associations rule algorithm such as Apriority, frequent pattern growth, etc.., From Association rule to correlation analysis.

Un-supervised algorithms

Clustering Techniques: Hierarchical and partitioned clustering. K-means, Cluster Analysis-Types of data in cluster analysis, Partition based Clustering, Hierarchical Clustering, Density based Clustering, Grid based Clustering, Model based Clustering, Discussion on scalability of clustering algorithm, Outlier analysis, Parallel approaches to clustering. Introduction to CLARA, CLARANS, Hierarchical -DBSCAN, BIRCH, CURE, Categorical-STIRR, ROCK, CACTUS etc.

Advanced Mining Concepts

Data Mining attributes, Result Data Presentation, Data Preprocessing process, Dispersion of data.
Essential of Graph mining, FP-tree construction, sample of text mining.
Data mining issues in object-oriented databases, spatial databases, and multimedia
Data bases, time series databases, text databases, web mining: web usage mining – web Content mining – web log attribute.

Applications of Data Warehousing and Data Mining

Exploration of web sites on data warehousing and data mining application including bibliography databases, Corporate Houses and Research labs.

Mining-Pattern, opinion, Social media and crowd-sourcing data mining
Use of data mining packages and data warehousing packages, e.g. SAS, IBM, excel miner tools.

Web content Mining, Web structure Mining, Web usage Mining, Text Mining

Temporal and Spatial Data Mining: Basic concepts of temporal data Mining, Introduction to the GSP algorithm, SPADE, SPIRIT, WUM

2.17.7. Recommended Books

1. Hobbs, Lillian, et al. Oracle 9iR2 data warehousing Boston, MA: Digital Press, 2003.
2. Kimball, Ralph. The data warehouse ETL toolkit practical techniques for extracting, cleaning, conforming, and delivering data Indianapolis, Ind. : Wiley, c2004
3. Kimball, Ralph. The data warehouse toolkit the complete guide to dimensional modeling, second edition New York: Wiley, c2002.
4. Data Mining: Concepts and Techniques, Second Edition (The Morgan Kaufmann
5. Series in Data Management Systems) Jiawei Han and Micheline Kamber, ISBN-10:
6. 1558609016 ISBN-13: 978-1558609013; 2005
7. Arun K Pujari, "Data Mining Techniques" Universities Press.
8. M. Jarke, M. Lenzerni, Y. Vassiliou, and P. Vassiladis, “Fundamentals of Data
9. Warehouses, SpringerVerlag New York, Inc. Secaucus, NJ, USA.
10. Margaret Dunham, "Data mining: Introductory and Advanced Topics", Prentice Hall;

2.18. Module: B3.E5-R5- Software Testing and Quality Assurance

2.18.1. Introduction

In this course, students will study the various topics relevant to Software testing and quality assurance practices. It will provide understanding documents used in Pre- testing and post testing. The course will prepare the student for software testing and debugging. It will further lay the foundation for advanced topics -agile software Testing and Test Pyramid.

2.18.2. Objectives

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

- To provide knowledge on life cycle models of a software and Industry practices
- To provide understanding documents used in Pre- testing and post testing
- To explore the Testing Techniques and Strategies
- To develop the Test Cases and Plans
- To conduct the test and produce reports
- To analyze applicable Quality Assurance and Standards
- To impart knowledge on Agile Software development practices and Agile Testing
- To provide knowledge on Version Management practices

2.18.3. Duration

120 Hours - (Theory: 47hrs + Practical/Tutorial: 73hrs)

2.18.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical /Tutorial) in Hours	Learning Objectives
1. Introduction	2	3	After completion of this unit the Learner will be able to understand the concept of Software testing and quality assurance practices
2. Industry practices and Software Quality	4	6	Familiarize with the Industry practices and Software Quality
3. Understanding Pre- testing	4	6	Understands the Pre- testing documents and its purposes

documents			
4. Testing Techniques and Strategies	7	13	i. Familiarize with Testing Terminologies, activities in Testing and designing the Test ii. Practice the Unit Testing process iii. Practice the other Integration, system, acceptance testing etc.
5. Building Test Cases and Plans	7	13	Developed Test Cases, Plans, and require reports
6. Verification, Validation and Debugging Technique and Tools	5	10	Familiarize with the Requirement verification, Coding standards, Walk through etc. and Debugging Technique and Tools, debugging, tracing
7. Quality Assurance and Standards	4	6	Familiarize the Software Quality Assurance and related standards
8. Post testing activities and documents	4	6	Understands the Post testing documents and its purposes
9. Agile Software development practices and Agile Testing	4	6	Familiarize with advance testing topics- Agile testing, test pyramid etc.
10. Version Control	4	6	Understand the practices of version Management, Changed management
Total	45	75	

2.18.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction	05
2. Industry practices and Software Quality	06
3. Understanding Pre- testing documents	06
4. Testing Techniques and Strategies	20
5. Building Test Cases and Plans	20

6. Verification, Validation and Debugging Technique and Tools	15
7. Quality Assurance and Standards	10
8. Post testing activities and documents	08
9. Agile Software development practices and Agile Testing	05
10. Version Control	05
Total	100

2.18.6. Detailed Syllabus

Introduction

Software program and its objective, Life Cycle of a Software, Software development techniques, and top-down verses bottom-up approach, modular and structures programming. A brief introduction about object-oriented approach. Software testing and its importance, software development life cycle verses software testing life cycle, Deliverables, version, and error control

Industry practices and Software Quality

Industry practices- extreme Programming, Agile practices, Scrum
Software Quality Models-Hierarchical Quality Model, Quality Attributes, McCall's Quality Model, Quality Assurance: Planning and Reviewing, Quality in extreme Programming, Quality System and Standards, Capability Maturity Model (CMMI)

Understanding Pre- testing documents

Business Requirements Document, Purpose, Business Rules, Assumptions, Product Requirements, Functional Requirements, Mandatory Requirements etc.
Statement of Work-Objectives, Business Case, Scope of Effort, Management Approach, Quality Approach, Technical Approach, Phases of Design, Coding or construction, Test, Implementation, Roles, Responsibilities, Time, Cost, Risk, delivery dates etc.

Technical Detailed Design Specifications, Technical Architecture, Code Specifications, Components and layouts -Programs, Mock screen etc.

High Level Design Document-System Architecture, Detailed Design, Process Flow and Database and Files, sample layouts of Mockup Screen, Report and Templates etc.

Testing Techniques and Strategies

Life of a Bug, Validation, verification, Testing Terminologies-Test Case, Test Criteria, Test Design, Test Strategy, Test Stub, Test Driver, Test Suite, Test Script, Test Model etc.

Activities in Testing and Test Design Methods

Unit Testing process -Data Inputs and Data Outputs, Test cases, Expected Results, Actual Result, Test Result Analysis etc.

White-Box testing, testing -path, condition multiple condition, mutation. Integration testing, System testing, Acceptance testing. Flow Graph notation, Cyclamate Complexity, Graph matrices, control structure and loop testing. Black-Box testing: Equivalence partitioning, Boundary Value Analysis, Orthogonal Array testing. Testing UI/UX apps

Other testing type- accessibility, performance, mobile apps, script less apps, security testing-dynamic and static applications etc

Building Test Cases and Plans
Format of test cases, and other data paths, Test data selection, branch coverage, and statement coverage, pre-condition and post-condition, Test schedule and check pointing, suitable exercises for creating test cases for each type of techniques mentioned.

Verification, Validation and Debugging Technique and Tools
Requirement verification, Coding standards, Walk through, Formal Inspection, Design validation and verification, Function test, Design metrics, correctness proof and its requirement.

Debugging Technique and Tools-Integrated development environment, debugging, tracing, data inspection, exception errors, code and data redundancy, unreachable code.

Quality Assurance and Standards
Basic software quality parameters and its metrics, Software Configuration Change and types of errors, Quality management models: ISO, SPICE, IEEE, CMM.

Post testing activities and document
Requirements Traceability Matrix [RTM], Requirement Functionality, Code Module or File, Test Cases and References

Concept on Agile Software development practices and Agile Testing
Fundamentals of Agile Software and the Agile Manifesto, Role and Skills of the team
Agile Software Testing Techniques, Agile Testing Methods, Techniques, and Tools
The Test Pyramid, Testing Quadrants, Test Levels, and Testing Types

Version Control
Configuration Management, Change Management, tools, Roles and Responsibilities

2.18.7. Recommended Books

1. Desikan S, Ramesh G, “Software Testing”, Pearson Education
2. Tamres L, “Introducing Software Testing”, Pearson Education
3. Mathura A.P, “Fundamentals of Software Testing”, Pearson Education
4. Testing Object Oriented Systems, Robert V. Binder, Addison Wesley
5. G. J. Myers, The Art of Software Testing
6. Beizer, Boris. Software Testing Techniques, 2nd Ed. Van Nostrand Reinhold, New York.
7. Pfleeger, L. Shari. Software Engineering-Theory and Practice. Prentice-Hall.
8. Brian Marick, “The Craft of Software Testing”, Pearson Education, 2008.
9. Rajani & Oak, “Software Testing: Methodology, Tools and Processes” Tata McGraw-Hill, 2007.
10. R. Pressman, “Software Engineering”, 6th Edition, Tata McGraw-Hill.
11. IEEE PMBOK
12. PRINCE2 materials

2.19. Module: B3.E6-R5- Digital Image Processing

2.19.1. Introduction

This course Explain why the ability to perform digital processing of radiographic images is a Significant advantage. It Cover the basic theory and algorithms that are widely used in digital Image processing and Expose students to current technologies and issues that are specific to image processing systems. It gives to students the fundamentals of digital image processing, covering some topics from the following list: inverse problems in imaging; image enhancement; edge detection; feature extraction; and geometric diffusion. Describe the general relationship between image contrast and pixel values. It introduces the Virtual Reality and Augmented Reality practices.

2.19.2. Objectives

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

- Explore the different aspect of Image processing and its applications
- Implement the designed model of Image Digitization, Image Enhancement, Image Restoration, Image Compression, and Image Segmentation etc.
- Design and implementation of process of Image Transformations
- implementation of algorithms of Object detection
- Explore the different concepts on Virtual Reality and Augmented Reality

2.19.3. Duration

120 Hours - (Theory: 45 hrs + Practical/Tutorial: 75hrs)

2.19.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical/ Tutorial) in Hours	Learning Objectives
1. Introduction	4	6	After completion of this unit, the Learner will be able to uunderstand the basics concept of Image processing and its applications
2. Image Digitization	6	9	Familiarize with the Image Digitization process.
3. Image Enhancement	4	6	Implement the process of Image enhancement techniques

4. Image Restoration	4	6	Implement the process of Image Restoration techniques
5. Image Compression	4	6	Implement the process of Image Compression techniques
6. Image Segmentation	5	10	Implement the process of Image Segmentation techniques
7. Image registration and Multi-valued Image Processing	4	6	Familiarize with concept on Image registration and Multi-valued Image Processing
8. Image Transformations	4	6	Implement the process of Image Transformations
9. Object detection process	5	10	Implement the process of Object detection process
10. Introduction to Virtual Reality and Augmented Reality	5	10	Understand the advanced Topic-Introduction to Virtual Reality and Augmented Reality
Total	45	75	

2.19.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Introduction	08
2. Image Digitization	10
3. Image Enhancement	09
4. Image Restoration	10
5. Image Compression	10
6. Image Segmentation	08
7. Image registration and Multi-valued Image Processing	10
8. Image Transformations	10
9. Object detection process	15
10. Introduction to Virtual Reality and Augmented Reality	10

Total	100

2.19.6. Detailed Syllabus

Introduction
Introduction of Image, Image Processing with its applications, Components of Image processing system, Fundamentals of Image Processing: Image Acquisition, Image Model, Sampling, Quantization, Image Formation model.

Image Digitization
Image digitization process, Image representation schemes like, GIF, TIFF, BMP, JPEG etc. Resolution, Image size, File formats -bitmap and vector.

Image Enhancement
Introduction of Image enhancement, Image enhancement techniques: Contrast intensification by Linear stretching, Non-Linear stretching, Exponential stretching, Noise cleaning or Smoothing by Image averaging, Special filters like Mean filter, Median Filter, Max filter, Mean filter and Image sharpening and Christening. Cleaning process of the background of image and a video.

Image Restoration
Minimum Mean-square Error restoration, Least-square error restoration, Restoration by Singular Value Decomposition, Restoration by Maximum Posterior Estimation, Restoration by Homomorphism Filtering

Image Compression
Introduction, Error Criterion, Stages of Image compression, Difference between Lossy Compression techniques and Loss less image compression techniques, Compression techniques like Huffman coding, Run Length Encoding, Lempel-Ziv-Welch (LZW) coding, JPEG, Transform compression, Block Truncation compression, example of compression algorithms.

Image Segmentation
Definition of segmentation, Characteristics of Segmentation, Detection of Discontinuities, Thresholding. Pixel Based Segmentation Method. Region Based Segmentation Methods, Segmentation by Pixel Aggregation, Segmentation by Sub Region Aggregation, Histogram Based Segmentation, Spilt and Merge Technique, Segmentation of moving objects.

Image registration and Multi-valued Image Processing
Introduction of image registration, Geometric transformation, Plane to plane Transformation, Mapping, Stereo imaging, Multi-modal and Multi-spectral image processing, Pseudo and False colouring, Image fusion. Colour Models

Image Transformations
A Detail Discussion on Fourier Transform, DFT, FFT, and Properties of Fourier transform, Enhancement, Smoothening Filters

Object detection process
Image Classification, Object Localization, Object Detection, Object detection algorithms

Introduction to Virtual Reality and Augmented Reality
Evolution and Immersive Experience and application areas.
Visual presentation of objects through Transformation like zooming, panning, clipping, rotation and Rendering.
Basics of Animation like frame animation, Morphing, sample of Dynamic and responsive AR/VR – Applications, Languages and Tools.
Introduction to Unity SDK for implementing AR/VR, A-Frame, Browsers.
Introduction to Entity Component System, JavaScript, Events
Introduction to Tools like three.js, 3D Models, Visual Inspector and Dev Tools
Case study on related Met averse

2.19.7. Recommended Books

1. Rafael C. Gonzalez& Richard E. Woods: Digital Image Processing, Addision-Wesley
2. Chanda, D. Dutta Majumder: Digital Image Processing and Analysis, PHI, 2000.
3. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins: “Digital Image Processing using MATLAB”, Parsons Education Asia, 2004
4. Nick Afford: Know the basics of edge computing
5. Know the Challenges in Federating Edge Resources
6. Know the method Data Management in Edge Computing age Processing, Addison-Wesley Publishing Company, 2000.
7. Scott E Umbaugh: Computer Vision and Image Processing, PHI, 1998.

2.20. Module: B3.E7-R5- Accounting and Financial Management

2.20.1. Introduction

Every person performs some kind of economic activity. A worker daily works and get wages and he spends to buy goods, cloths and some part of earnings saves for future. A business man purchases goods and sales it. He incurred various expenses like salaries, rent etc. A partner in firm contributes towards capital in the firm which carries on business may be trading in goods. Similarly, companies, Governments are also carries on some financial 3 activities. All are carrying some kind of economic activities. Such economic activities are performed through transactions and / or events. Thus the business transactions include purchase, sale of goods, rendering various services, receipts and payments for such transactions. In a business concerns the transactions are numerous. The details of all transactions cannot be remembered by the business man. Therefore, it is necessary to keep written records of all such transactions. The records of written transaction will help business to settle disputes and also possible to provide valuable information to the owner of business. Book-keeping disciple has been developed to serve this purpose. The aim of Book-keeping is to provide the information needed by the businessmen and also it helps him to take decisions.

2.20.2. Objectives

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

- To keep a systematic record of financial transactions
- To help the users to understand the day to day transactions in a systematic manner so as to gain knowledge about overall business
- To reveal the profits and losses of the business and provide a true and fair view of the business which is aimed at safeguarding the interest of various stakeholders internal as well as external which are connected to the business.
- To explain the basic accounting procedures and financial management processes.
- To focus on the computerized implementation of the various accounting principles discussed at different levels.

2.20.3. Duration

120 Hours - (Theory: 45hrs + Practical: 75 hrs)

2.20.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical) in Hours	Learning Objectives
Basic Accounting System	5	10	After completion of this unit of module, the Learner will be able to understand Accounting and its Functions, Scope of Accounting, Emerging Role of Accounting, Accounting as an Information System, Role and Activities of an Accountant, Accounting Personnel, Nature of Accounting Function, Organization Chart for Accounting and Finance
Accounting Concepts and Standards	7	13	After completion of this unit of module, the Learner will be able to understand Accounting Framework Accounting Concepts, Accounting Standards, Changing Nature of Generally Accepted, Accounting Principles (GAAP), Attempts towards Standardization, Accounting Standards in India
Preparation of Profit & Loss & Balance Sheet	5	10	After completion of this unit of module, the Learner will be able to understand i. Accounting Equation ii. Classification of Accounts Definitions of Journal and Ledger iii. Journalizing Process Ledger Posting iv. Balancing an Account v. Trial Balance vi. Objectives of Preparing Trial Balance vii. Preparation of Profit & Loss and Balance Sheet. Ledger Posting and Trial Balance. viii. Use of any Financial Accounting software either

			Licensed or Open source
Financial Management	8	12	After completion of this unit of module, the Learner will be able to understand, Cash and Treasury Management, Treasury Risk `Management, Functions of Treasury Department, Facets of Cash Management, Motives for Holding Cash, Cash Planning, Determining the Optimum Cash Balance, Methods of Cash Flow Budgeting, Investing Surplus Cash Collection and Disbursements. Budgeting and Budgetary Control.
Inventory & Receivables Management	8	12	After completion of this unit of module, the Learner will be able to understand, Reasons for Holding Inventory, Objectives of Inventory Management, Techniques of Inventory Control. Various techniques of receivable management
Portfolio Management and IT applications	6	9	After completion of this unit of module, the Learner will be able to understand, what is portfolio management, Portfolio management methods Design and implementation of portfoliomanagement, Risk Management, Disaster Management, Portfolio management issues and challenges, Tools and techniques
Social, Ethical and Legal Aspects	6	9	After completion of this unit of module, the Learner will be able to understand Society in information age, Moral dimensions and information age, Technology trends and ethical issues, Ethical principal and dilemma, Responsibility, accountability and liability Information right and acts

Total	45	75	

2.20.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Unit 1	30
2. Unit II	30
3. Unit III	25
4. Unit IV	15
Total	100

2.20.6. Detailed Syllabus

Unit 1

Basic Accounting System

Accounting and its Functions, Scope of Accounting, Emerging Role of Accounting, Accounting as an Information System, Role and Activities of an Accountant, Accounting Personnel, Nature of Accounting Function, Organization Chart for Accounting and Finance

Accounting Concepts and Standards

Accounting Framework Accounting Concepts, Accounting Standards, Changing Nature of Generally Accepted, Accounting Principles (GAAP), Attempts towards Standardization, Accounting Standards in India

Preparation of Profit & Loss & Balance Sheet

Accounting Equation, Classification of Accounts Definitions of Journal and Ledger, Journalizing Process Ledger Posting, Balancing an Account, Trial Balance, Objectives of Preparing Trial Balance, Preparation of Profit & Loss and Balance Sheet. Ledger Posting and Trial Balance.

Use of any Financial Accounting software either Licensed or Open source

Unit II

Financial Management

Cash and Treasury Management, Treasury Risk `Management, Functions of Treasury Department, Facets of Cash Management, Motives for Holding Cash, Cash Planning, Determining the Optimum CashBalance, Methods of Cash Flow Budgeting, In

vesting Surplus Cash Collection and Disbursements. Budgeting and Budgetary Control.

Inventory & Receivables Management

Reasons for Holding Inventory, Objectives of Inventory Management, Techniques of Inventory Control. Various techniques of receivable management

Unit III

Portfolio Management and IT applications

What is portfolio management, Portfolio management methods Design and implementation of portfolio management, Risk Management, Disaster Management, Portfolio management issues, Tools and techniques?

Unit IV

Social, Ethical and Legal Aspects

Society in information age, Moral dimensions and information age, Technology trends and ethical issues,
Ethical principal and dilemma, Responsibility, accountability and liability Information right and acts

2.20.7. Recommended Books

1. R.Narayanaswamy: Financial Accounting: A Managerial Perspective, PHI
2. MN Arora: Copst and Management Accounting, Vikas Publications
3. Prasanna Chandra, "Financial Management: Theory and Practices, 5th Edition, 2001,Tata McGraw Hill.
4. Robert N. Anthony and James s. Reece: Accounting Principles
5. S.N. Maheswari : Advanced Accountancy
6. M.Y. Khan and P.K. Jain, "Management: Accounting", Second Edition, 1995 (TataMcGraw Hill Publishing Co. Ltd, New Delhi.
7. R.L. Gupta and M. Radhaswamy : Advanced Accountancy
8. Horngran, C.T., Foster G and Sales, S.M., "Cost Accounting: A Managerial Emphasis, 10th Edition, 2000, Prentice Hall of India.
9. Paresh Shah, Management Accounting, OUP
10. Ravi M. Kishore, Cost and Management Accounting, Taxmann

11. Pandey I.M., "Financial Manager, 7th Edition, 2002 Vikas Publishing Pvt.Ltd.
12. Ravi M. Kishore, Financial Management: Problems and Solutions, Taxman

2.21. Module: B3. E8-R5- Wireless and Mobile Communication

2.21.1. Introduction

This course introduces students to the fundamentals of wireless and mobile communication concepts. This subject is framed to set the required background in wireless communication. Being the backbone for all the IT based developments; Wireless Technology has seen tremendous growth in the past decade. There are new techniques and protocols emerging from time-to-time to cater the requirements of this rapidly growing area. The subject will cover from rf fundamentals to the topics like cellular, WiFi, WPN and WSN technologies. The treatment would look at current and upcoming wireless communications technologies for various wireless accesses.

2.21.2. Objective

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

- Basic concept of Radio frequency & characteristics of a wireless communication channel.
- Basic concepts of cellular communication
- Different methods of improving coverage and increasing the capacity of cellular systems.
- Types of hand-off mechanism and spread spectrum techniques
- The architecture of modern and emerging cellular standards – 3G, 4G, 5G, CDMA, LTE, UMTS
- Wireless LAN and its applications
- Technologies used for building the Wireless Sensor Network and Wireless personal area networks
- To enable students to acquire in-depth knowledge in the field of wireless communication technology with an ability to integrate existing and new knowledge with the advancement of the technology.

2.21.3. Duration

120 Hours - (Theory: 45 hrs + Practical: 75 hrs)

2.21.4. Outline of Module

Module Unit	Duration in Hours (Theory)	Duration in Hours (Practical)	Learning Objectives(Learner will learn after completion of unit)
1. Wireless Communication Fundamentals	11	19	i. Radio frequency fundamentals ii. Modulation Techniques for Wireless and Mobile communication. iii. Wireless Frequency Spectrum
2. Cellular & Mobile technologies	11	19	Basic cellular system concept Cellular s
3. Wireless LAN Technologies	11	19	i. Wireless LAN overview ii. WiFi standards iii. WiFi security
4. WSN and WPAN Technologies	12	18	i. Wireless Sensor Network basics ii. WSN Topology iii. WSN standards iv. WPAN standards & Applications
Total	45	75	

2.21.5. Marks Distribution

Module Unit	Written Marks (Max.)
1. Wireless Communication Fundamentals	25
2. Cellular & Mobile Technologies	25
3. Wireless LAN technologies	25
4. WSN and WPAN Technologies	25
Total	**100**

2.21.6. Detailed Syllabus

Wireless Communication Fundamentals

RF Basics: Radio Frequency (RF) Fundamentals: Introduction to RF & Wireless Communications Systems, Units of RF measurements, Analog & Digital Modulation techniques for Mobile communication, Multiple access techniques, Wireless Antenna basics, OFDM, MIMO

Cellular & Mobile technologies

Types of wireless communication, The modern wireless communication system, The cellular concept - system design issues, Cellular carriers and Frequencies, Channel allocation, Cell coverage, Cell Splitting,

Microcells, Picocells, Handoff and outage, Improving coverage and system capacity, Cellular Systems (1G, 2G, 3G, 4G, 5G and beyond 5G), AMPS, GSM, IS-95 & CDMA, Mobile IP, GPRS, EDGE, UMTS,
NBIoT. (3gpp standards), LTEM, optical high speed backend networks, 6G overview, Software Defined Networking (SDN) , Virtual RAN & Open RAN (VRAN & ORAN)

Wireless LAN Technologies

Wi-Fi Organizations and Standards: Regulatory Bodies, IEEE, Wi-Fi Alliance, WLAN Connectivity, WLAN QoS & Power-Save, IEEE 802.11 Standards,802.11-2007,802.11a/b/g, 802.11e/h/I,802.11n, 802.11AC.

Wi-Fi Hardware & Software: Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters, WLAN Controllers/Switches, Wireless Topologies, PoE Infrastructure, Wireless signaling.WiFi6, WiFi Security standards

WSN and WPAN Technologies

Wireless Sensor Network (WSN) & Wireless Personal Area Network(WPAN): Introduction to WSN, WSN IEEE standards, WSN Topologies, routing protocols for WSN, Wireless Adhoc Networks, Zigbee, Zwave, Thread, Bluetooth 1.0 to 6.0, LoRA & LoRA WAN, WiMaX, 6lowPAN,sigfox

2.21.7. Recommended Books

1. Theodore S. Rappaport, “Wireless Communications: Principles and Practice”, Second Edition, 2002, Pearson Education Asia.
2. David Tse and Pramod Viswanath, Fundamentals of wireless communications, Cambridge University Press, First Edition, 2012
3. Henrik Schulz And Christian L¨uders, Theory and Applications of OFDM and CDMA Wideband Wireless Communications, , John Wily & Sons, First Edition, 2005
4. Bluetooth Revealed; By: Miller, Brent A, Bisdikian, Chatschik; Addison Wesley Longman Pte Ltd., Delhi
5. Wilson , “Sensor Technology hand book,” Elsevier publications 2005.
6. Andrea Goldsmith, “Wireless Communications,” Cambridge University Press, 2005
7. Mobile and Personal Communications Services and Systems; 1 st Edition; By: Raj Pandya; PHI, New Delhi
8. Mobile Communications; By: Schiller, Jochen H; Addison Wesley Longman Pte

Ltd., Delhi

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18. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
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2.22. Module: B3.E9-R5- Blockchain Technology

2.22.1. Introduction

The main purpose of the course is to develop and gain an understanding of the principles, concepts of Blockchain technologies. The course structure has been designed to provide the participants a sound theoretical knowledge as well as hands-on practical experience on formulating and developing Blockchain-based Daps. The course will help

To solve some real-life problems being faced today the technology has attracted huge interest from both academia as well as the industries that spread from crypto currencies to various other domains, including business process management, smart contracts, IoT, and so on.

2.22.2. Objectives

After completing the module, the incumbent will:

- Learn the concept of crypto currencies, predominantly Bitcoin, and Blockchain structure along with cryptography and consensus mechanisms.
- Learn about Ethereal and the process to use Blockchain technologies to create decentralized applications with the help of Smart Contracts.
- Learn Hyperledger and possess to develop an enterprise-grade and open-source distributed ledger framework. You will be taught about the Hyperledger architecture and its consensus mechanism
- Help to develop a DApp service and deploy it on a local test Blockchain

2.22.3. Duration

120 Hours - (Theory: 45 hrs + Practical/Tutorial: 75h rs)

2.22.4. Outline of Module

Module Unit	Duration (Theory) in Hours	Duration (Practical /Tutorial) in Hrs.	Learning Objectives
1. Introduction	4	6	After completion of this unit, the Learner will be able to understand the objectives, and importance of the course
2. Fundamentals of Blockchain Technology	2	3	Familiarize with Properties of Blockchain, Types of Systems,

			possible application areas and concept of the smart contracts, etc.
3. Consensus Mechanism	4	6	Familiarize with the consensus Mechanisms, Proof-of-Work, Mining and Incentives, Proof-of-Authority, Proof-of-Stake, Practical Byzantine Fault Tolerance (PBFT),etc
4. Encryption & Decryption Algorithm	4	6	Implement of Encryption & Decryption algorithms- RSA, Ceaser Cipher, Rijndael algorithm logic, Message Authentication Code
5. Crypto currencies and Bitcoin	2	3	Familiarize with crypto currencies, crypto currencies, Digital cash, Wallets, and Altcoins, etc
6. Types of Blockchain	6	9	Development of applications using Public Blockchain: (Ethereal), Ethereal Virtual Machine (EVM),
7. Private Blockchain	7	13	Development of applications using Hyperledger, uPort, SlockIt, Crypto-kitties, Augur, etc.
8. Implementation/Case studies	7	13	Development of i. Private application son the Ethereal Blockchain platform. ii. Smart Contracts, iii. DApp Development environment
9. Standards and possible attacks	4	6	Familiarize with the Development Tools and libraries, Front End Technologies, Attacks on Smart Contracts, etc.
10. Use Case	5	10	Developing a use case and implementation as a mini project
Total	45	75	

2.22.5. Marks Distribution

Module Unit		Written Marks (Max.)
1.	Introduction	6
2.	Fundamentals of Blockchain Technology	6
3.	Consensus Mechanism	10
4.	Encryption & Decryption Algorithm	10
5.	Crypto currencies and Bitcoin	8
6.	Types of Blockchain	10
7.	Private Blockchain	10
8.	Implementation/Case studies	15
9.	Standards and possible attacks	10

10. Use Case	15
Total	100

2.22.6. Detailed Syllabus

Introduction

Providing an intuition, objectives, and importance of the course. Introduction to Cryptography, Security goals (CIA Triad), Security services and mechanism, Prime Numbers, Modular Division, Encryption and Decryption, Types of Ciphers(Substitution, Transportation, Stream, and Block)

Group, Fields, and Rings, Symmetric and Asymmetric Cryptography, Public Key Infrastructure, Brief introduction to AES and DES, RSA Algorithm

Hashing and Digital Signature: Properties of hash functions, Message Authentication Code, Secure Hash Algorithm(SHA 256), Digital Signatures, Need for Digital Signatures, Elliptic Curve Digital Signature Algorithm (ECDSA)

Fundamentals of Blockchain Technologies

Definition of Blockchain, Properties of Blockchain, Types of System (Centralized, Distributed, Peer-to-Peer, Decentralized), CAP Theorem, Distributed Ledgers & Blockchain, Components of Blockchain (Blocks, Block Header, Block Pointer), Types of Blockchain, in brief, Identifying the need for Blockchain, Applications of Blockchain Technology (FinTech, IoT, Agriculture).
Smart Contracts.

Consensus Mechanism

Need for having a consensus mechanism, 3 Generals Problem, Impossibility Theorem, Types of consensus mechanism, (Challenge-Response Based, Voting Based), Proof-of-Work, Mining and Incentives, Proof-of-Authority, Proof-of-Stake, Practical Byzantine Fault Tolerance (PBFT).
Attack Models on Consensus Mechanism.

Encryption & Decryption Algorithm

Encryption & Decryption using DES Algorithm. Encryption & Decryption using RSA Algorithm. Creaser Cipher Algorithms, Rijndael algorithm logic, Implement Message Authentication Code

Crypto currencies and Bitcoin

Definition of crypto currencies, crypto currencies v/s digital cash, History of Bitcoin, Properties of Bitcoin, Economics of Bitcoin, Roles of Bitcoin Exchanges, Wallets, and its types (Hot, Cold, and Paper), Wallet Security, Bitcoin v/s Altcoins

Types of Blockchain

a. Platforms
b. Public Blockchain: (Ethereum): Introduction to Ethereum Blockchain, State Transition Model

c. Ethereum Virtual Machine (EVM), Accounts, Concept of Gas, Gas Price, Gas Limit, Ethereum, Test Nets (Rinkeby, Kovan), Ethereum Main Net, Ethash, clique, Casper Ethereum PoS, Difference between Ethereum and Bitcoin, Application of Ethereum beyond crypto currencies

Private Blockchain

a. Hyperledger: Introduction to Hyperledger projects in brief.
b. Consortium Blockchain (R3 Corda): Introduction to R3 project in brief
c. Use Cases of Ethereum Blockchain: (uPort, SlockIt, Crypto-kitties, Augur, etc.)

Implementation/Case studies

a. Setting up a private, permission Blockchain network on the Ethereum Blockchain platform.
b. Smart Contracts: Introduction to Solidity: Background of Solidity, variables, storage, memory, messages, etc. Stack operations, mappings other basic constructs, etc.
c. DApp Development: Formulating the problem for the DApp project with proper Flowcharts and diagrams following software engineering principles.

Standards and possible attacks

Development Tools and libraries: Remix IDE, Ganache, Metamask, web3.js.

Learning Front End Technologies required for the project (React, HTML, JS, etc)

Attacks on Smart Contracts: DAO Attack and Parity Hack. Best Practices while writing smart contracts.

Use Case

Developing a use case and its implementation

2.24 Module: B-SE-R5- Employability Skills

S. No	Module Name	Duration (hours)
1.	Introduction to Employability Skills	3
2.	Constitutional values - Citizenship	3
3.	Becoming a Professional in the 21st Century	5
4.	Basic English Skills	20
5.	Career Development & Goal Setting	4
6.	Communication Skills	10
7.	Diversity & Inclusion	5
8.	Financial and Legal Literacy	10
9.	Essential Digital Skills	20
10.	Entrepreneurship	15
11.	Customer Service	10
12.	Getting Ready for Apprenticeship & Jobs	15
	Total	**120**

Section 3

Sample Assignments

B0.1-R5: BASIC MATHEMATICS

No practical module is there.

B1.1-R5: MANAGEMENT FUNDAMENTALS & INFORMATION SYSTEMS

Assignment 1

a) Every organization needs a manager and management. Justify
b) Explain the pillars of classical organizational theory.

Assignment 2

a) Explain the term 'Management as Science'.
b) What is SWOT analysis? Explain each term with help of example.
c) What are functions of management?

Assignment 3

a) Explain the following types of managements
    a. Operation Management
    b. Sales Management
    c. Strategic Management
    d. HR Management

b) What is the relevance of computer applications at different level of management?

Assignment 4

a) Explain the following types of managements.
b) Differentiate between
    a. Formal and informal organization
    b. Centralization and de-centralization

Assignment 5

a) Explain the following motivational theories.
    a. Content Theories
    b. Process Theories
b) Explain - Vroom's Expectancy Theory of Motivation.
c) What are factors that influences job satisfaction?

Assignment 6

a) What do you understand by the term 'System'? Explain its various types.
b) Explain any two areas of an organization where information system can improve the preformation. Also systems and sub-systems along with functions.

Assignment 7

a) What are component of information systems?
b) Explain the role of Information System in following systems.
    a. Accounts payable system
    b. Inventory control system
    c. Marketing and Sales System

Assignment 8

a) Explain
    a. OAS
    b. TPS
    c. MIS
    d. DSS

e. EIS

Assignment 9

a) What is ERP? What are its characteristics?
b) What are the risks involved in implementation of ERP? Explain with help of example.
c) Explain the architecture of ERP.

Assignment 10

a) Explain the followings with respect to ERP.
    a. Supply Chain Management
    b. Customer Relationship Management
b) What are different components of Business Analytics Based EIS?
c) What are the issues involved in Business Analytics?

Assignment 11

a) What is SDLC? Explain its stages in detail with help of diagram?
b) Explain following strategies of software development.
    a. DevOp
    b. Agile
    c. RAD
c) What are differences between agile and scaled agile?
d) How Scaled Agile Framework is implemented?

Assignment 12

a) What do you understand by Information Security? Why is it required in an organization?
b) Explain principles of Information Security in detail.
c) What is system vulnerability?
d) How computer frauds can be identified and prevented?

Assignment 13

a) Explain the following terms.
    a. Authentication and Authorization
    b. Encryption
    c. Firewall
b) What precautions should be taken to secure password?
c) What is the role of backup? What if, backup is not taken timely?

Assignment 14

a) What do you understand by term Project Management? What are different stages of project management?
b) What are possible controls that can be helpful to mitigate risks, once identified.
c) Explain
    a. Integration Management
    b. Quality Management

Assignment 15

a) What are possible modules of academic ERP? Explain in detail.
b) Write 5 organizations whose services you or your family members use and which ask for 2 factor authentication.

Assignment 16

a) Write some issues that arise during coding and testing stage of software development.
b) Identify the main functions of finance and accounting module of ERP.

c) Identify the main functions of CRM module of ERP.

Assignment 17

a) Give two examples of Supply Chain Management.
b) What is operational manual? What are its benefit? Explain the structure of operational manual.

Assignment 18

a) Give two examples of Supply Chain Management.
b) What is the purpose of Post-Implementation Review (PIR)? How it is conducted?
c) What Post-Implementation Review will consist of?

Assignment 19

a) What are differences between vision and mission? Explain with help of example.
b) What is controlling process in management? Explain its steps.
c) Discuss the functions of Human Resource Management with relevant example.

Assignment 20

a) Describe the importance of HRM.
b) What are differences between vision and mission? Explain with help of example.

Assignment 21

a) Describe the importance of HRM.
b) What are challenges in managing workforce?
c) Explain different types of selection test.

Assignment 22

a) Describe the importance of HRM.
b) Explain the methods of performance appraisal.

Assignment 23

a) Differentiate between deterministic and probabilistic system.
b) What is database? Explain the importance of use of database in an information system.
c) What are potential questions that useful in SWOT analysis.

Assignment 24

a) What is purpose of requirement analysis in software development? Explain the activities involved in requirement analysis.
b) Explain requirement analysis technique.
c) Differentiate between as-is process and to-be process.

Assignment 25

a) What is quality management system? What are its benefit and types?
b) Explain any three emerging technologies.
c) Explain GDSS along with its components. Also explain its advantages and limitation.

B1.2-R5: DISCRETE STRUCTURES

1. Write Python Code to find Union and intersection of two sets A = {1, 2, 3, 4, 5} B = {4, 5, 6, 7, 8}.

2. Write Python Code to find difference of two sets A = {1, 2, 3, 4, 5} B = {4, 5, 6, 7, 8}.

3. Write Python Code to remove 3rd Element of Set A= {1,2,3, 8}.

4. Use Python to perform

   a) ({1, 3, 5, 7} ∪ {3, 1}) ∩ {3, 5, 7}

   b) ({1, 2} - {5, 7, 9}) ∪ ({5, 7, 9} - {1, 2, 7})

5.

Find Time Complexity of following Algorithm:

Algorithm: SUM (A, B)

Step 1 − START

Step 2 − C ← A + B + 10

Step 3 − Stop

6. Following are code for factorial of a number developed by two employees of an organization:

E1:

```
def fact(n):
    product = 1
    for i in range(n):
        product = product * (i+1)
    return product
print(fact(5))
```

E2:

```
def fact2(n):
    if n == 0:
        return 1
    else:
        return n * fact2(n-1)
print(fact2(5))
```

Find complexity of both the functions and identify which is better.

1. Given the following code fragment, what is its Big-O running time?

```
test = 0

for i in range(n):

  for j in range(n):

    test = test + i * j
```

2. Given the following code fragment, what is its Big-O running time?

```
test = 0

for i in range(n):

  test = test + 1


for j in range(n):

test = test - 1
```

3. Given the following code fragment what is its Big-O running time?

```
i = n
while i > 0:
  k = 2 + 2
  i = i // 2
```

4. Given two strings, find the length of longest substring present in both of them. Both the strings are of uppercase.

   Illustration:
   Input: A = 6, B = 6
   str1 = ABCDGH
   str2 = AEDFHR
   Output: 3
   Explanation: LCS for input Sequences "ABCDGH" and "AEDFHR" is "ADH" of length 3.

   Write a python function lcs() which takes the length of two strings respectively and two strings as input parameters and returns the length of the longest subsequence present in both of them.

5. Write a python script to implement following recurrence relation

$$a_n = a_{n-1} + a_{n-2}\,; a_1 = 1, a_2 = 1$$

   Find its complexity.
6. Implement above using non-recursive approach and find its complexity.

7. Suppose we have a 2D matrix, where each row and column are sorted in non-decreasing order, write a python script to find the nth smallest number.

8. Given two integers N and X. Write a Python Script to convert 1 to N such that total cost is minimum.

   The costs for operations are illustrated as follows:

   a. Change a number (say T) into T*X. This costs one unit.
   b. Right rotate the number. This costs one unit.

Note: Right rotation means the last digit of the number becomes the first and all other digits get shifted rightwards. For example, 456 becomes 645. The right-shuffle operation cannot be done on single-digit integers or integers which are a multiple of 10.

Illustration

Input: N = 61, X =4

Output: 3

Explanation: The sequence of operations is as follows:

1 -> 4 (Using first operation -> T*X= 1 * 4 = 4) cost = 1

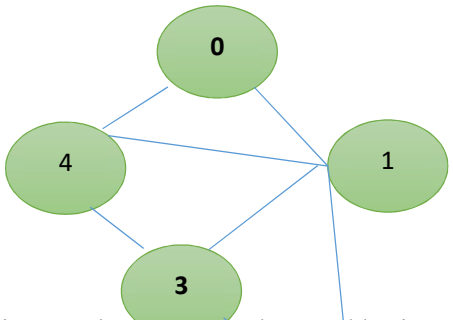
4 -> 16 (Using first operation -> T*X = 4 * 4 = 16) cost = 1

16 -> 61 (Using second operation -> right shuffling 16 -> 61) cost = 1

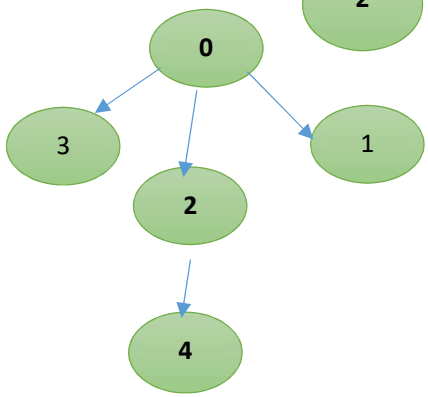
Hence, the minimum costs required to convert from initial 1 to N is 3.

Find time complexity also.

9. Write a python function that takes two parameters n and k and returns the value of Binomial Coefficient C (n, k). For example, your function should return 6 for n = 4 and k = 2, and it should return 10 for n = 5 and k = 2. Find its time complexity?
10. Solve problem in 15. Using Overlapping Subproblem method and find its time complexity.
11. Write a Python code to display adjacency list of following graphs:

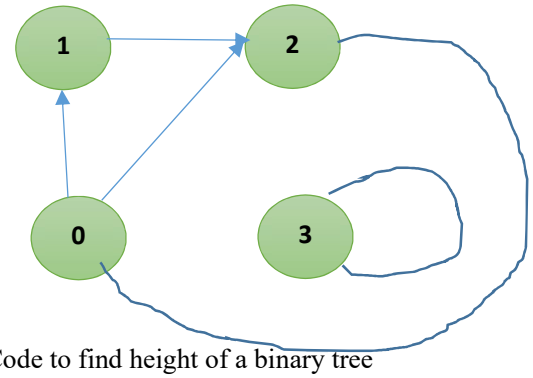


12. Given a directed graph as below: Write a Python script to do Breadth First Traversal of this graph starting from 0.

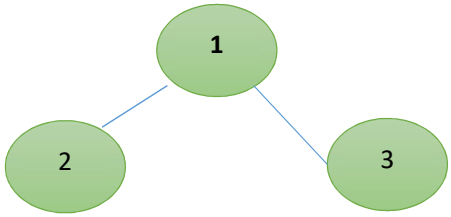


Note: One can move from node u to node v only if there's an edge from u to v and find the BFS traversal of the graph starting from the 0th vertex, from left to right according to the graph. Also, you should only take nodes directly or indirectly connected from Node 0 in consideration.

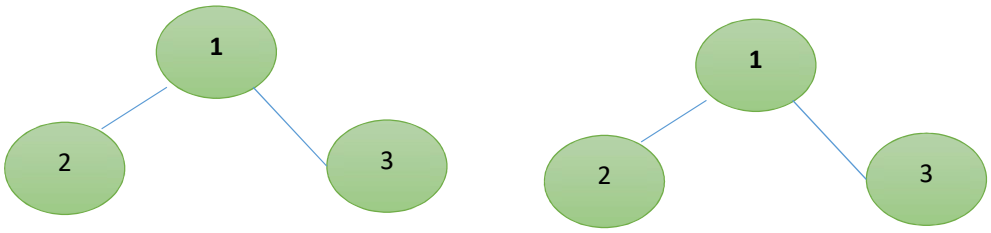
13. Given a directed graph, write a python function to check whether the graph contains a cycle or not. Your function should return true if the given graph contains at least one cycle, else return false.



14. Write a Python Code to find height of a binary tree



15. We have two Binary trees. Write a Python Code to check whether these are identical or not?



16. Given an M × N matrix of integers where each cell has a cost associated with it, Write a python code to find the minimum cost to reach the last cell (M-1, N-1) of the matrix from its first cell (0, 0). We can only move one unit right or one unit down from any cell, i.e., from cell (i, j), we can move to (i, j+1) or (i+1, j).
17. Write a Python code to solve $a_n=5a_{n-1}+7n$, a1=5.
18. Write a Python code to expand $(1+x)^5$.
19. Write a Python code to check whether a graph is planar ?

B1.3-R5 SOFTWARE ENGINEERING

Scenerio1:

Miss Elena is a teacher for a Special Education School. She deals with Asperger Syndrome (AS) students who lack social skills. Social Story is an individualized short story being written or drawn to help them interpret social situations. Hence, Elena writes and draws a lot of social stories using cards and markers to teach them social skills. She spends about 30 minutes explaining and repeating the social stories to the students in each session. She spends about 1 hour to draw out a story, and she has to draw a lot of social stories for each session.

Problem Encountered: Generally, students find the hand drawn social stories not interesting and do not like to learn. Furthermore, Miss Elena found preparing and explaining the social stories tiring and time-consuming. All the used story cards are piled up in the store room. Miss Elena learnt about using social stories in digital forms from her friend who teaches AS students in Australia. She also has access to free social stories in videos and animations. However, she searched high and low for suitable video and animation player software. Software like QuickTime, RealPlayer and Window Media Player has many difficult functions for her to learn and use. It is also difficult for her to teach other teachers and parents to use the software.

Feasible Solution: She would like to organize and play various social stories to teach AS students in her class. She just needs simple software to manage social stories for different students. She would like to create a new playlist and then add social stories. When a playlist needs an update, she would like to add or remove social stories in that playlist. She would also like to delete a playlist that is no longer in use. She wishes to view playlists and play a selected playlist using a laptop computer. She can also share the playlist and social stories with other teachers and parents of AS students at her school.

You are invited to participate in the analysis, design and evaluation of the requested software, namely *SoS*.

1. Define the Objectives, Solution Scope and Possible Solutions
2. List out some possible risks and their possible impact, and possible ways to handle the risk
3. List the possible Deliverables
4. What are possible Quality Goals? Hints: Usability, Reliability, Efficiency, Maintainability, Correctness, Work quality, Paint quality etc.
5. Which process model will be the best and why?
6. List of Tasks/activities/WBS
7. Schedule: The best way to show a schedule is with an annotated Gantt or PERT/CPM chart. You also need to indicate in the schedule when milestones (various deliverables described above) will be completed.
8. List the required recourse (Human and software/hardware)
9. Draw the DFD for the following system.
10. Why is the Spiral life cycle model considered to be a meta model? Differentiate between throw away and evolutionary prototype process model.
11. Describe the technique for tracking and controlling Software Quality. How can we do effective contract management?
12. What is the method of estimating software quality? What is to be done in subcontracting and quality auditing?

13. Use scenerio1: Draw an Activity Diagram to show the workflow of Edit Playlist as per the above scenerio1.
14. Use the scenerio1: Use your scenarios as a basis for an UseCase. Give a detailed description of the UseCase. Include the name, primary actor, goal, pre-condition and success guarantee, and the main success scenario and extensions.
15. Use the scenerio1: Draw a Class diagram.
16. Draw an Activity Diagram to show Remove a Playlist in the proposed system
17. Develop applicable cases of Black box and white box testing

B1.4-R5: OPERATING SYSTEMS

Assignment 1. Try the commands in linux/unix:

a) To see the detail directory listing
b) To see the processes running
c) To see the number of users logged in
d) To create new directories and create files within those directories
e) To see the count of number of lines, words and characters in a file.

Assignment 2. Try the commands in linux/unix:

a) To create file and give read and write permissions to all.
b) To change the permission to execute also for the same file using absolute method.
c) See the last 10 lines of a file.
d) Store the directory listing in a file and sort it.
e) Run disk commands like du,df
f) Use calculator

Assignment 3.

a) Explore the filesystem tree using cd, ls, pwd and cat. Look in /bin, /usr/bin, /tmp /etc.

b) Explore /dev. Can you identify what devices are available? Which are character-oriented and which are block-oriented? Can you identify your tty (terminal) device (typing who am i might help); who is the owner of your tty (use ls -l)?

c) Explore /proc. Display the contents of the files interrupts, devices, cpuinfo, meminfo and uptime using cat. Can you see why we say /proc is a pseudo-filesystem which allows access to kernel data structures?

Assignment 4.

e) Convert the decimal number 192 to octal and hexadecimal using bc command.
f) Run ps , the script command and run ps again . What is its output. Explain.

g) Write a command to create following directory structure
in one command: NIELIT BLEVEL BL54…
h) Create above Directory Structure with permission 777.?

Assignment 5.

a) Write a command to delete a non-empty directory.
b) What output will this command sequence produce ?
who | grep –c "^$LOGNAME"

c) What is the difference between pipe (|) and tee command, explain with example.

Assignment 6. Enumerate some of the most commonly used network commands in UNIX

- telnet
- ping
- su
- ftp

- finger

Assignment 7. Using vi editor

a) Two consecutive lines are combined into one. Which vi command is used to do so?
b) Write a command to move line number 1,10 after line number 25.

c) In the middle of a file being typed you want to import the output of who command. How would you do so?

Assignment 8.

Each time you enter a command, a variable named PATH or path will define in which directory the shell will search for that command.

If an error comes, then what is the solution.

Assignment 9.

Write a shell script

a) To copy source file to destination file using cp Command
b) To copy source file to destination file without using cp Command
c) To append file f1 at the end of file f2.
d) To concate content of two files.

Assignment 10.

Write a shell script that

a) Works as a calculator.
b) Takes a number and Checks it is a prime or not.
c) Finds sum of digits of a number till the sum is a single digit number.
d) Factorial of the given number.
e) Finds reverse of a given number.
f) Generates Fibonacci series

Assignment 11.

a) Write a shell script to wish "good morning", "good afternoon" and "good night" as per the current system time.
b) Write a Shell script to send mail to all users on your System
c) Write a shell script to input marks in three subjects. Add the marks and find the percentage. Assign grade based on:

marks >=80 A Grade
marks >=60 B Grade
marks >=40 C Grade
marks <40 Fail

Assignment 12.

a) Write a shell script that changes directory as specified by the user

b) Write a shell script to find out no. of vowels from the file.
c) Write a shell script to find out the biggest number from the given three numbers. Numbers are supplied as command line argument. Print error message if sufficient arguments are not supplied.
d) Write a shell script for checking file have write(w) read(r) and execute permission or not. And also that file exists or not`

Assignment 13.

a) We have a file emp.mast which consists of detail of employees
Fields:
emp_id,emp_name,dept_name,basic_salary,designation,dob.
Write a command to display name of employee who is not director.
b) Write a command to display name and basic_salary of each employee.

Assignment 14.

f) Using at command submit a job at 7 pm.
g) Using batch command submit a job at 7 pm..
h) Delete a job from at queue.
i) Display the listing of jobs in at queue.
j) Write a command to kill a job.

Assignment 15.

Create a virtual machine :

- with windows
- with Ubuntu

Assignment 16

Write the banker's algorithm for resource allocation and deadlock avoidance.

Assignment 17

Write the algorithm for Producer consumer problem by using semaphores.

Assignment 18

Consider the following segment table:

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses?

a. 0, 430
b. 1, 10
c. 2, 500
d. 3, 400

Assignment 19.

Suppose that the following processes arrive for execution at the times indicated. Each process will run for the amount of time listed. In answering the questions, use non-preemptive CPU scheduling, and base all decisions on the information you have at the time the decision must be made.

Process	Arrival Time	Burst Time
P1	0.0	8
P2	0.4	4
P3	1.0	1

(i) What is the average turnaround time for these processes with the FCFS scheduling algorithm ?
(ii) Find the average waiting time for these processes with the SJF scheduling algorithm.

Assignment 20.

a) Write a shell script to generate salary slip of employees (emp_id wise) in file emp.mast by using following formula :

Net salary=Basic+DA+HRA+CCA-EPF.

b) Get student information of students and store them in a file. The students'

information contains roll no., name and marks of students.

c) Write a shell script to print name of top five students.

Assignment 21.

Consider the following table of 4 processes and determine whether the current allocation is in safe state for deadlock avoidance.

Process	Max Need	Current usage
P1	7	3
P2	4	1
P3	6	2

Assignment 22.

Consider the virtual page reference string 1, 2, 3, 2, 4, 1, 3, 2, 4, 1

On a demand paged virtual memory system running on a computer system that main memory size of 3 pages frames which are initially empty. How many page fault occur for the following replacement algorithm, assuming three frames ?

1) FIFO 2) OPTIMAL 3) LRU

Assignment 23.

Consider a system with 80% hit ratio, 50 nano-seconds time to search the associative registers, 750 nano-seconds time to access memory.

Find the time to access a page:

i) When the page number is in associative memory.
ii) When the time to access a page when not in associative memory.
iii) Find the effective memory access time.

Assignment 24.

With the help of two neat diagram, compare linked and index methods for free space management on a hard disk

Assignment 25

Consider the following set of processes which are to be executed on uniprocessor system, with the length of the CPU burst time given in seconds. The processes are assumed to arrive in the order P, Q, R, S and T at time 0. Calculate average waiting time and turn-around time using given scheduling algorithm. Draw Gantt Chart for Scheduling algorithms.

Process ID	CPU Burst Time
P	4
Q	3
R	8
S	1
T	2

i. FCFS
ii. SJF
iii. RR (Quantum = 2 seconds)

B 1.5 R5 DATA COMMUNICATION AND COMPUTER NETWORKS

Assignment 1.

a) Working on TCP/IP Troubleshooting utilities, hostname, ipconfig/ ifconfig, arp, tracert/traceroute, Pathping, route, getmac, etc.
b) Working on TCP/IP Troubleshooting utility netstat and Analysing possible Session States in netstat output,
c) Working on TCP/IP Troubleshooting utility nslookup and DNS Resource Records

Assignment 2.

a) Explore PING command and answer the following questions
   I. What is the option required to specify the number of echo requests to send with ping? What is the option required to set time interval (in seconds), rather than the default one second interval, between two successive ping ECHO_REQUESTs?
   II. What is the command to send ECHO_REQUEST packets to the destination one after another without waiting for a reply?
   III. What is the command to set the ECHO_REQUEST packet size (in bytes)? If the Packet Size is set to 64 bytes, what will be the total packet size?

Assignment 3.

a) If a class A network on the Internet has a subnet mask of 255.255.248.0, what is the maximum number of hosts per subnet?
b) If a class B network on the Internet has a subnet mask of 255.255.248.0, what is the maximum number of hosts per subnet?
c) If a class C network on the Internet has a subnet mask of 255.255.255.128, what is the maximum number of hosts per subnet?

Assignment 4.

a) Calculate MTU with the help of ping utility.
b) Download and install Wireshark Network Protocol Analyzer software and study the working functions of this tool.
c) Run the Wireshark tool and capture some traffic using Wireshark on your machine and List at least 05 different protocols that appear in the protocol column in the unfiltered packet listing window
d) Run the Wireshark tool and access some websites from your browser and capture the traffic and analyze the following
   I. How long did it take from when the HTTP GET message was sent until the HTTP OK reply was received?
   II. What is the Internet address of your computer and destination computer

Assignment 5.

a) Run the Wireshark tool and access some websites from your browser and capture the traffic and analyze the following
b) What is the 48-bit Ethernet address of your computer?
c) What is the 48-bit destination address in the Ethernet frame? Is this the Ethernet address of the website?
d) Identify the device with the destination address captured in the frame
e) Give the hexadecimal value for the two-byte Frame type field. What do the bit(s) whose value is 1 mean within the flag field?

Assignment 6.

a) Perform a ping request to any computer in your local network and examine one of the ping

request/reply packets sent/received with the help of wireshark.

I. What are the ICMP type and code numbers?
II. What other fields does this ICMP packet have?
III. How many bytes are the checksum, sequence number, and identifier fields?

b) Examine the corresponding ping reply packet.

I. What are the ICMP type and code numbers?
II. What other fields does this ICMP packet have?
III. How many bytes are the checksum, sequence number and identifier fields.

Assignment 7.

a) What is the load on a simple ALOHA system in packet/sec, with a data rate of 9600 bps, the packet size of 804 bits and G=0.75
{Where G is the total rate of data presented to network for transmission or simply offered load}

Assignment 8.

a) Calculate the baud rate for the given bit rate and type of modulation

I. 2000 bps, 4-PSK
II. 4000 bps, 8-PSK
III. 4000 bps, 4-QAM

b) Calculate the bit rate for given baud rate and type of modulation

I. 2000 baud, ASK
II. 1000 baud, 8 PSK
III. 1000 baud, 16 QAM

c) A line has a signal-to-noise ratio of 1000 and a bandwidth of 4000 kHz. What is the maximum data rate supported by this line?

Assignment 9.

a) Explain the steps involved in computing the checksum for a given message frame:Data Polynomial D(x) = 10011101010101100000 , Generator polynomial G(x) =$x^4 + x^3 + 1$
b) Explain the steps involved in computing the checksum for a given message frameData Polynomial D(x) = 11001010101, Generator polynomial G(x) =$x^4 + x^3 + x + 1$

Assignment 10.

a) Write a python program to display the Hostname and IP address of the local computer.
b) Write a python program to find the IP Address of a host having a domain name.
c) Write a python program to perform network scanning using ICMP Echo Request.

Assignment 11.

a) Write a python program to create a server application to accept data stream on TCP port 50001.
b) Write a python program to create a client application to send a message to the above server application, both running on localhost.
c) Verify the results by displaying the message on the server-side as well as also verify the connectivity with the help of the netstat command.

Assignment 12.

Write short notes on

a) IPv6 Addressing

b) IPv6 Autoconfiguration
c) Neighbor-Discovery Messages
d) Transition mechanisms for IPv4 to IPv6

Assignment 13.
Write short notes on
a) Types of data protocols in IoT
b) Types of Network protocols in IoT

Assignment 14.
Write short notes on
a) ATM
b) Frame Relay
c) Gigabit Ethernet,
d) MPLS over IP
e) IP over SONET
f) IP over WDM
g) IP over fiber
h) Gigabit Passive Optical Networks (GPON).

Assignment 15.

Configure the PC with the first useable class C private IP address and subnet mask.

Assignment 16.
Write short notes on
i) QoS
j) IntServ vs DiffServ
k) Queuing Discipline: FQ, PS, BRFQ, GPS,
l) RSVP
m) RTCP

Assignment 17.

Write short notes on
a) SDN
b) SD-WAN
c) NFV
d) IBN

Assignment 18.

A channel has a bit rate of 4 kbps and a propagation delay of 40msec. For what range offrame sizes does stop-and-wait give an efficiency of at least 60%?

Assignment 19.

Assignment 20.

Give the port number on which the following protocols work. TFTP, FTP, SMTP, DNS, DHCP, POP3,IMAP,HTTP,HTTPS,.

Assignment 21.

Write short notes on

a) Reliability, Delay, Bandwidth, Delay Variation w.r.t Multimedia Applications.
b) RTP
c) RTCP
d) Voice Over IP(VOIP)
e) Voice Over IP(VOIP)
f) H.323
g) SIP
h) SDP
i) MGCP
j) CDN
k) Peer to Peer CDN
l) Push CDN
m) Origin Pull CDN

Assignment 22.

Write short notes on

a) Subnet Masks
b) Subnetting
c) CIDR
d) NAT
e) ARP
f) RARP
g) BOOTP
h) DHCP
i) ICMP
j) ICMP Codes and types

Assignment 23.

Write short notes on

a) Static and Dynamic routing
b) Distance Vector Routing Protocol
c) Link State Routing protocol
d) Open Shortest Path First (OSPF)
e) Border Gateway Protocol(BGP)

Assignment 24.

Write short notes on

a) ITU
b) IETF
c) ISOC
d) IAB
e) IRTF
f) W3C
g) IEEE
h) RFC
i) RIR
j) IANA

B2.1-R5: COMPUTER BASED STATISTICAL AND NUMERICAL METHODS

[Use Python for assignments]

1. Write a python script to Approximate e^{-30} using different order of Taylor series, and print out the results.
2. Write a python code to compute the seventh order Taylor series approximation for sin(x) around a=0 at x=π/2. Compare the value to the correct value, 1.
3. Write a python code to solve the equation $x^5 - 3x^4 + 2x^3 - x^2 + x = 3$. using Bisection Method and Newton-Raphson method. How many solutions are there?
4. Write a python code to Solve the equation x = cos x by the Bisection method and by the Newton-Raphson method. How many solutions are there?
5. Write a python code to Solve the equation sin(x) = cos x by the Bisection method and by the Newton-Raphson method. How many solutions are there?
6. Use Python to find the determinant of the matrix M= [[0,2,1,3], [3,2,8,1], [1,0,0,3], [0,3,2,1]]. Use the np.eye function to produce a 4×4 identity matrix, I. Multiply M by I to show that the result is M.
7. Write a python code to Integrate f(x) = $\frac{1}{x^2}$ over the interval [0.2, 1] using Simpson's rule. Use a tolerance value of 0.02 to terminate the halving of h = Δx. From calculus, we know that the exact answer is 4.0.
8. For these four matrices:

$$A = \begin{bmatrix} 3 & 2 & -1 \\ 2 & 1 & 3 \\ -3 & -2 & 1 \end{bmatrix}$$

$$B = \begin{bmatrix} 2 & 4 \\ -1 & -2 \\ 3 & 0 \end{bmatrix}$$

$$C = \begin{bmatrix} 3 & -1 & 3 \\ 1 & 1 & -2 \\ 4 & -2 & 0 \end{bmatrix}$$

$$D = \begin{bmatrix} 0 & -2 & 3 \\ -1 & 5 & 0 \\ -2 & -1 & 6 \end{bmatrix}$$

   a. Which pairs can be added?
   b. Which pairs can be subtracted? Get their differences, then repeat in opposite order.
   c. Which pairs can be multiplied? Find the products.
   d. Which of these has a trace? Compute the traces.

9. Write these equations in matrix form:

$$6x - 2y + 3z = 12$$
$$x + y - 4z = 8$$
$$-2x - 3y = 12$$

10. Solve this system by Gaussian elimination with partial pivoting:

$$\begin{bmatrix} \mathbf{1} & \mathbf{-2} & \mathbf{4} & \mathbf{6} \\ \mathbf{8} & \mathbf{-3} & \mathbf{2} & \mathbf{2} \\ \mathbf{-1} & \mathbf{10} & \mathbf{2} & \mathbf{4} \end{bmatrix}$$

11. Solve the System:

$$2.51x + 1.48y + 4.53z = 0.05$$
$$1.48x + 0.93y - 1.30z = 1.03$$
$$2.68x + 3.04y - 1.48z = -0.53$$

12. Solve this pair of equations by Gaussian Elimination Method:

$$0.2205x + 0.1254y = 0.6606$$
$$0.4457x + 0.2506y = 0.89897$$

13. Use the Trapezoid Rule to approximate $\int_0^{\pi} \boldsymbol{sinx\ dx}$ with 11 evenly spaced grid points over the whole interval. Compare this value to the exact value of 2.

14. Compare the result of $\int_{0.2}^{0.6} \boldsymbol{exp(-x\text{^}2)\ dx}$ using trapezoidal, Simpsons' 1/3rd and Simpson's 3/8th method.
15. Make a Binomial Random variable X, X~Bin(n=10, p=0.2) and compute its probability mass function (PMF) and cumulative density function (CDF). Find Mean and Variance.
16. Make a Poisson Random variable Y as Y~Poi(λ=2). Find P(y=3).
17. Make a Normal Random variable A as A~N (μ=3, σ^2=16). Then calculate **$f_Y(0)$ and $F_Y(0)$.**
18. A quality inspector finds 10 defective parts in a sample of 500 parts received from manufacturer A. Out of 400 parts from manufacturer B, she finds 12 defective ones. A computer-making company uses these parts in their computers and claims that the quality of parts produced by A and B is the same. At the 5% level of significance, do we have enough evidence to disprove this claim?
19. A sample of 6 measurements 2.5, 7.4, 8.0, 4.5, 7.4, 9.2 is collected from a Normal distribution with mean μ and standard deviation σ = 2.2. Test whether μ = 7 against a two-sided alternative $H_A: \mu \neq 7$ at the 2% level of significance.
20. Salaries of entry-level computer engineers have Normal distribution with unknown mean and variance. Three randomly selected computer engineers have salaries (in INR 1000s):
    30, 50, 70
    Construct a 90% confidence interval for the average salary of an entry-level computer engineer.

21. We have to accept or reject a large shipment of items. For quality control purposes, we collect a sample of 200 items and find 24 defective items in it.
    a. Construct a 96% confidence interval for the proportion of defective items in the whole shipment.
    b. The manufacturer claims that at most one in 10 items in the shipment is defective. At the 4% level of significance, do we have sufficient evidence to disprove this claim? Do we have it at the 15% level?
22. A sample of 250 items from lot A contains 10 defective items, and a sample of 300 items from lot B is found to contain 18 defective items.
    a. Construct a 98% confidence interval for the difference of proportions of defective items.
    b. At a significance level $\alpha = 0.02$, is there a significant difference between the quality of the two lots?
23. A news agency publishes results of a recent poll. It reports that candidate A leads candidate B by 10% because 45% of the poll participants supported Ms. A whereas only 35% supported Mr. B. What margin of error should be reported for each of the listed estimates, 10%, 35%, and 45%? Notice that 900 people participated in the poll, and the reported margins of error typically correspond to 95% confidence intervals.

24. The number of transmission errors in communication channels is typically modeled by a Poisson distribution. Let us test this assumption. Among 170 randomly selected channels, 44 channels recorded no transmission error during a 3-hour period, 52 channels recorded one error, 36 recorded two errors, 20 recorded three errors, 12 recorded four errors, 5 recorded five errors, and one channel had seven errors.
25. The time it takes to transmit a file always depends on the file size. Suppose you transmitted 30 files, with the average size of 126 Kbytes and the standard deviation of 35 Kbytes. The average transmittance time was 0.04 seconds with the standard deviation of 0.01 seconds. The correlation coefficient between the time and the size was 0.86. Based on this data, fit a linear regression model and predict the time it will take to transmit a 400 Kbyte file.

B2.2 R5 PROFESSIONAL AND BUSINESS COMMUNICATION

1. Write an email to your instructor to introduce yourself. Put your first and last name and the assignment title in the subject line.
2. Choose a social media platform that best fits your message. For this assignment, you can use any social media channel
3. What are the basic writing skills? Support your answer by illustrations.
4. Bring out reasons as to why it is important to be good listener.
5. How can one an effective team performer?
6. List some of the good negotiating skills.
7. What are the most common kinds of persuasive messages?
8. Sitting on a committee or leading one, draft the meeting minutes.
9. Enumerate the role of humor in oral communication. What kind of humor is appropriate in business context?
10. State the differences between individual behavior and group behavior, and its implications for group related communication.
11. You have completed your doctorate in Computer Science. Prepare your resume highlighting your academic achievements and suitability for a teaching job.
12. Enumerate the features of a good power-point presentation. Give reasons for the effectiveness of power-point slides.
13. Internet has transformed the entire business communication field. How?
14. How has the modern communication technologies affected the job productivity and satisfaction? Give examples in support of your answer.
15. Explain the concept of virtual office. Is it a boon or curse? Justify.
16. Explain the common rules that should be kept in mind to achieve success in job search.
17. List the essential etiquettes which need be observed when corresponding via emails.
18. List the common Web 2.0 tools for social interaction. How has these tools contributed to make this world a 'flat world'?
19. Write 500 words describing your business message by explaining which social media channel is ideal for your company
20. Discuss the role of ethics in electronic business communications and dealings.
21. CASE STUDY

    The Technical Writing Department of IIS Vision Pvt (Ltd.) needs new computer equipment. Currently, the department has outdated H/W and application S/W, with hardly any graphical capabilities. There is a great need of color printers and scanners. Video camera will also of great support for technical work. Due to these constraints, company's manuals, pamphlets and course material are not being liked/appreciated by the customers. Moreover, IIS Vision has no web-site for product advertisement and/or company recognition on the internet. All this has led to a decline in profits. As technical Writing Department Manager, you have consulted with your group members to set the situation right. As a team, you have decided the company needs to purchase the following H/W and S/W:

    - Five new PCs
    - Two laser printers
    - MS-office
    - Graphics S/W
    - Scanner
    - Video camera

    Draft a technical proposal to CEO of IIS Vision, giving justification for the purchase and installation of the equipment. Invent the required details.
22. Explain Team Communication in the Workplace
23. Explain Establishing Workplace Etiquette
24. Write an appealing job advertisement of your company.
25. Your advertisement has brought in several candidates, and you've narrowed down the pool to a final three candidates to interview one on one. You want to ensure you evaluate the

candidate fairly, so you've decided to have structured interviews, asking from a pre-established list of questions. Your task is to write a list of questions to be asked in each interview.

Submit your job description and your list of interview questions to your instructor as an email attachment.

B2.3 R5 ADVANCED DATABASE TECHNOLOGIES

1. What is a Transaction?
2. What is the difference between OLTP and OLAP operations
3. Explain Physical Data Independence and Logical Data Independence with examples
4. Give an example of database triggers. Explain Block processing triggers
5. Demonstrate an exception Handling
6. Demonstrate a Lost Update Problem
7. Demonstrate Dirty Read & Write
8. What are the Locking Policies? Why does DELETE not cause a problem like INSERT with row locking?
9. What are the processes to handle the Deadlock of a transaction?
10. What are the Logfile Principles?
11. What is the transaction log?
12. Why the log file grows very quickly? What are the uses of Log Records during system failure?
13. What other lock 'granularities' do we have (what are the possible entities we can lock)?
14. How do REDO and UNDO perform during recovery?

15. Design the data warehouse for a new wholesale ABC company which deals with varieties of products. The company has promotion schemes to promote the products. The data warehouse has to allow analyzing the company's situation at least concerning the products, promotions, stores, customers and time. The company is interested in learning the quantity sold, promotion scheme and sales amount of the product. Assume the possible attributes for any dimensions.
    a. Give names of fact tables with important keys and dimension tables and measures of such DW.
    b. Design the DW star schema showing the necessary relationships
    c. Please give the name of two data mart and provide their benefits
    d. What are the possible results (s) you can use aspect after using Rollup and Drilldown functions

B2.4 R5 COMPUTER GRAPHICS AND MULTIMEDIA

1. Explain and Implement DDA Line drawing algorithm for line drawing.
2. Explain and Implement Bresenham's Line drawing algorithm for slope < 1 as well as slope >1
3. Explain and Implement Bresenham's Circle drawing algorithm.
4. Explain and Implement Cohen-Sutherland Line clipping algorithm for 2D.
5. Explain and Implement Midpoint Sub-division clipping algorithm for 2D.
6. Explain and Implement Boundary fill algorithm for polygon filling.
7. Explain and Implement Flood fill algorithm for polygon filling.
8. Explain and Generate the Bezier curve.
9. In 2D, draw a Square (Edge: 100 pixels) on the left top corner of the screen. Move it to the centre of the screen. Convert it into rectangle such that Horizontal edge =2×Vertical edge.
10. Explain and Implement 2D general pivot-point rotation and shear for a square.
11. Give the syntax of drawing a circle in computer graphics using various algorithms
12. Explain parallel projection with different types
13. How to calculate inverse of a Matrix. Explain with examples
14. Explain Shading algorithms
15. Explain Vectors and Co-ordinate System
16. Explain 3D Geometrical transformation
17. Explain Projections- Parallel, Perspective and Isometric
18. How to calculate determinant of a Matrix Explain with relevant examples
19. Explain MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21 with Basic Video Editing.
20. Use image editing tool to repair an old damaged image.
21. Create a 2D animation to show a ball moving on a square path with the ball changing its colour and size during its movement on the path.
22. Do the following using bundled Video Editor in Windows

    i. Create videos using your photos and videos.
    ii. Pick a theme, pick a soundtrack or automatically generate a movie with one click
    iii. Trim and / or Split video.
    iv. Add effects to video.
    v. Publish Video.

23. Perform the following using Windows 10 bundled photo editing tool (Photos App)
    i. Importing Photos: from Local Disk, from Device.
    ii. Creating Albums – Adding Photos to custom albums.
    iii. Image Editing – Crop, Straightening, Flip, Aspect Ratio,
    iv. Image Enhancement – Using different filters, Adjustments for Light, Colour, Clarity etc. Red Eye correction, Spot Fix correction.
    v. Add 3D Effects, Animated text, to the image.
24. Perform morphing on images using freeware tool.
25. Working on Vector Images & Text. Converting vectors into bitmaps. Adding Gradient to the vector images.

B2.5-R5 IOT & CLOUD SERVICES

Assignment 1.

Design an IoT system, which reads data from MQ135 sensors and display the results at the interval of one minute in serial monitor.

Assignment 2.

Design an IoT system, which reads data from MQ135 sensors and display the results on LCD.

Assignment 3.

Design an IoT system, which reads data from MQ135-Air quality and MQ 7-Carbon monoxide sensors and display the results on LCD. The buzzer connected to development board should be put ON whenever the value of sensors crosses the threshold values.

Assignment 4.

Design and implement an IoT system which stores the values read from sensors (e.g. MQ135-Air quality, MQ 7-Carbon monoxide, etc.) in the csv file along with Current system timestamp). [Development board with onBoard Realtime clock (RTC) e.g. Raspberry Pi, etc. can be used to execute the assignment]

Assignment 5.

Design and implement a webserver (using open-source software – WordPress, Drupal, etc.). [Development board e.g. Raspberry Pi, etc. can be used to execute the assignment]

Assignment 6.

The backend database has to be integrated with web server configured in Assignment 5. The database-table to store the data read by the sensors (e.g. MQ135-Air quality, MQ 7-Carbon monoxide, etc.)

Assignment 7.

The data read by IoT system is passed over cloud(open-source/free) using REST protocol and displayed on the webpage in the webserver.

Assignment 8.

Design and implement IoT system on open-source Cloud to publish the data read from sensor on the web.

Assignment 9.

Design an IoT system, which reads data from DHT11 sensor and save the data in CSV file along with timestamp only if the values read from sensor are different from the previous values. [In words when the value read from the sensor changes from the previous saved value, then the data is saved in the CSV file]

Assignment 10.

Develop an IoT system which is installed in agriculture field, and reads and stores temperature and humidity (using DHT11 sensor) samples and maps the data from germination to final produce.

Assignment 11.

Make a machine learning model based on data collected from the agriculture field and use for predicting/forecasting the crop production.

Assignment 12.

Develop an IoT based Smart Street Light System under smart city, which automatically switches on and/or switches off depending upon the environmental conditions.

Assignment 13.

Develop a Home automation system to control lights and fan inside home using MQTT protocol.

Assignment 14.

Develop a webpage in python having database access integrating OAuth2 access management.

Assignment 15.

Develop a Home automation system to control lights and fan inside home using Bluetooth protocol.

B3.1 R5 SOFTWARE PROJECT MANAGEMENT

1. Study Software Project management basics concept. Define Case study project of any software system. With synopsis of it.
2. Study of Life cycle of a project using steps. Prepare rough project task list and plan for software project.
3. Case study for Roles played by the project Manager and various team members in Software project. Distribute the project work according to role of team members.
4. Software Time, Effort and Cost Estimation of given project using various methods.
5. Prepare Gantt chart (Task Entry) for project plan of software project with duration and create baseline and milestones.
6. Prepare PERT for project plan of software project with duration.
7. Prepare CPM for project plan of software project with duration.
8. Prepare list of resource in Software project task. Assigned resources to particular task. Enter respective entry in PERT, CPM and Gantt chart.
9. A Case Study on Risk management using given software project.
10. Track the project using recording actual duration or work done in each task of project. Enter data in Tracking Gantt chart wizard.
11. Generate various reports for all level of managers of Software Project for different milestone.
12. How Project fails: A Case Study on Common mistakes made during different phases of a project
13. Practical on Resource re-allocation & smoothing for resolving conflicts in Project schedule and resources.
14. Case study of various projects Management CASE tools and compare functionality with each other.

Scenerio1:
Miss Elena is a teacher for a Special Education School. She deals with students with Asperger Syndrome (AS) who lack of social skills. Social Story is individualized short story being written or drawn to help them interpret social situations. Hence, Elena writes and draws a lot of social stories using cards and markers to teach them social skills. She spends about 30 minutes to explain and repeat the social stories to the students in each session. She spends about 1 hour to draw out a story, and she has to draw a lot of social stories for each session.

Problem Encountered: Generally, students find the hand drawn social stories not interesting and do not like to learn. Furthermore, Miss Elena found preparing and explaining the social stories very tiring and time consuming. All the used story cards are piled up in the store room. Miss Elena learnt about using social stories in digital forms from her friend who teaches AS students in Australia. She also has access to free social stories in the form of videos and animations. However, she has been searching high and low for a suitable video and animation player software. Software like QuickTime, RealPlayer and Window Media Player has many functions that are difficult for her to learn and use. It is also difficult for her to teach other teachers and parents to use the software.

Feasible Solution: She would like to organize and play various social stories to teach AS students in her class. She just needs simple software for her to manage social stories for different students. She would like to create a new playlist then add social stories into it. When a playlist needs an update, she would like to add or remove social stories in that playlist. She would also like to delete a playlist that is no longer in use. She wishes to view playlists and play a selected playlist using a laptop computer. She can also share the playlist and social stories with other teachers and parents of AS students at her school.

You are invited to participate in the analysis, design and evaluation for the requested software namely *SoS*.

15. Use scenerio1: Draw WBS of the system
16. Use the scenerio1: Demonstrate how to schedules the activities of such system.
17. Use the scenerio1: Demonstrate how to track and monitor the activities.

18. What is the main purpose of risk management and why is risk management important? What is the likely outcome if a project lacks risk management?
19. What are the challenges of a *cost-benefit analysis* in the context of risk management?

20. Explain (in your own words) the principal difference between a *milestone* and a *deliverable*. Which of the two concepts is (more) important in regards to risk management.

21. Explain the eXtreme Programming practices of "Pair Programming" and "40 Hour Week" (aka *sustainable development*) and discuss which principal risks they attempt to mitigate.

22. Consider the following extract from a research report on software metrics: "Coping with huge amounts of data is one of the major problems in the context of software evolution. Current approaches reduce this complexity by filtering out irrelevant information. In this report we propose an approach based on a combination of software visualization and software metrics, as software visualization is apt for complexity reduction and metrics introduce the possibility to qualify evolution. We discuss a simple and effective way to visualize the evolution of software systems that helps to recover the evolution of object-oriented software systems. In addition we define a vocabulary that qualifies some specific situations that occurs when considering system evolution."
    a. Calculate the *"Fog Index"* (= 0.4 * (# words / # sentences) + (% words ≥ 3 syllables) for the extract given above.
    b. Does the *Fog Index* meet the desirable properties of a metric (i.e. (i) valid and reliable, (ii) objective and precise, (iii) intuitive(Easy to use and understand), (iv) robust and (v) automatable)?
    c. Illustrate why a *Fog Index* of 12 or above indicates that a given text is very difficult to read for most people.

B3.2 R5 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Assignment 1.

Create a numpy array with following columns: hindi, English, science, math and commerce with data type int32.

i. Insert at least 10 rows in the above array.
ii. Display size and shape of the array.
iii. Print sum of each column.
iv. Print maximum element from each column.
v. Print sum of 1,4,5 row.

Assignment 2.

Create an array for a given range of elements between 2 to 40 step by 3.

Assignment 3.

Create an array of size (3, 4) and reshape to (4, 3).

Assignment 4.

1. Create two array of size (3, 3) and print their sum and multiplication.
2. Create an array of size 10 and calculate square root and standard deviation.
3. Print size and dimension of above arrays.

Assignment 5.

1. Write a Python program to create and display a series of data using Pandas module.
2. Create a pandas series of 10 elements and specify their index as 101 to 110.
3. Print bottom 5 elements of the series created in question 2.
4. Insert 3 new elements in above series on index 111, 112 and 113.
5. Delete the elements at index- 103, 104,107,111 in above list.

Assignment 6.

Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels. Sample Python dictionary data and list labels:

1. exam_data = {'name': ['Ankita', 'Dia', 'Kapil', 'Jayesh', 'Esha', 'Mayank', Ravi, 'Lata', 'Kamal', 'Jatin'],
2. 'score': [12.5, 9, 16.5, 15, 9, 20, 14.5, 17.5, 8, 19],
3. 'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
4. 'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}

Assignment 7.

Create a data frame using dictionary.

1. Dictionary (‘id’:[P101,P102,P103,P104,P105], ‘Price’:[256, 340, 540, 260, 470])
2. Print the price of product id – p102.
3. Print values of Price column.
4. Rename the column id to Product_Id and Price to Base_Price.

Assignment 8.

Create a new data frame with three columns – Product_Name, Cost, Sales.

1. Add 10 values in data frame.

2. Add a new column named quantity with 10 values.
3. Add a new column named: Profit and total_profit and fill values.
4. Insert a new column named location after Product_Name column with 10 cities.

(New Delhi, Lucknow, Kolkata, Lucknow, New Delhi, Bengaluru, Chennai, Chennai, Kolkata, Bengaluru)

Assignment 9.

Create a data frame using given data:

'Name': ['Ankit', 'Amit', 'Aishwarya', 'Priyanka', 'Priya', 'Shaurya'],
'Age': [21, 19, 20, 16, 17, 21],
'Stream': ['Math', 'Commerce', 'Science', 'Math', Commerce, 'Science'],
'Percentage': [88, 92, 95, 70, 65, 78]}

Perform the following operations on the above dataframe.

1. A. Insert a new row – Name: Sahil, Age-23, Stream- Commerce, Percentage-88.
2. Selecting rows where percentage is >80
3. Selecting all the rows from the given dataframe in which 'Stream' is Commerce and science.
4. Selecting all the rows from the given dataframe in which 'Age' is greater than 18.
5. Print sum of age and percentage only.

Assignment 10.

Download the house price prediction data from:

https://www.kaggle.com/c/house-prices-advanced-regression-techniques/data?select=test.csv

Train the data with appropriate model and predict the price of new house.

Assignment 11.

Download the iris data set from: https://archive.ics.uci.edu/ml/datasets/iris

1. 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.
2. Print the Accuracy Score and Confusion matrix for KNN Classifier using iris data. (Split iris dataset to train and test sets)

Assignment 12.

Identify a suitable dataset from your area of interest for a clustering problem. Develop an ML model to do prediction.

Assignment 13.

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.

Assignment 14.

Download the mnist data of hand written digits. Train the data with appropriate model. Then predict the digit using the model.

Assignment 15.

Perform sentiment analysis on Twitter data. Train the data with appropriate model and predict the sentiment of new tweet.

Assignment 16.

Write a program using OpenCV to read an image and resize height and width of the image.

B3.3 R5 WEB TECHNOLOGIES

Assignment 1.

Write a Java Program to create three new types of exceptions. Write a class with a method that throws all three. In main( ), call the method but only use a single catch clause that will catch all three types of exceptions.

Assignment 2.

Open a text file so that you can read the file one line at a time. Read each line as a String and place that String object into a LinkedList. Print all of the lines in the LinkedList in reverse order.

Assignment 3.

Write a Java Program to create three interfaces, each with two methods. Inherit a new interface from the three, adding a new method. Create a class by implementing the new interface and also inheriting from a concrete class. Now write four methods, each of which takes one of the four interfaces as an argument. In main( ), create an object of your class and pass it to each of the methods.

Assignment 4.

Write a Java Program to find all the strings that match a given Regular Expression in one or more files or other sources.

Assignment 5.

Write a Java Program to read from or write to a particular location in a file, such as an indexed file.

Assignment 6.

Develop a message abstract class which contains playMessage abstract method. Write a different sub-classes like TextMessage, VoiceMessage and FaxMessage classes for to implementing the playMessage method.

Assignment 7.

Write a Java program to compare two sets and retain elements which are same on both sets.

Assignment 8.

Write a java program to implement Stack with using attributes stk[10],tos(top of stack) and operations push() and pop(). The program include following things:

a) Interface containing abstract method push() and pop()
b) Fixedstack class implement the above method
c) Variablestack class implement above method with variablestack size
d) Main class create array of objects of Fixedstack class

Assignment 9.

Develop a small application for the below mentioned activity

a) Assign the scores to the teachers in a competition for the following evaluation indexes:
   - Content clarity score (Max 10)
   - Content organization score (Max 10)
   - Communication skills score (Max 10)
   - Presentation score (Max 10)
   - Expertise score (Max 10)

b) Scores once submitted should not be editable by the user.
c) Final score for the teacher should be the average of all the scores from all the Judges in a competition.
d) Final score for the teacher should be displayed after all the judges submit the score for that particular teacher.

Assignment 10.

Write a program that can create a concordance (A concordance lists every word that occurs in the document, and for each word it gives the line number of every line in the document where the word occurs).The document should be read from an input file, and the concordance data should be written to an output file. The names of the input file and output file should be specified as command line arguments when the program is run.

Assignment 11.

Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this, derive the classes “cur_acct” and “sav_acct” to make them more specific to their requirements. Include necessary functions in order to achieve the following tasks:

a) Accept deposit from a customer and update the balance.
b) Display the balance.
c) Compute and deposit interest.
d) Permit withdrawal and update the balance.
e) Check for the minimum balance, impose penalty, necessary, and update the balance.

Assignment 12.

A hospital wants to create a database regarding its indoor patients. The information to stores include

a) Name of the patient
b) Date pf admission
c) Disease

d) Date of discharge

Create a base class to store the above information. The base class should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. Write a code to list the information about all the paediatric patients (less than 12 years in age).

Assignment 13.

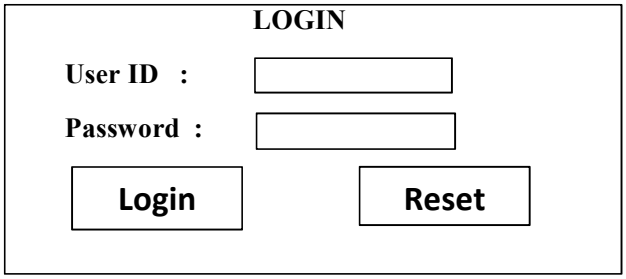
Write a program to create simple CRUD (Create, Read, Update, and Delete) application using Spring and Hibernate.

Assignment 14.

Create table with the following structure:

Userid	Character	10 Primary Key
Password	Character	10

Now design a login form(connected to database using Jdbc) and show a welcome message if userid and password combination is correct, otherwise display an error message.



Assignment 15.

Develop an application which will take an input from user using suitable GUI say Student Roll No, Name, Address, Attendance(in %). Prepare on student controller which will keep all the information of student and show the detail information in result.jsp page (Use Spring Framework)

Assignment 16.

Develop a CURD application using Spring and Hibernate to manage Employee task details. To perform the above operations create one table named EmployeeJob.

Field Name	**Field Type**
EmpId	Integer
Empname	Varchar
Job_Allocation_datetime	date
Job_completion_time	date
Job_Hours	int

Assignment 17.

Develop a spring application with hibernate to authenticate a user, where the loginid and password are available as request parameters. In case the authentication is successful, it

should setup a new session and store the user's information in the session before forwarding to home.jsp, which displays the user's information like full name, address, etc

Assignment 18.

Create a spring application with web services called Product with the following properties: name, description, price. Create a listener that notifies (through System.out) whenever a user adds a product to a shopping cart or removes it again. Make it print the name and price of the object (hint: access the session through the HttpBindingEvent object). Also, let the listener print the total price of all objects saved in the session so far.

Assignment 19.

Develop a JSF application to perform the database driven operation like insert, Delete, Update and select. To perform the above operations create one table named Employee.

Field Name Field Type

EmpId Integer
Empname Varchar
Emp_desig Varchar
Emp_J_Date Varchar
Emp_Salary Numeric

Assignment 20.

Develop an application using Spring to demonstrate how the client (browser) can remember the last time it visited a page and displays the duration of time since its last visit. (Hint: use Cookie)

Assignment 21.

Develop a booking system having two types of privileged users – the Booking Manager and the Team Manager. The functionally available to the Booking Manager include viewing and editing the booking information, viewing and editing ticket information and running the sales reports. The Team Manager should be able to view and edit event information, view and edit player information, and view bookings for a particular event.

Assignment 22.

Create a database consisting of Name of University, Number of Affiliated Colleges, and Number of students in each affiliated college, Number of students who passed from each affiliated college year wise during the last five years

After creating the database, List the names of all affiliated colleges during last five years from where less than 50% students passed in comparison to the number of students appeared from that college year wise. Make necessary assumptions

Assignment 23.

Write a program in Java that connects to a database and generates a report that consists of the list of Vaccination Centers which are offering a specific Vaccine (Covishield or Covaxin). Some centers may offer both the vaccines. Input to the Java program will be name of Vaccine. Make assumptions wherever necessary

Assignment 24.

The PetDAO class is used for various database operations on the Pet entity.Write findNamedPetsBySpecies method so that it returns all pets of the appropriate species. The method should not return any Pets whose name field is null. The method accepts a Hibernate Session object that it should use to make the query.

For example, if the Pets table contains:

id	name	species
0	Bruno	Dog
1	Max	Cat
2	null	Camel

Calling findNamedPetsBySpecies with "Cat" as the species should return a list that contains a pet named "Max" with the id 1.

Assignment 25.

Create a database consisting of Name of Regional Centre, Code of Regional Centre, Number of Study Centres under RC, Number of Students enrolled and courses offered

After creating the database, perform the following tasks (Make assumptions wherever necessary):

a) List the names and codes of Regional Centres which are in the top 5 positions in terms of enrolment
b) Write a program to generate a report that consists of the list of Study Centres where a particular programme is offered.

B3.E1-R5 DIGITAL MARKETING

THEORY ASSIGNMENTS

Assignment 1.

1. Explain Digital Marketing.
2. What are the different types of Digital Marketing?
3. What are the most effective ways to increase traffic to your website?
4. What are the 4P's of Digital Marketing?
5. What are the types of Digital Touch-points?

Assignment 2.

1. Discuss the SEO in Digital Marketing? Also explain its type.
2. What are on-page and off-page optimization?
3. What do you understand by the term SEO Myth busters?
4. What are Meta Tags? Explain.
5. Explain Back Link strategies.

Assignment 3.

1. What is Search Engine Marketing?
2. Explain PPC campaigns.
3. What is Link Building?
4. Explain performance measurement and matrices.
5. What is Ad writing techniques? Why is it important in Ad Campaign?

Assignment 4.

1. What is SMM?
2. What do you understand by the term Niche Research?
3. How to customize SMM campaign?
4. Explain the Reverse Engineering concept.
5. Explain the importance of bookmarking.

Assignment 5.

1. Why content writing is important in Digital Marketing?
2. What do you understand by the term Guest Blogging?
3. What is Bulk Email concept?
4. Explain the importance of Segmentation.
5. Define the term Click-through-rates, unsubscribe rates and bounce rates?

Assignment 6.

1. What is Affiliate Marketing? Explain.
2. Define the term AdSense?
3. Differentiate between Referral and Affiliate Marketing?
4. What is Ad Words? Explain.
5. How to customize Affiliate campaign? Explain.

Assignment 7.

1. Explain Real-time reports.
2. What is UTM Parameters? Explain.
3. What is google search console? Explain.
4. What do you mean by term Audience Behaviour?
5. What are Landing and Exit pages?

Assignment 8.

1. How Keyword planning is important in Digital Marketing?
2. What is ORM? Explain.
3. Define bidding in Keyword Planning?
4. What is Keyword Research? Explain.
5. Explain the term Brand Building?

Assignment 9.

1. Explain the term CRM integration.
2. What is ORM? Explain.
3. Define SMS Auto Responder.
4. What do you mean by term Virtual Assistant?
5. Explain CTA.

PRACTICAL ASSIGNMENTS

Practical Assignment 1.

- Design a webpage and perform on-page and off-page optimization.
- Design a 3-page website and implement at least 5 Meta tags.

Practical Assignment 2.

6. Write a blog post using any blogging site and implement Back Link?
7. Design a webpage using any blogging site and embed an online streaming video or map.

Practical Assignment 3.

6. Write a blog using guest blogging and bookmark the same.
7. Create an account on any bookmarking site? Write all the steps involved in bookmarking.

Practical Assignment 4.

6. Create an account on any Micro Blogging site (e.g. X, Koo etc). Write all the steps involved in SMM campaign.
7. Create an account on a Social Networking Site (e.g. Facebook). Write all the steps involved in SMM campaign.

Practical Assignment 5.

6. Create an account on Professional Networking site (e.g. LinkedIn). Write the steps involved to post an article?
7. Write an email for your upcoming brand promotion. Write down the steps involved in bulk sending.

Practical Assignment 6.

6. Create an Affiliate Marketing account? Write down the steps to create an affiliate link.
7. Add a property on Search Console? Write down the steps involved.

Practical Assignment 7.

6. Create an account on Keyword planning tool. Write down the steps involved in Keyword Research.
7. Write down the steps involved in refining a Keyword?

B3.E2-R5 SYSTEM MODELLING & COMPUTER SIMULATION

1. Introduction to Simulation

Assignment 1.

a) Explain when simulation is appropriate and when it is not appropriate. Provide examples.
b) Discuss the advantages and disadvantages of simulation in system modeling.
c) Define and differentiate between discrete and continuous systems. Give examples of each.
d) Discuss the components that constitute a system environment.

Assignment 2.

a) Describe the types of models used in discrete-event system simulation.
b) Provide examples of queuing systems and discuss their simulation challenges.
c) Explain the Event-Scheduling / Time-Advance Algorithm used in simulation software.
d) Discuss the principles of manual simulation using event scheduling.
e) Calculate the time advance in a discrete-event simulation given specific event schedules and time intervals.

2. Statistical Models in Simulation

Assignment 3.

a) Define and discuss discrete distributions commonly used in simulation.
b) Explain continuous distributions and their applications in modeling.
c) Describe queuing models and their characteristics.
d) Calculate the long-run measures of performance for a queuing system usingM/G/1 queue parameters.

3. RandomNumber Generation

Assignment 4.

a) Discuss properties of random numbers and techniques for generating them.
b) Generate pseudo-random numbers using a given algorithm and verify their statistical properties.
c) Discuss different types of tests for Random number.

4. Random-Variant Generation

Assignment 5.

a) Explain the inverse transforms technique for generating random variants.
b) Describe the acceptance-rejection technique in random variant generation.
c) Compare and contrast the inverse transforms and acceptance-rejection techniques.
d) Discuss scenarios where each technique is preferred.
e) Apply the acceptance-rejection technique to generate random variants with specified parameters.

5. Input Modelling

Assignment 6.

a) Discuss methods for data collection in simulation studies.
b) Explain parameter estimation and goodness of fit tests in input modeling.

Assignment 7.

a) Fit a non-stationary Poisson process to given data sets.
b) Calculate parameters and perform goodness of fit tests.
c) Describe multivariate and time-series input models.
d) Provide examples and discuss their applications in simulation studies.
e) Explain Birth Death Process.

6. Estimation of Absolute Performance

Assignment 9.

a) Define and calculate measures of performance for terminating and steady-state simulations.
b) Analyze output from simulations using Markov processes.
c) Estimate performance metrics from a simulated system using data from multivariate models.

7. Verification, Calibration, and Validation

Assignment 10.

a) Explain the steps involved in building and verifying simulation models.
b) Apply calibration techniques to improve model accuracy.
c) Discuss how simulation can be used for optimization purposes.
d) Provide examples and methods for optimizing simulation models.

Assignment 11.

a) Analyze simulation results using visualization tools like tables, graphs, and multidimensional visualization.
b) Validate simulation results against real-world data.
c) Optimize a simulation model to maximize performance metrics using calibration and validation techniques.

B3.E3-R5 DISTRIBUTED AND PARALLEL COMPUTING

Module 1: Introduction to Distributed and Parallel computing Technologies

Assignment 1:

a) Define soft computing and describe its main components.
b) Differentiate soft computing with Distributed computing and parallel computing.
c) Define Parallel computing and explain how does it improve performance
d) Define distributed computing and explain its significance in modern computing
e) Describe the key characteristics of distributed systems
f) Differentiate between soft computing and HPC
g) Compare the benefits of distributed computing, parallel computing, and edge computing in terms of performance, scalability, and flexibility.

Module 2: Distributed computing (3x10)

Assignment 2:

a) Define transactions with reference to distributed systems.
b) Compare different methods of IPC.
c) Explain group communication and multicast communication in distributed systems.
d) Describe the characteristics of Inter-process Communication (IPC) in distributed systems.
e) Discuss briefly the differences between distributed computing Models.
f) Explain the Pros and Cons of Distributed Systems.
g) Setup and Install HDFS (Hadoop Distributed File System)
h) Setup and install Distributed Database System on Multiple nodes.

Module 3: Parallel Computing

Assignment 3:

a) Define parallel computing and explain how it differs from sequential computing.
b) Explain the need for parallel computing with real-world example.
c) Explain the principles of designing parallel algorithms.
d) Explain the Pros and Cons of Parallel Computing.
e) Explain the Pros and Cons of using a shared address space system for parallel computing.
f) Define the Parallel Random Access Machine (PRAM) model.
g) Parallel Programming with OpenMP in C++, Write a parallel program using OpenMP to perform matrix multiplication in a shared address space system. Analyze the performance improvement over a sequential implementation.
h) Implement a PRAM algorithm for sorting an array using the CRCW model. Use a parallel computing library or simulation environment to test your implementation.

Module 4: Edge Computing

Assignment 4:

a) Define edge computing and explain how it differs from traditional cloud computing.
b) Define SCALE.
c) Describe the hierarchical structure of edge computing.
d) Explain the Pros and Cons of Edge Computing.
e) Define middleware in the context of edge computing.
f) Design a simulation to compare the latency and efficiency of a cloud-based application versus an edge-based application. Use a distributed simulator like iFogSim or EdgeCloudSim.

g) Develop a health monitoring system that uses edge computing to process biometric data from wearable devices. Implement real-time alerts and data visualization on the edge device.
h) Create a smart transportation system prototype that uses edge computing to process data from vehicle sensors and traffic cameras. Demonstrate real-time traffic management and incident detection.

B3.E4-R5 DATA WAREHOUSING AND DATA MINING

1. Give the difference between a Web crawler and an Intelligent Agent
2. Demonstrate the process of handling Missing values and outliers
3. Demonstrate the process of Data Binning and process of Data Reduction
4. A bank wants to develop a data warehouse for effective decision-making about its loan schemes. The banks provide loans to customers for various purposes, like House Building loans, Car Loans, Educational loans, Personal loans, etc. The whole country is categorized into some regions, namely, North, South, East and West. Each region consists of a set of states. The loan is disbursed to customers at interest rates that change from time to time. Also, at any given point in time, the different types of loans have different rates. The data warehouse should record an entry for each disbursement of the loan to the customer. In the above business scenario, answer the following questions.
   a. Design a star schema for the data warehouse clearly identifying the fact table(s), dimensional table(s), their attributes and measures, along with the primary key and foreign key relationships.
   b. Write an SQL query by which you can display the region-wise, bank-wise, and year-wise total amount of loans disbursed from your schema.

5. Consider the given table and solve the following questions.
   a. Develop two classification rules giving an example.
   b. How does the accuracy measured?

Dept	status	age	Skill	Job
C	senior	18-30	Y	Y
A	junior	19-25	Y	N
B	junior	20-23	N	N
A	junior	19-25	N	N
C	senior	19-25	Y	Y
C	junior	20-23	Y	N
B	senior	18-30	Y	Y

6. Answer in brief with examples
   a. Explain data granularity in Data Warehouse(DW).
   b. What is the purpose of data Discretization? Give an example.
   c. What are the purposes of the staging area?

7. The warehouse of **ABC wholesale company** is designed by a team of experts. The warehouse has to allow analyzing the company's situation at least with respect to the Furniture, Customers and Time. The company is interested in learning at least the quantity, income and discount of its sales. The company needs to analyze:
   I. The furniture with respect to its type (chair, table, wardrobe. . .), category (kitchen, living room, bedroom, office. . .) and material (wood, marble. . .)
   II. The customers with respect to their location, cities, regions and states etc.
      i. Design the DW star schema showing the necessary relationships.
      ii. Give the structure of the possible error event table of this warehouse.
8. Consider the above scenario of **ABC wholesale company** and the following questions
   a. Draw a sample of basic DW architecture showing possible layers (Tiers). Show the possible input data and out of each of the layers.
   b. Design the DW star schema showing the necessary relationships.
   c. Write **pseudo query** for the following questions:

i. Find the average quantity, income and discount with respect to each country, furniture material and year
ii. Determine the 5 most sold furniture during the May month.

9. Answer the following

i. Consider the given table. If minimum support is <50% and minimum confidence are <60%, determine the frequent itemsets and association rules using the apriori algorithm. Show the detailed steps to do so.

ii. Consider the given table. Draw a final version of the FP-tree with the item in descending ordering for min support>50%. (You may prepare a draft version(s) of the tree before getting the final version).

TID	Items
1	{A,C,B}
2	{A,C,D,E}
3	{C,A,B}
4	{A,B,C}
5	{A,B,C,D}
6	{A,B,C}
7	{A,B,D}
8	{B,C,E}

iii. Take your own appropriate data sets. Specify a Classifier. Developed a basic algorithm for inducing a decision tree from training tuples.

10. Consider the structure of a DW and assume DW has enough data

DWTIME (DWTIMEID, DAY_OF_MONTH, MONTH_NUM_OF_YEAR)

ASS3_DW_CUST (DWCUSTID, SOURCE_TABLENAME, CUSTNO, CUSTNAME, GENDER)

ASS3_DW_PROD (DWPRODID, SOURCE_TABLENAME, PRODNO, PRODNAME, CATNAME)

ASS3_DW_SALES (DWPRODID, DWCUSTID, DWTIMEID, QTY, GROSSMARGIN)

1. Draw the warehouse schema
2. Write **pseudo query** for the following queries
   a. List the total number of sales for each product
   b. To Use the Cube operator to list totals for custname, prodname
   c. List the ranked sales by product name

11. "Market Basket Analysis is a kind of classification" is this correct? If yes, justify; if no, correct the statement & give the reason.
12. When mining association rules, how can the data mining system tell which rules are likely to be attractive to the user?
13. Differentiate between Clustering and classification. What are the similarities? Can we replace/use one in place of another?
14. Where is Attribute Relevance Analysis used? How entropy based method related to it? Explain in detail.
15. Where are supervised and unsupervised learning used, and what purpose do they serve? How do we improve the accuracy of the classifiers?
16. What is backpropagation? How does backpropagation work? How is it possible to understand what the backpropagation network has learned?

B3.E5-R5 SOFTWARE TESTING AND QUALITY ASSURANCE

1. A computer system is required that will support the following small garage business. Customers bring their cars to the garage for servicing and repair. The attendant must check the car in and record details about the owner and the car and any specific customer requests. The workshop manager inspects each car and creates a job specification for it. He then schedules the job and assigns a mechanic to complete the specified tasks. During this process, if any new problems are discovered, the workshop manager creates a new job specification before carrying out the work. The mechanic completes a report detailing the time spent, work done, and materials used when the job is finished. The attendant uses this information to create an invoice for the customer when they come to collect their car. Represent the system described above as a use-case diagram.

2. Senerio2 (for Testing)
   A training institute has the following discount fees for any admission:
   a. 90% marks in the entrance test will get a discount of 50%.
   b. 60% to 89% marks in the entrance test will get a discount of 30%.
   c. Students in the reserved category of 'ST' or 'SC' will get a discount of 50%.
   d. A reserved category student can join the entrance test and avail of extra discounts.

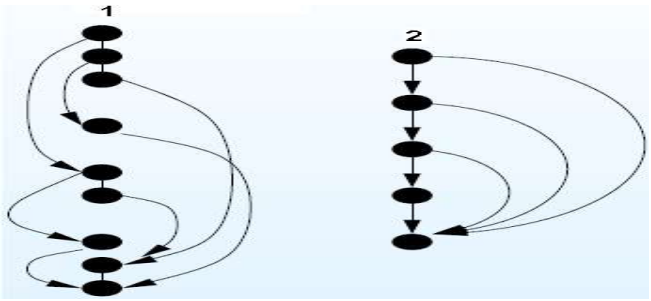
   A computer program reads all the marks of the entrance test and cast category of the student; then, the discount rate is printed. The program will assume only whole number values as input.

   Write three different sets of Black Box test cases to test the program, which solves the problem above.

Case name	Description	Input Values	Expected Output

3. What are the important components of the High-Level Design Document and Requirements Traceability Matrix? Explain with examples.

4. What is the aim of McCabe's Cyclomatic Complexity? Which of the following flow graph will have more Complexity value? Justify your answer.



5. " Write a small fragment of code that will find the largest number in an array of numbers".
   Apply a White Box test technique to the code fragment you wrote. It would help to draw a CFG based on your code before designing your tests. The CFG will indicate how many tests you need to write.

Purpose	Input(s)	Environment (if needed)	Expected output(s)

6. A programmer team is coding a large program that has 3 thousand lines of code. This program has 30subprograms having approximately 1,000 lines of code each. 10members are involved in the development and plan to complete it within 10 days. In the first 2days, they could complete 2 subprograms and encounter 2 defects during testing. The team does not follow the software engineering process, and thus they have this risk.

a. Find out the relevant direct measures and module defect density for this program.
b. Provide a WBS to support the team in finishing the work as soon as possible.

c. Show a proper schedule required to complete the activities of this project.

d. Calculate the Risk Exposure of the situation. Assume your Risk Impact and Probability values.
e. A member refers to a guidebook for 2minutes after each 1hour of coding. He took 10 hours to complete the work. Find out the ideal time, real-time, and productivity time of the coding (in hours).

7. Explain The Test Pyramid, Testing Quadrants, Test Levels, and Testing Types with examples
8. Explain the Scrum process with a proper example.
9. Consider the following scenario. Develop a] Business Requirements Document and purpose, b] Statement of Work, c] Scope of Effort, and d] Phases of Design etc
   "City Car Park operators provide parking management services at the big bazaar shopping mall. This involves services for 2 car parks, two of them multi-storey taking enforcement such as issuing parking tickets. The company employs 10 people, full-time and part-time. 2 do clerical jobs using computers, and the rest are parking attendants (PAs) working in shifts. Currently, they have a manual system for allotting the car parking slots. When a parking coupon is provided to the car owner, s/he will know the free available space to park their car without unnecessarily searching for a free space. The PA on duty handles the allocation of car spaces manually using a small whiteboard at the car park entrance.
   The manager is planning to computerize the 'car parking allocation system' to monitor free parking spaces and automatically allocate free space to newly arriving cars."

10. Give three significances of the 'Critical Path' of a project.
11. Software projects are measured using different metrics. Give any four important reasons for using the software metrics.
12. Describe the difference between Time-boxed Scheduling and Activity based scheduling. Which activity will be more suitable to plan for your final year project? Justify your answer.
13. Compare the process 'Tracking' and 'Monitoring' giving the required documents.
14. Give the main purposes of using a Burn-down chart? Give the significance of its axis.
15. Give any three important ideas that a manager can know from a Gantt chart.
16. You have been assigned as a new project manager for a new software development project. How will you set up risk mitigation strategies 'Likelihood reduction' and 'Risk transfer' for this project?
17. Give one example for each of the three principal risk drivers.
18. A Car loan Software provides various options to users. Users can calculate the down payment rate, repayment duration, and interest rate. The users can analyse the repayment structures of a chosen loan with respect to their income. Explain any two External quality factors of this application with examples.
19. Give three reasons why Change Management is an essential aspect of a software project.

20. When a change is made to a source code module, how can the project manager determine what other deliverables need to be changed?

B3.E6-R5 DIGITAL IMAGE PROCESSING (WITH AR/VR)

Assignment 1. Introduction to MATLAB & Image processing Toolbox.
Assignment 2. Write a m-function for following image transforms for grayscale image. **(Input:** Gray Scale Image)

i. Inverse Transform
ii. Power-law Transform
iii. Log Transform

Assignment 3. Write m-function for Histogram Equalization for grayscale image. **(Input:** Gray Scale Image)
Assignment 4. Write m-function for Local Histogram Equalization. **(Input:** Gray Scale Image)
Assignment 5. Write m-function for Histogram Specification for grayscale image.**(Input:** 2Gray Scale Images)
Assignment 6. Demonstrate the use of Smoothing and Sharpening using various Filters for Smoothing (Average (Mean) Filter, Weighted Filter, Median Filter, Gaussian Averaging Filter, Laplacian Filter for Sharpening (HV and H-V-D))
(Input: Gray Scale Image)

Assignment 7. Perform the BIT PLANE SLICING for the gray scale image. Show the effect of removing the each bit plane from the image.
(Input: Gray Scale Image)

Assignment 8. Demonstrate the use of Filtering in Frequency Domain. Implement the function for the IDEAL, GAUSSIAN, and BUTTERWORTH (both High pass and Low pass) filters. Also compare and analyze results.
(Input: Gray Scale Image)
Assignment 9. Demonstrate the use of different filter applied for image restoration which is degraded by Raleigh, Gaussian, and Salt & Pepper Noise.
Implement following filters:

i. Mean Filter
    a. Arithmetic Mean filter
    b. Geometric filter
    c. Harmonic Filter
    d. Contra Harmonic filter
ii. Order Statistics Filters
    a. Median filter
    b. Max & Min Filters
    c. Mid point Filter

(Input: Gray Scale Image)

5. Demonstrate use of Prewit, Sobel, Robert, Canny edge detector for Edge detection. **(Input:** Gray Scale Image)

6. Implement Fourier Descriptor for shape detection and prepare CHAIN CODE for shape.
(Input: Binary Image with one Shape)
7. Demonstrate use of Morphological Operations (Dilate & Erosion). **(Input:** Binary Image with one Shape)
8. Write a M-function for Color space Transformation. (RGB_YUV_CMYK). **(Input:** Color Code)

AR/VR part

1) Create a Unity project to show working of image targets feature of vuforia. Display a 3D cube on top of Image target. Write down steps of project with snapshots of output.

2) Create a A-Frame based HTML page, demonstrating VR features and having objects such as cubes and spheres
3) Write down the steps in creating a AR application using unity
4) Write down the differences between AR and VR
5) What are the degrees of freedom namely 3DOF and 6DOF

B3.E7 R5 ACCOUNTING AND FINANCIAL MANAGEMENT

Q1. Accounting is an art of recording, classifying and summarizing in a significant manner and in terms of money transactions and events. Explain the accounting process and write the objectives of accounting.
Ans: Accounting process

1. **Identifying the transactions and events:** This is the first step of the accounting process. It identifies the transaction of financial character that is required to be recorded in the books of accounts.
1. **Measuring:** This denotes expressing the value of business transactions and events in terms of money.
2. **Recording:** It deals with recording of identifiable and measurable transactions and events in a systematic manner in the books of original entry that are in accordance with the principles of accountancy.
3. **Classifying:** It deals with periodic grouping of transactions of similar nature that appear in the books of original entry into appropriate heads by posting or transfer entries.
4. **Summarizing:** It deals with summarizing or condensing transactions in a manner useful to the users. This function involves the preparation of financial statements such as income statement, balance sheet, statement of changes in financial position and cash flow statement.
5. **Analyzing:** It deals with the establishment of the relationship between the various items or group of items taken from income statement or balance sheet or both.
6. **Interpreting:** It deals with explaining the significance of those data in a manner that the end users of the financial statement can make a meaningful judgment about the profitability and financial position of the business. The accountants should interpret the statement in a manner useful to the users, so as to enable the user to make a reasoned decision out of the alternative course of action.
7. **Communicating:** It deals with communicating the analyzed and interpreted data in the form of financial reports/ statements to the users of financial information eg Profit and loss account, Balance Sheet, Cash flow and Funds Flow statement, Auditors report etc.

Objectives of accounting

1. **a)** Accounting helps in the systematic recording of all business events or transactions. Written records are more preferable to memorizing (oral recording) because the latter may fade away with time.
2. **b)** Accounting measure the financial performance of the enterprise. The results of operations are ascertained by preparing profit and loss account, balance sheet and cash flow statements.
3. **d)** Accounting is required to fulfil the statutory requirements of various regulatory bodies such as Registrar of Companies, SEBI (Securities Exchange Board of India) income tax authorities and the Government.
4. **e)** Accounting helps in internal control by holding the concerned persons responsible for any errors, lapses or under performance.

Q2. Journal is a book of original entry and only one journal is maintained if the business is very small in size and the transactions are limited.

Give the meaning of a subsidiary book. List and explain all the types of subsidiary books.

Ans:

Subsidiary books

Journal is a book of original entry and only one journal is maintained if the business is very small in size and the transactions are limited. However, if the transactions are multifarious, then subsidiary books which are known as books of original entry are prepared. Journal is a book of original entry. Journal is basically a day book in which transactions are first entered in a systematic manner adopting the principles of debit and credit. Journal is subdivided into several books of original entry, namely purchases, sales, cash, bills receivable, bills payable, returns inwards, returns outwards books.

Types of subsidiary books

- **Purchases book:** Purchases book is also called the purchases journal. Only credit purchases of goods are recorded in this journal. 'Goods' mean items or commodities procured for resale. Cash purchases are recorded in cash book and credit purchases are recorded in purchases book.
- **Sales book:** Sales book or sales day book contains the details of credit sales of goods made during a particular period. The total of the sales book is transferred to the ledger to an account called sales account.
- **Purchase returns book:** When the business person purchases the goods and finds they are damaged or not as per the specifications he /she decide to return the goods to the supplier from whom the goods were purchased.
- **Sales returns book:** Sales returns book (also known as Return Inward book) is opened for the purpose of recording the return of goods sold on credit. Then a credit note is prepared to show that the customer's/debtor's account is credited to the extent of the value of the goods returned by them to us. Goods are received from the customers and a credit note is sent to them.
- **Bills receivable book:** When a business person sells goods on credit, the proceeds are received at a later date. Suppose the business person requires cash immediately, he may opt to draw a bill of exchange against the customer.
- **Bills payable book:** What are bills receivable for a drawer, bill payable to the drawee. When a business person purchases goods on credit he need not pay for it immediately.

7. Cash book: Cash book is an important subsidiary book and a book of original entry. It is a record of cash receipts and cash payments made during a particular period.

Q3. For the following balances extracted from a trial balance, prepare a trading account.

Particulars	Amount in Rs.
Stock on 1-1-2004	70700
Returns inwards	3000
Returns outwards	3000
Purchases	102000
Debtors	56000
Creditors	45000
Carriage inwards	5000

Carriage outwards	4000
Import duty on materials received from abroad	6000
Clearing charges	7000
Rent of business shop	12000
Royalty paid to extract materials	10000
Fire insurance on stock	2000
Wages paid to workers	8000
Office salaries	10000
Cash discount	1000
Gas, electricity, and water	4000
Sales	250000

Ans:

Dr TRADING ACCOUNT FOR THE YEAR ENDING – – – – Cr

Particulars		Rs	**Particulars**		Rs
To stock on 1-1-2004		70700			
To Purchases	102000		By sales	250000	
(-) Returns			(-) Returns		
Outwards	3000	99000	Inwards	3000	247000
To Carriage inwards		5000	By Closing stock		56000
To import duty		6000			
To Clearing charges		7000			
To Royalty		10000			
To Fire Insurance		2000			
To Wages		8000			
To Gas, electricity, water		4000			
To Gross Profit		**91300**			
Total		**303000**	**Total**		**303000**

Q4. Write short notes on :

a) Cost Management System(CMS)

b) Value added

Q5. Ajay industries manufacture product X. On 1st January 2007, there were 5000 units of the finished product in stock.

Work-in-progress	**Rs.57,400**
Raw materials	**Rs.1,16,200**

The information available from cost records for the year ended 31st December 2007 is as follows:

Direct material	9,06,900
Direct labour	3 ,26,400
Freight on R M purchased	55,700
Indirect labour	1,21,600
Other factory overhead	3,17,300
The stock of raw materials on 31st Dec 2007	96,400
Work-in-progress on 31st Dec 2007	78,200
Sales (1,50,000 units)	30,00,000
Indirect materials	2,13,900

There are 15000 units of finished stock in hand on 31st December 2007. Prepare a statement of cost and profit assuming that opening stock of finished goods is to be valued at the same cost per unit as the finished stock at the end of the period.

Q6. Assume a company is considering dropping product B from its line because accounting statement shows that product B is being sold at a loss.

Product	Income Statement			
	A	B	C	Total
Sales revenue	50,000	7,500	12,500	70,000
Cost of sales:				
D. material	7,500	1,000	1,500	10,000
D. labour	15,000	2,000	2,500	19,500
Indirect manufacturing cost (50% of Direct labour)	7,500	1,000	1,250	9,750

Total	30,000	4,000	5,250	39,250
Gross margin on sales	20,000	3,500	7,250	30,750
Selling and Admn	12,500	4,500	4,000	21,000
Net income	7,500	(1,000)	3,250	9,750

Additional information:

a) Factory overhead cost is made up of a fixed cost of Rs. 5850 and variable cost of Rs. 3900.

b) Variable cost by-products are A – Rs. 3000, B – Rs. 400, and C – Rs. 500.

c) Fixed costs and expense will not be changed if product B is eliminated.

d) Variable selling and administrative expenses to the extent of Rs. 11000 can be traced to the product: A – Rs.7,500, B – Rs.1500, and C – Rs. 2000.

e) Fixed selling and administration expense are Rs. 10000.

Q7. Inventory in a business is valued at the end of an accounting period, at either cost or market price, whichever is lower. This is an accepted convention or a practice in accounting. Give a small introduction on accounting conventions and elucidate all the eight accounting conventions.

Q8. Write down a table with the accounts involved / the nature of account/its affects/ debit or credit. Please have the transactions given below and prepare the table as per the instructions are given above for each transaction.

1.1.2011 Sunitha started his business with cash Rs. 5,00,000

2.1.2011 Borrowed from Malathi Rs. 5,00,000

2.1.2011 Purchased furniture Rs. 1,00,000

4.1.2011 Purchased furniture from Meenal on credit Rs. 1,50,000

5.1.2011 Purchased goods for cash Rs. 50,000

6.1.2011 Purchased goods from Ram on credit Rs. 2,50,000

8.1.2011 Sold goods for cash Rs. 1,25,000

8.1.2011 Sold goods to Shyam on credit Rs. 55,000

9.1.2011 Received cash from Shyam Rs. 25,000

10.1.2011 Paid cash to Ram Rs. 90,000

Q9. From the given trial balance, draft an Adjusted Trial Balance.

Trial Balance as on 31.03.2013

Debit balances	Rs.	Credit balances	Rs.
Furniture and Fittings	15000	Bank Over Draft	16000
Buildings	500000	Capital Account	400000
Sales Returns	1000	Purchase Returns	4000
Bad Debts	2000	Sundry Creditors	35000
Sundry Debtors	25000	Commission	5000
Purchases	90000	Sales	235000
Advertising	20000		
Cash	10000		
Taxes and Insurance	5000		
General Expenses	7000		
Salaries	20000		
TOTAL	**695000**	**TOTAL**	**695000**

Adjustments:

1. Charge depreciation at 10% on Buildings and Furniture and fittings.
2. Write off further bad debts 1000
3. Taxes and Insurance prepaid 2000
4. Outstanding salaries 5000
5. The commission received in advance1000

Q10. Draw the Balance Sheet for the following information provided by Sandeep Ltd.

1. Current Ratio : 2.50
2. Liquidity Ratio : 1.50
3. Net Working Capital : Rs.300000
4. Stock Turnover Ratio : 6 times
5. The ratio of Gross Profit to Sales : 20%
6. Fixed Asset Turnover Ratio : 2 times
7. Average Debt collection period : 2 months
8. Fixed Assets to Net Worth : 0.80
9. Reserve and Surplus to Capital : 0.50

Q11. Write the main differences between cash flow analysis and fund flow analysis.

Following is the balance sheet for the period ending 31st March 2011 and 2012. If the current year's net loss is Rs.38,000, Calculate the cash flow from operating activities.

31st MARCH

	2011	2012
Short-term loan to employees	15,000	18,000
Creditors	30,000	8,000
Provision for doubtful debts	1,200	–
Bills payable	18,000	20,000
Stock in trade	15,000	13,000
Bills receivable	10,000	22,000
Prepaid expenses	800	600
Outstanding expenses	300	500

Q12. Accounting is one of the oldest, structured management information system. Give the meaning of accounting and book keeping? Explain the objectives of accounting?

Q13. Explain GAAP and write down the relationship between accounting principles, accounting concepts, and accounting conventions. Explain all the five accounting concepts with an example.

Q14. List down the classification of accounts according to accounting equation approach. Give the meaning and examples for all the types of accounts.

Q15. What is the cash book? Differentiate between other subsidiary books and cash book.

Q16. The following items are found in the trial balance of M/s Sharada Enterprise on 31st December 2000.

Sundry Debtors	Rs.160000
Bad Debts are written off	Rs 9000
Discount allowed to Debtors	Rs. 1800
Reserve for Bad and doubtful Debts 31-12-1999	Rs. 16500
Reserve for a discount on Debtors 31-12-1999	Rs. 3200

You are required to provide the bad and doubtful debts at 5% and for a discount on debtors at 2%. Show the adjustments for bad debts, bad debts reserve, discount account, and provision for discount on debtors.

Hint: RBD to be provided = 500

Reserve for discount to be provided now =1640

Q17. What is management accounting? Explain the roles of management accounting and write down about any 2 functions of management accounting.

Q18. An accountant finds that the trial balance of his client did not tally and it showed an excess credit of Rs. 69.74. He transferred it to a suspense account and later discovered the following errors.

a) Rs. 44.37 paid to Anand has been credited to his account as Rs. 34.37.

b) Purchase of Rs. 145.50 has been posted as Rs. 154.50 to the purchases account.

c) An expenditure of Rs. 158 on repairs has been debited to the building's account.

d) Rs. 80 was allowed by B as a discount which has not been entered in the books.

e) A sum of Rs. 125.05 realised on the sale of old furniture has been posted to the sales account.

Give journal entries to rectify the errors and show the suspense account as it would appear after adjustments

Hint: Total of suspense a/c = 78.74

Q19. Distinguish between management accounting and financial accounting.

Q20. Draw the Balance Sheet for the following information provided by Sarawath Ltd.

1. Current Ratio : 2.50
2. Liquidity Ratio : 1.50
3. Net Working Capital : Rs.300000
4. Stock Turnover Ratio : 6 times
5. Ratio of Gross Profit to Sales : 20%
6. Fixed Asset Turnover Ratio : 2 times
7. Average Debt collection period : 2 months
8. Fixed Assets to Net Worth : 0.80
9. Reserve and Surplus to Capital : 0.50

Hint: B/S total 1100000

Q21. Following is the balance sheet for the period ending 31st March 2006 and 2007. If the current year's net loss is Rs.38,000, calculate the cash flow from operating activities.

	31st MARCH	
	2006	**2007**
Short-term loan to employees	15,000	18,000
Creditors	30,000	8,000

Provision for doubtful debts	1,200	–
Bills payable	18,000	20,000
Stock in trade	15,000	13,000
Bills receivable	10,000	22,000
Prepaid expenses	800	600
Outstanding expenses	300	500

Hint: Net cash lost in operating activities (69800)

Q22. The following data are related to the manufacture of a standard product during the month of July 2009.

Raw materials consumed	Rs.15,000
Direct wages	Rs. 9,000
Machine hours worked	900 hours
Machine hours rate	Rs.5
Administrative overheads	20% of works cost
Selling overheads	Re.0.50 per unit
Units produced	17,100
Units Sold	16,000 @ Rs.4 per unit

Prepare a cost sheet from the above to show:

1. **The cost per unit**
2. **The profit per unit sold and profit for the period**
   Hint: Profit = 24000

Q24. The reports prepared in financial accounting are also used in management accounting. But there are few major differences between financial accounting and management accounting. Explain the differences between financial accounting and management accounting in various dimensions.

Q25. Analyze the following transaction under the traditional approach.

18.1.2011 Received a cheque from a customer, Sanjay at 5 p.m. Rs.20,000

19.1.2011 Paid Ramu by cheque Rs.1,50,000

20.1.2011 Paid salary Rs. 30,000

20.1.2011 Paid rent by cheque Rs. 8,000

21.1.2011 Goods withdrawn for personal use Rs. 5,000

25.1.2011 Paid an advance to suppliers of goods Rs. 1,00,000

26.1.2011 Received an advance from customers Rs. 3,00,000

31.1.2011 Paid interest on loan Rs. 5,000

31.1.2011 Paid instalment of loan Rs. 25,000

31.1.2011 Interest allowed by bank Rs. 8,000

Q26. The trial balance of Nilgiris Co Ltd., as taken on 31st December 2002 did not tally and the difference was carried to the suspense account. The following errors were detected subsequently.

a) Sales book total for November was under cast by Rs. 1200.

b) Purchase of new equipment costing Rs. 9475 has been posted to Purchases a/c.

c) Discount received Rs.1250 and discount allowed Rs. 850 in September 2002 have been posted to wrong sides of a discount account.

d) A cheque received from Mr Longford for Rs. 1500 for goods sold to him on credit earlier, though entered correctly in the cash book has been posted in his account as Rs. 1050.

e) Stocks worth Rs. 255 taken for use by Mr Dayananda, the Managing Director, have been entered in the sales day book.

f) While carrying forward, the total in Returns Inwards Book has been taken as Rs. 674 instead of Rs. 647.

g) An amount paid to cashier, Mr Ramachandra, Rs. 775 as salary for the month of November has been debited to his personal account as Rs. 757.

Pass journal entries and draw up the suspense account.

Q27. From the given trial balance draft an Adjusted Trial Balance.

Trial Balance as on 31.03.2011

Debit balances	Rs.	Credit balances	Rs.
Furniture and Fittings	10000	Bank Over Draft	16000
Buildings	500000	Capital Account	400000

Sales Returns	**1000**	**Purchase Returns**	**4000**
Bad Debts	**2000**	**Sundry Creditors**	**30000**
Sundry Debtors	**25000**	**Commission**	**5000**
Purchases	**90000**	**Sales**	**235000**
Advertising	**20000**		
Cash	**10000**		
Taxes and Insurance	**5000**		
General Expenses	**7000**		
Salaries	**20000**		
TOTAL	**690000**	**TOTAL**	**690000**

Adjustments:

1. **Charge depreciation at 10% on Buildings and Furniture and fittings.**
2. **Write off further bad debts 1000**
3. **Taxes and Insurance prepaid 2000**
4. **Outstanding salaries 5000**
5. **The commission received in advance1000**

Q28. Compute trend ratios and comment on the financial performance of Infosys Technologies Ltd. from the following extract of its income statements of five years

(in Rs. Crore)

Particulars	**2010-11**	**2009-10**	**2008-09**	**2007-08**	**2006-07**
Revenue	**27,501**	**22,742**	**21,693**	**16,692**	**13,893**
Operating Profit (PBIDT)	**8,968**	**7,861**	**7,195**	**5,238**	**4,391**
PAT from ordinary activities	**6,835**	**6,218**	**5,988**	**4,659**	**3,856**

(Source: Infosys Technologies Ltd. – Annual Report)

Q29. Give the meaning of cash flow analysis and put down the objectives of cash flow analysis. Explain the preparation of cash flow statement.

Q30. Write the assumptions of marginal costing. Differentiate between absorption costing and marginal costing.

Q31. Analyse the following transactions according to the traditional approach.

1.1.2011 Sunitha started his business with cash Rs. 5,00,000

2.1.2011 Borrowed from Malathi Rs. 5,00,000

2.1.2011 Purchased furniture Rs. 1,00,000

4.1.2011 Purchased furniture from Meenal on credit Rs. 1,50,000

5.1.2011 Purchased goods for cash Rs. 50,000

6.1.2011 Purchased goods from Ram on credit Rs. 2,50,000

8.1.2011 Sold goods for cash Rs. 1,25,000

8.1.2011 Sold goods to Shyam on credit Rs. 55,000

9.1.2011 Received cash from Shyam Rs. 25,000

10.1.2011 Paid cash to Ram Rs. 90,000

Q32. Assure you have just started a Mobile store. You sell mobile sets and currencies of Airtel, Vodaphone, Reliance and BSNL. Take five transactions and prepare a position statement after every transaction. Did you firm earn profit or incurred loss at the end? Make a small comment on your financial position at the end.

Q33. Prepare a Three-column Cash Book of M/s Thuglak & Co. from

The following particulars:

21st Jan 1. Cash in hand Rs. 50,000, Bank Overdraft Rs. 20,000

2. Paid into bank Rs. 10,000

3. Bought goods from Hari for Rs, 200 for each

4. Bought goods for Rs. 2,000 paid cheque for them, discount allowed 1%

5. Sold goods to Mohan for each Rs. 1.175

6. Received a cheque from Shyam to whom goods were sold for Rs. 800. Discount allowed 12.5%

7. Shyam's cheque deposited into bank

8. Purchased an old typewriter for Rs. 200, Spent Rs. 50 on its repairs

9. Bank notified that Shyam's cheque has been returned dishonoured and debited the account in respect of charges Rs. 10

10. Received a money order Rs. 25 from Hari

11. Shyam settled his account by means of a cheque for Rs. 820, Rs. 20 being for interest charged.

12. Withdrew from the bank Rs. 10,000

18. Discounted a B/E for Rs. 1,000 at 1% through bank

20. Honoured our own acceptance by cheque Rs. 5,000

22. Withdrew fir personal use Rs. 1,000

24. Paid tread expenses Rs. 2,000

25. Withdrew from the bank for private expenses Rs. 1,500

26. Purchased machinery from Rajiv for 5,000 and paid him by means of a bank draft purchased for Rs. 5,005

27. Issued cheque to Ram Saran for cash purchased of furniture Rs. 1,575

28. Received a cheque for commission Rs. 500 from R.& Co. and deposited into bank

29. Ramesh who owned us Rs. 500 became bankrupt and paid us 50 paise in the rupee

30. Received payment of a loan of Rs. 5,000 and deposited Rs. 3,000 out of into bank

31. Paid rent to landlord "Mohan" by cheque of Rs. 220

31. Interest allowed by bank Rs. 30

31. Half-yearly bank charges Rs. 50

Q34. From the following data of Jagdish Company prepare (a) a statement of source and uses of working capital (funds) (b) a schedule of changes in working capital

Assets	**2008**	**2007**
Cash	1,26,000	1,14,000
Short-term investment	42,400	20,000
Debtors	60,000	50,000
Stock	38,000	28,000
Long term Investment	28,000	44,000
Machinery	2,00,000	1,40,000

Building	2,40,000	80,000
Land	14,000	14,000
Total	**7,48,400**	**4,90,000**

Liabilities and Equity

Accumulated depreciation	1,10,000	60,000
Creditors	40,000	30,000
Bills Payable	20,000	10,000
Secured loans	2,00,000	1,00,000
Share capital	2,20,000	1,60,000
Share premium	24,000	Nil
Reserves and surplus	1,34,400	1,30,000
Total	**7,48,400**	**4,90,000**

Income statement

Sales		2,40,000
Cost of goods sold		1,34,600
Gross Profit		1,05,200
Less Operating expenses:		
Depreciation – machinery	20,000	
		92,000
Depreciation – building	32,000	
Other expenses	40,000	
Net profit from the operation		13,200
Gain on sale on long-term investment		4,800
Total		18,000
Loss on sale of machinery		2,000
Net Profit		16,000

Adjustments:

1) Machinery worth Rs.70000 was purchased and worth Rs.10000 was sold during the year [Accumulated depreciation on machinery is Rs.18000 after adjusting depreciation on machinery sold]. Proceeds from the sale of machinery were Rs.6000

2) Dividends paid during the year Rs.11600

Q35. What is DuPont analysis? Explain all the ratios involved in this analysis. Your answer should be supported by the chart.

Q36. Find the value of the following:

1. **If the total assets are Rs. 87,000 and the liabilities are Rs. 47,000, find out the amount of capital.**
2. **If the capital of proprietor is Rs. 4,00,000 and the total assets are Rs. 6,00,000, what is the amount of liabilities to outsiders?**
3. **If creditors are Rs. 56,000, bank overdraft is Rs.1,00,000, and outstanding expenses are Rs. 8,000, what is the total amount of assets?**
4. **Fixed assets are Rs.70,000 and current assets are Rs.1,00,000 and the creditors are Rs.30,000. What is capital?**

Q37. Enter the following transactions in the single column cash book of Gopichand.

March 2003

1st. Commenced business with cash	**20000**
2nd. Bought goods for cash	**5000**
3rd. Sold goods for cash	**4000**
4th. Goods purchased from Ravi Kumar	**10000**
10th. Paid to Ravi Kumar	**7000**
14th. Cash sales	**8000**
18th. Purchased furniture for office	**4000**
22nd. Paid wages	**500**
25th. Paid rent	**600**
30th. Received commission	**4000**
30th. Withdrew for personal purpose	**1000**
Cash balance	**170000**

Hint: Goods Purchased from Ravi Kumar is a credit purchase.

Q38. Find out the missing figures.

	Office stationery	Consumables
Opening stock	**5000**	**8000**
Purchased during the year	**25000**	**?**
Closing stock	**3000**	**6000**
Consumed for the year?		**24000**

Q39. Explain the tools of management accounting.

Q1. Accounting is an art of recording, classifying and summarizing in a significant manner and in terms of money transactions and events. Explain the accounting process and write the objectives of accounting.

Ans:

Accounting process

1. **Identifying the transactions and events:** This is the first step of the accounting process. It identifies the transaction of financial character that is required to be recorded in the books of accounts.
1. **Measuring:** This denotes expressing the value of business transactions and events in terms of money.
2. **Recording:** It deals with recording of identifiable and measurable transactions and events in a systematic manner in the books of original entry that are in accordance with the principles of accountancy.
3. **Classifying:** It deals with periodic grouping of transactions of similar nature that appear in the books of original entry into appropriate heads by posting or transfer entries.
4. **Summarizing:** It deals with summarizing or condensing transactions in a manner useful to the users. This function involves the preparation of financial statements such as income statement, balance sheet, statement of changes in financial position and cash flow statement.
5. **Analyzing:** It deals with the establishment of the relationship between the various items or group of items taken from income statement or balance sheet or both.
6. **Interpreting:** It deals with explaining the significance of those data in a manner that the end users of the financial statement can make a meaningful judgment about the profitability and financial position of the business. The accountants should interpret the statement in a manner useful to the users, so as to enable the user to make a reasoned decision out of the alternative course of action.
7. **Communicating:** It deals with communicating the analyzed and interpreted data in the form of financial reports/ statements to the users of financial information eg Profit and loss account, Balance Sheet, Cash flow and Funds Flow statement, Auditors report etc.

Objectives of accounting

1. **a)** Accounting helps in the systematic recording of all business events or transactions. Written records are more preferable to memorizing (oral recording) because the latter may fade away with time.
2. **b)** Accounting measure the financial performance of the enterprise. The results of operations are ascertained by preparing profit and loss account, balance sheet and cash flow statements.
3. **d)** Accounting is required to fulfil the statutory requirements of various regulatory bodies such as Registrar of Companies, SEBI (Securities Exchange Board of India) income tax authorities and the Government.
4. **e)** Accounting helps in internal control by holding the concerned persons responsible for any errors, lapses or under performance.

Q2. Journal is a book of original entry and only one journal is maintained if the business is very small in size and the transactions are limited.

Give the meaning of a subsidiary book. List and explain all the types of subsidiary books.

Ans:

Subsidiary books

Journal is a book of original entry and only one journal is maintained if the business is very small in size and the transactions are limited. However, if the transactions are multifarious, then subsidiary books which are known as books of original entry are prepared. Journal is a book of original entry. Journal is basically a day book in which transactions are first entered in a systematic manner adopting the principles of debit and credit. Journal is subdivided into several books of original entry, namely purchases, sales, cash, bills receivable, bills payable, returns inwards, returns outwards books.

Types of subsidiary books

- **Purchases book:** Purchases book is also called the purchases journal. Only credit purchases of goods are recorded in this journal. 'Goods' mean items or commodities procured for resale. Cash purchases are recorded in cash book and credit purchases are recorded in purchases book.
- **Sales book:** Sales book or sales day book contains the details of credit sales of goods made during a particular period. The total of the sales book is transferred to the ledger to an account called sales account.
- **Purchase returns book:** When the business person purchases the goods and finds they are damaged or not as per the specifications he /she decide to return the goods to the supplier from whom the goods were purchased.
- **Sales returns book:** Sales returns book (also known as Return Inward book) is opened for the purpose of recording the return of goods sold on credit. Then a credit note is prepared to show that the customer's/debtor's account is credited to the extent of the value of the goods returned by them to us. Goods are received from the customers and a credit note is sent to them.
- **Bills receivable book:** When a business person sells goods on credit, the proceeds are received at a later date. Suppose the business person requires cash immediately, he may opt to draw a bill of exchange against the customer.
- **Bills payable book:** What are bills receivable for a drawer, bill payable to the drawee. When a business person purchases goods on credit he need not pay for it immediately.

7. Cash book: Cash book is an important subsidiary book and a book of original entry. It is a record of cash receipts and cash payments made during a particular period.

Q3. For the following balances extracted from a trial balance, prepare a trading account.

Particulars	Amount in Rs.
Stock on 1-1-2004	70700
Returns inwards	3000
Returns outwards	3000
Purchases	102000
Debtors	56000
Creditors	45000
Carriage inwards	5000
Carriage outwards	4000
Import duty on materials received from abroad	6000
Clearing charges	7000
Rent of business shop	12000
Royalty paid to extract materials	10000
Fire insurance on stock	2000
Wages paid to workers	8000
Office salaries	10000
Cash discount	1000
Gas, electricity, and water	4000
Sales	250000

Ans:

Dr TRADING ACCOUNT FOR THE YEAR ENDING – – – – Cr

Particulars	Rs	**Particulars**	Rs

To stock on 1-1-2004		70700			
To Purchases	102000		By sales	250000	
(-) Returns			(-) Returns		
Outwards	3000	99000	Inwards	3000	247000
To Carriage inwards		5000	By Closing stock		56000
To import duty		6000			
To Clearing charges		7000			
To Royalty		10000			
To Fire Insurance		2000			
To Wages		8000			
To Gas, electricity, water		4000			
To Gross Profit		**91300**			
Total		**303000**	**Total**		**303000**

Q4. Write short notes on :

a) Cost Management System(CMS)

b) Value added

Q5. Ajay industries manufacture product X. On 1st January 2007, there were 5000 units of the finished product in stock.

Work-in-progress **Rs.57,400**

Raw materials **Rs.1,16,200**

The information available from cost records for the year ended 31st December 2007 is as follows:

Direct material	9,06,900
Direct labour	3 ,26,400
Freight on R M purchased	55,700
Indirect labour	1,21,600
Other factory overhead	3,17,300
The stock of raw materials on 31st Dec 2007	96,400
Work-in-progress on 31st Dec 2007	78,200
Sales (1,50,000 units)	30,00,000
Indirect materials	2,13,900

There are 15000 units of finished stock in hand on 31st December 2007. Prepare a statement of cost and profit assuming that opening stock of finished goods is to be valued at the same cost per unit as the finished stock at the end of the period.

Q6. Assume a company is considering dropping product B from its line because accounting statement shows that product B is being sold at a loss.

Product	Income Statement			
	A	B	C	Total
Sales revenue	50,000	7,500	12,500	70,000
Cost of sales:				
D. material	7,500	1,000	1,500	10,000
D. labour	15,000	2,000	2,500	19,500
Indirect manufacturing cost (50% of Direct labour)	7,500	1,000	1,250	9,750
Total	30,000	4,000	5,250	39,250
Gross margin on sales	20,000	3,500	7,250	30,750
Selling and Admn	12,500	4,500	4,000	21,000
Net income	7,500	(1,000)	3,250	9,750

Additional information:

a) Factory overhead cost is made up of a fixed cost of Rs. 5850 and variable cost of Rs. 3900.

b) Variable cost by-products are A – Rs. 3000, B – Rs. 400, and C – Rs. 500.

c) Fixed costs and expense will not be changed if product B is eliminated.

d) Variable selling and administrative expenses to the extent of Rs. 11000 can be traced to the product: A – Rs.7,500, B – Rs.1500, and C – Rs. 2000.

e) Fixed selling and administration expense are Rs. 10000.

Q7. Inventory in a business is valued at the end of an accounting period, at either cost or market price, whichever is lower. This is an accepted convention or a practice in accounting. Give a small introduction on accounting conventions and elucidate all the eight accounting conventions.

Q8. Write down a table with the accounts involved / the nature of account/its affects/ debit or credit. Please have the transactions given below and prepare the table as per the instructions are given above for each transaction.

1.1.2011 Sunitha started his business with cash Rs. 5,00,000

2.1.2011 Borrowed from Malathi Rs. 5,00,000

2.1.2011 Purchased furniture Rs. 1,00,000

4.1.2011 Purchased furniture from Meenal on credit Rs. 1,50,000

5.1.2011 Purchased goods for cash Rs. 50,000

6.1.2011 Purchased goods from Ram on credit Rs. 2,50,000

8.1.2011 Sold goods for cash Rs. 1,25,000

8.1.2011 Sold goods to Shyam on credit Rs. 55,000

9.1.2011 Received cash from Shyam Rs. 25,000

10.1.2011 Paid cash to Ram Rs. 90,000

Q9. From the given trial balance, draft an Adjusted Trial Balance.

Trial Balance as on 31.03.2013

Debit balances	**Rs.**	**Credit balances**	**Rs.**
Furniture and Fittings	15000	Bank Over Draft	16000
Buildings	500000	Capital Account	400000
Sales Returns	1000	Purchase Returns	4000
Bad Debts	2000	Sundry Creditors	35000
Sundry Debtors	25000	Commission	5000
Purchases	90000	Sales	235000
Advertising	20000		
Cash	10000		
Taxes and Insurance	5000		
General Expenses	7000		
Salaries	20000		
TOTAL	**695000**	**TOTAL**	**695000**

Adjustments:

1. Charge depreciation at 10% on Buildings and Furniture and fittings.
2. Write off further bad debts 1000

3. Taxes and Insurance prepaid 2000
4. Outstanding salaries 5000
5. The commission received in advance1000

Q10. Draw the Balance Sheet for the following information provided by Sandeep Ltd.

1. Current Ratio : 2.50
2. Liquidity Ratio : 1.50
3. Net Working Capital : Rs.300000
4. Stock Turnover Ratio : 6 times
5. The ratio of Gross Profit to Sales : 20%
6. Fixed Asset Turnover Ratio : 2 times
7. Average Debt collection period : 2 months
8. Fixed Assets to Net Worth : 0.80
9. Reserve and Surplus to Capital : 0.50

Q11. Write the main differences between cash flow analysis and fund flow analysis.

Following is the balance sheet for the period ending 31st March 2011 and 2012. If the current year's net loss is Rs.38,000, Calculate the cash flow from operating activities.

	31st MARCH	
	2011	**2012**
Short-term loan to employees	15,000	18,000
Creditors	30,000	8,000
Provision for doubtful debts	1,200	–
Bills payable	18,000	20,000
Stock in trade	15,000	13,000
Bills receivable	10,000	22,000
Prepaid expenses	800	600
Outstanding expenses	300	500

Q12. Accounting is one of the oldest, structured management information system. Give the meaning of accounting and book keeping? Explain the objectives of accounting?

Q13. Explain GAAP and write down the relationship between accounting principles, accounting concepts, and accounting conventions. Explain all the five accounting concepts with an example.

Q14. List down the classification of accounts according to accounting equation approach. Give the meaning and examples for all the types of accounts.

Q15. What is the cash book? Differentiate between other subsidiary books and cash book.

Q16. The following items are found in the trial balance of M/s Sharada Enterprise on 31st December 2000.

Sundry Debtors	Rs.160000
Bad Debts are written off	Rs 9000
Discount allowed to Debtors	Rs. 1800
Reserve for Bad and doubtful Debts 31-12-1999	Rs. 16500
Reserve for a discount on Debtors 31-12-1999	Rs. 3200

You are required to provide the bad and doubtful debts at 5% and for a discount on debtors at 2%. Show the adjustments for bad debts, bad debts reserve, discount account, and provision for discount on debtors.

Hint: RBD to be provided = 500

Reserve for discount to be provided now =1640

Q17. What is management accounting? Explain the roles of management accounting and write down about any 2 functions of management accounting.

Q18. An accountant finds that the trial balance of his client did not tally and it showed an excess credit of Rs. 69.74. He transferred it to a suspense account and later discovered the following errors.

a) Rs. 44.37 paid to Anand has been credited to his account as Rs. 34.37.

b) Purchase of Rs. 145.50 has been posted as Rs. 154.50 to the purchases account.

c) An expenditure of Rs. 158 on repairs has been debited to the building's account.

d) Rs. 80 was allowed by B as a discount which has not been entered in the books.

e) A sum of Rs. 125.05 realised on the sale of old furniture has been posted to the sales account.

Give journal entries to rectify the errors and show the suspense account as it would appear after adjustments

Hint: Total of suspense a/c = 78.74

Q19. Distinguish between management accounting and financial accounting.

Q20. Draw the Balance Sheet for the following information provided by Sarawath Ltd.

1. Current Ratio : 2.50
2. Liquidity Ratio : 1.50
3. Net Working Capital : Rs.300000
4. Stock Turnover Ratio : 6 times
5. Ratio of Gross Profit to Sales : 20%
6. Fixed Asset Turnover Ratio : 2 times
7. Average Debt collection period : 2 months
8. Fixed Assets to Net Worth : 0.80
9. Reserve and Surplus to Capital : 0.50

Hint: B/S total 1100000

Q21. Following is the balance sheet for the period ending 31st March 2006 and 2007. If the current year's net loss is Rs.38,000, calculate the cash flow from operating activities.

	31st MARCH	
	2006	**2007**
Short-term loan to employees	15,000	18,000
Creditors	30,000	8,000
Provision for doubtful debts	1,200	–
Bills payable	18,000	20,000
Stock in trade	15,000	13,000
Bills receivable	10,000	22,000
Prepaid expenses	800	600
Outstanding expenses	300	500

Hint: Net cash lost in operating activities (69800)

Q22. The following data are related to the manufacture of a standard product during the month of July 2009.

Raw materials consumed	Rs.15,000
Direct wages	Rs. 9,000
Machine hours worked	900 hours
Machine hours rate	Rs.5

Administrative overheads	20% of works cost
Selling overheads	Re.0.50 per unit
Units produced	17,100
Units Sold	16,000 @ Rs.4 per unit

Prepare a cost sheet from the above to show:

1. **The cost per unit**
2. **The profit per unit sold and profit for the period**
   Hint: Profit = 24000

Q24. The reports prepared in financial accounting are also used in management accounting. But there are few major differences between financial accounting and management accounting. Explain the differences between financial accounting and management accounting in various dimensions.

Q25. Analyze the following transaction under the traditional approach.

18.1.2011 Received a cheque from a customer, Sanjay at 5 p.m. Rs.20,000

19.1.2011 Paid Ramu by cheque Rs.1,50,000

20.1.2011 Paid salary Rs. 30,000

20.1.2011 Paid rent by cheque Rs. 8,000

21.1.2011 Goods withdrawn for personal use Rs. 5,000

25.1.2011 Paid an advance to suppliers of goods Rs. 1,00,000

26.1.2011 Received an advance from customers Rs. 3,00,000

31.1.2011 Paid interest on loan Rs. 5,000

31.1.2011 Paid instalment of loan Rs. 25,000

31.1.2011 Interest allowed by bank Rs. 8,000

Q26. The trial balance of Nilgiris Co Ltd., as taken on 31st December 2002 did not tally and the difference was carried to the suspense account. The following errors were detected subsequently.

a) Sales book total for November was under cast by Rs. 1200.

b) Purchase of new equipment costing Rs. 9475 has been posted to Purchases a/c.

c) Discount received Rs.1250 and discount allowed Rs. 850 in September 2002 have been posted to wrong sides of a discount account.

d) A cheque received from Mr Longford for Rs. 1500 for goods sold to him on credit earlier, though entered correctly in the cash book has been posted in his account as Rs. 1050.

e) Stocks worth Rs. 255 taken for use by Mr Dayananda, the Managing Director, have been entered in the sales day book.

f) While carrying forward, the total in Returns Inwards Book has been taken as Rs. 674 instead of Rs. 647.

g) An amount paid to cashier, Mr Ramachandra, Rs. 775 as salary for the month of November has been debited to his personal account as Rs. 757.

Pass journal entries and draw up the suspense account.

Q27. From the given trial balance draft an Adjusted Trial Balance.

Trial Balance as on 31.03.2011

Debit balances	Rs.	Credit balances	Rs.
Furniture and Fittings	10000	Bank Over Draft	16000
Buildings	500000	Capital Account	400000
Sales Returns	1000	Purchase Returns	4000
Bad Debts	2000	Sundry Creditors	30000
Sundry Debtors	25000	Commission	5000
Purchases	90000	Sales	235000
Advertising	20000		
Cash	10000		
Taxes and Insurance	5000		
General Expenses	7000		
Salaries	20000		
TOTAL	690000	TOTAL	690000

Adjustments:

1. **Charge depreciation at 10% on Buildings and Furniture and fittings.**
2. **Write off further bad debts 1000**
3. **Taxes and Insurance prepaid 2000**
4. **Outstanding salaries 5000**
5. **The commission received in advance1000**

Q28. Compute trend ratios and comment on the financial performance of Infosys Technologies Ltd. from the following extract of its income statements of five years

(in Rs. Crore)

Particulars	2010-11	2009-10	2008-09	2007-08	2006-07
Revenue	27,501	22,742	21,693	16,692	13,893
Operating Profit (PBIDT)	8,968	7,861	7,195	5,238	4,391
PAT from ordinary activities	6,835	6,218	5,988	4,659	3,856

(Source: Infosys Technologies Ltd. – Annual Report)

Q29. Give the meaning of cash flow analysis and put down the objectives of cash flow analysis. Explain the preparation of cash flow statement.

Q30. Write the assumptions of marginal costing. Differentiate between absorption costing and marginal costing.

Q31. Analyse the following transactions according to the traditional approach.

1.1.2011 Sunitha started his business with cash Rs. 5,00,000

2.1.2011 Borrowed from Malathi Rs. 5,00,000

2.1.2011 Purchased furniture Rs. 1,00,000

4.1.2011 Purchased furniture from Meenal on credit Rs. 1,50,000

5.1.2011 Purchased goods for cash Rs. 50,000

6.1.2011 Purchased goods from Ram on credit Rs. 2,50,000

8.1.2011 Sold goods for cash Rs. 1,25,000

8.1.2011 Sold goods to Shyam on credit Rs. 55,000

9.1.2011 Received cash from Shyam Rs. 25,000

10.1.2011 Paid cash to Ram Rs. 90,000

Q32. Assure you have just started a Mobile store. You sell mobile sets and currencies of Airtel, Vodaphone, Reliance and BSNL. Take five transactions and prepare a position statement after every transaction. Did you firm earn profit or incurred loss at the end? Make a small comment on your financial position at the end.

Q33. Prepare a Three-column Cash Book of M/s Thuglak & Co. from

The following particulars:

21st Jan 1. Cash in hand Rs. 50,000, Bank Overdraft Rs. 20,000

2. Paid into bank Rs. 10,000

3. Bought goods from Hari for Rs, 200 for each

4. Bought goods for Rs. 2,000 paid cheque for them, discount allowed 1%

5. Sold goods to Mohan for each Rs. 1.175

6. Received a cheque from Shyam to whom goods were sold for Rs. 800. Discount allowed 12.5%

7. Shyam's cheque deposited into bank

8. Purchased an old typewriter for Rs. 200, Spent Rs. 50 on its repairs

9. Bank notified that Shyam's cheque has been returned dishonoured and debited the account in respect of charges Rs. 10

10. Received a money order Rs. 25 from Hari

11. Shyam settled his account by means of a cheque for Rs. 820, Rs. 20 being for interest charged.

12. Withdrew from the bank Rs. 10,000

18. Discounted a B/E for Rs. 1,000 at 1% through bank

20. Honoured our own acceptance by cheque Rs. 5,000

22. Withdrew fir personal use Rs. 1,000

24. Paid tread expenses Rs. 2,000

25. Withdrew from the bank for private expenses Rs. 1,500

26. Purchased machinery from Rajiv for 5,000 and paid him by means of a bank draft purchased for Rs. 5,005

27. Issued cheque to Ram Saran for cash purchased of furniture Rs. 1,575

28. Received a cheque for commission Rs. 500 from R.& Co. and deposited into bank

29. Ramesh who owned us Rs. 500 became bankrupt and paid us 50 paise in the rupee

30. Received payment of a loan of Rs. 5,000 and deposited Rs. 3,000 out of into bank

31. Paid rent to landlord "Mohan" by cheque of Rs. 220

31. Interest allowed by bank Rs. 30

31. Half-yearly bank charges Rs. 50

Q34. From the following data of Jagdish Company prepare (a) a statement of source and uses of working capital (funds) (b) a schedule of changes in working capital

Assets	**2008**	**2007**
Cash	1,26,000	1,14,000
Short-term investment	42,400	20,000
Debtors	60,000	50,000
Stock	38,000	28,000
Long term Investment	28,000	44,000
Machinery	2,00,000	1,40,000
Building	2,40,000	80,000
Land	14,000	14,000
Total	**7,48,400**	**4,90,000**
Liabilities and Equity		
Accumulated depreciation	1,10,000	60,000
Creditors	40,000	30,000
Bills Payable	20,000	10,000
Secured loans	2,00,000	1,00,000
Share capital	2,20,000	1,60,000
Share premium	24,000	Nil
Reserves and surplus	1,34,400	1,30,000
Total	**7,48,400**	**4,90,000**

Income statement

Sales	2,40,000
Cost of goods sold	1,34,600
Gross Profit	1,05,200
Less Operating expenses:	
Depreciation – machinery 20,000	92,000
Depreciation – building 32,000	
Other expenses 40,000	
Net profit from the operation	13,200
Gain on sale on long-term investment	4,800
Total	18,000
Loss on sale of machinery	2,000
Net Profit	16,000

Adjustments:

1) Machinery worth Rs.70000 was purchased and worth Rs.10000 was sold during the year [Accumulated depreciation on machinery is Rs.18000 after adjusting depreciation on machinery sold]. Proceeds from the sale of machinery were Rs.6000

2) Dividends paid during the year Rs.11600

Q35. What is DuPont analysis? Explain all the ratios involved in this analysis. Your answer should be supported by the chart.

Q36. Find the value of the following:

1. **If the total assets are Rs. 87,000 and the liabilities are Rs. 47,000, find out the amount of capital.**
2. **If the capital of proprietor is Rs. 4,00,000 and the total assets are Rs. 6,00,000, what is the amount of liabilities to outsiders?**
3. **If creditors are Rs. 56,000, bank overdraft is Rs.1,00,000, and outstanding expenses are Rs. 8,000, what is the total amount of assets?**
4. **Fixed assets are Rs.70,000 and current assets are Rs.1,00,000 and the creditors are Rs.30,000. What is capital?**

Q37. Enter the following transactions in the single column cash book of Gopichand.

March 2003

1st. Commenced business with cash 20000

2nd. Bought goods for cash **5000**

3rd. Sold goods for cash **4000**

4th. Goods purchased from Ravi Kumar **10000**

10th. Paid to Ravi Kumar **7000**

14th. Cash sales **8000**

18th. Purchased furniture for office **4000**

22nd. Paid wages **500**

25th. Paid rent **600**

30th. Received commission **4000**

30th. Withdrew for personal purpose **1000**

Cash balance **170000**

Hint: Goods Purchased from Ravi Kumar is a credit purchase.

Q38. Find out the missing figures.

	Office stationery	Consumables
Opening stock	**5000**	**8000**
Purchased during the year	**25000**	**?**
Closing stock	**3000**	**6000**
Consumed for the year?		**24000**

Q39. Explain the tools of management accounting.

Accounting and Financial Management MCQ with Answers

1. ___ accounting is concerned with accounting information that is useful to management.
a. Financial
b. Cost
c. Management
d. All of the above
Show Answer

Answer (C)
2. Sunk cost is relevant cost –
a. True
b. False
Ans. (b)

3. Quick Ratio is also known –
a. Liquid ratio
b. Acid test ratio
c. Both of above
d. Current ratio
Show Answer

Answer (C)
4. COGS = Opening stock + Purchase + ___ – closing stoc
a. Direct income
b. Direct expenses
c. Indirect expenses
d. Indirect income
Show Answer

Answer (B)
5. On the basis of traceability, costs are classified –
a. Fixed cost & variable cost
b. Direct & indirect cost
c. Relevant & opportunity cost
d. Incremental & documented cost
Show Answer

Answer (B)
6. ___ Defined as the allotment of whole items of costs to cost centre or cost unit.
a. Apportionment
b. Distribution
c. Allocation
d. Overheads
Show Answer

Answer (C)
7. ___ cost increases with the increase in the number of batches.
a. Set-up cost
b. Carrying cost
c. Holding cost
d. Total cost
Show Answer

Answer (A)
8. ___ work is executed outside the premises of the contractor.
a. Job
b. Contract
c. Process
d. Batch
Show Answer

Answer (B)

9. Escalation clause included in the contract to reduce the element of risk by fluctuation.
a. True
b. False
Show Answer

Answer (A)
10. Normal loss may be in the form of –
a. Normal waste
b. Normal spoilage
c. Normal scrap
d. All of the above
Show Answer

Answer (D)
11. Two or more products separated in processing, each having a sufficiently high saleable value to merit recognition as the main product is known as –
a. Joint product
b. By-Product
c. Batch product
d. Combined product
Show Answer

Answer (A)
12. Which method is also known as an arbitrary method –
a. Standard cost method
b. Physical unit method
c. Average unit cost method
d. Survey method
Show Answer

Answer (D)
13. Higher current ratio, i.e. more than 2:1 indicate sound solvency position while higher quick ratio i.e. more than 1:1 indicate sound financial position.
a. True
b. False
Show Answer

Answer (A)
14. Which of the following is true –
a. C = S – VC
b. C = F + P
c. S – VC = F + P
d. All of the above
Show Answer

Answer (D)
15. Margin of safety = Sales ___.
a. Break-even point
b. Break-even sales
c. Profit volume
d. Contribution
Show Answer

Answer (B)

16. ___ is a formal expression of anticipated income & expenditure for a definite future period.
a. Budgeting
b. Budgetary
c. Budgetary control
d. Budget
Show Answer

Answer (D)
17. On the basis of efficiency, budget is categorized as –
a. Functional & master budget
b. Fixed & flexible budget
c. Long term & short term budget
d. All of the above
Show Answer

Answer (B)
18. Budgetary control encourages productive competition among employees through an incentive scheme.
a. True
b. False
Show Answer

Answer (A)
19. Standard cost is similar with estimated cost –
a. True
b. False
Show Answer

Answer (B)
20. ___ is the difference between actual cost and the standard cost incurred during a period.
a. Variance
b. Controlling
c. Standard budgeting
d. Budgetary control
Show Answer

Answer (A)
21. Which of the following statement is not true –
a. SY > AY = (A)
b. SY < (AY = (B)
c. MCV = MUV + MPV
d. MUV = MCU + MPV
Show Answer

Answer (D)
22. ___ is the excess of units produced over the expected units of production. Over units of production.
a. Abnormal loss
b. Abnormal gain
c. Supernormal loss
d. Supernormal gain
Show Answer

Answer (B)

23. Liquid Assets = Current Assets = Quick Assets
a. True
b. False
Show Answer

Answer (B)
24. Larger the angle of incidence, higher is the profit.
a. True
b. False
Show Answer

Answer (A)
25. Fund include:
a. Cash
b. Total current assets
c. Networking capital
d. All of the above
Show Answer

Answer (D)
26. Which of the following statement shows major sources & uses of cash:
a. Fund flow statement
b. Cash flow statements
c. Balance sheet
d. Income expenditure
Show Answer

Answer (B)
27. ___ cost a cost which can be influenced by the action of a specified member of an undertaking.
a. Joint
b. Controllable
c. Common
d. Direct
Show Answer

Answer (B)
28. Controllable cost, variable cost and direct cost are synonymous
a. True
b. False
Show Answer

Answer (B)
29. The worker who works directly with the raw-materials in covering them to finished goods represents ___.
a. Direct expenses
b. Direct labour
c. Direct material
d. None of the above
Show Answer

Answer (B)
30. PRIME COST + Factory overheads = PRODUCTION COST.
a. True

b. False
Show Answer

Answer (B)
31. Which of the following stems are not included in the cost-sheet.
a. Preliminary expenses written off
b. Profit on sale of fixed assets
c. None of the above
d. Both a & b
Show Answer

Answer (D)
32. Unproductive wages in an item of –
a. OFFICE overheads
b. Factory overheads
c. DIRECT LABOR
d. PRODUCTION overhead
Show Answer

Answer (B)
33. Insurance overheads is allocated on the basis of –
a. Floor area
b. Capital value
c. Value of stock
d. Kilowatt
Show Answer

Answer (C)
34. Percentage of direct wage = Factory overhead X 100
Direct Wage
a. True
b. False
Show Answer

Answer (A)
35. Consolidated summary of the various functional budget is known as:
a. Common budget
b. Summarized budget
c. Master budget
d. Both b & c
Show Answer

Answer (D)

36. Depreciation is a type of ___ cost.
a. Incremental
b. Non-cash
c. Sunk
d. Imputed
Show Answer

Answer (B)
37. P/V ratio stands for profit/value ratio.
a. True

b. False
Show Answer

Answer (B)
38. The amount at any given volume of output by which the aggregate costs are changes in the volume of output is increased or decreased by one unit, is called.
a. Abruption
b. Marginal costing
c. Variable costing
d. CUP analysis
Show Answer

Answer (A)
39. Which o the following is the advantage of budgetary control –
a. Maximize output
b. Ensure teamwork
c. Controls expenditure
d. All of the above
Show Answer

Answer (D)
40. ___ Accounting to made compulsory buy law but ___ Accounting is adopted to increase the efficiency without any legal force.
a. Management, Financial
b. Cost, Financial
c. Financial, Management
d. None of the above
Show Answer

Answer (C)
41. Cash from the operation can be expressed as Net Profit + Increase in ___ – Decrease in ___.
a. Current Assets, Current liability
b. Current liability, Current Assets
c. Non operating income
d. None of the above
Show Answer

Answer (B)
42. Which of the following statement are true.
i. Allocation is defined as the allotment of whole items of cost to cost centre or cost units
ii. Apportionment means the allotment of proportions of items of cost to cost centres or cost units
a. Both I and ii
b. Only i
c. Only ii
d. None of the above
Show Answer

Answer (A)
43. A company has a current ratio of 4.5 to 1 and a liquidity ratio of 3 to 1 of merchandize inventory is Rs.24,000. Find out total current liabilities.
a. Rs.20,000
b. Rs.16,000
c. Rs.15,000

d. Rs.26,000
Show Answer

Answer (B)
44. COGS = Opening stock + ___ – ___.
a. Purchase, direct expenses
b. Direct expenses, direct income
c. Purchases, closing stock
d. Closing stock, purchases
Show Answer

Answer (C)
45. Which o the following statement is not true:
i. Abnormal costs are those cost. Which are not normally incurred at a given level of output.
ii. Relevant costs are the future costs which differ between alternatives
iii. Opportunity cost is the cost of opportunity lost
a. Both i & ii
b. Both ii & iii
c. All i, ii & iii
d. Neither of the above
Show Answer

Answer (C)
46. Which of the following feature is applied for job costing.
i. Work is executed at t6he premises of the contract
ii. The contract price is paid in instalments depending upon the program of work
iii. Price is decided on the basis of the pricing policy of the manufacturer
a. All i, ii & ii
b. Only i
c. Both i & iii
d. Neither of the above
Show Answer

Answer (C)
47. Which of the following statements are true –
i. The value of by-product is negligible
ii. The value of both joint & by-product are significant
iii. The value of both joint & by-product are negligible
iv. The value of joint & by-product is negligible
a. Both i & ii
b. ii & iii
c. ii & iv
d. i & iii
Show Answer

Answer (A)
48. Marginal Cost = ___
a. Prime cost
b. Prime cost + total variable cost
c. Fixed cost
d. All of the above
Show Answer

Answer (B)

49. P/V ratio is used in the determination of:
a. Break-Even point
b. Profit at any volume of sales
c. Sales volume to earn the desired profit
d. All of the above
Show Answer

Answer (D)
50. In Break Even chart, horizontal axis represents ___ and vertical axis represents ___.
a. Output, sales revenue
b. Cost of production output
c. Cost of production, sales revenue
d. Output, costing
Show Answer

Answer (A)
51. Which of the following statement is correct-
a. B.E.P is the point at which the total cost line cuts the total sales line
b. B.I.P is the point where the contribution is just equal to fixed costs
c. Both a & b
d. Neither a nor b
Show Answer

Answer (C)
52. ___ is the projection of cost accounting and ___ is the projection of financial accounting.
a. Budgetary control, standard costing
b. Standard costing, marginal costing
c. Standard costing, budgetary costing
d. Marginal costing, standard costing
Show Answer

Answer (B)
53. Which of the following statement are true –
i. Variable cost is one which in the aggregate varies in direct proportion to the volume of production
ii. Fixed cost is charged to finished stock or work in the program as it is treated as a period cost
iii. In small contracts, the contract price is given by the contractee on the completion of the contract
iv. Data accumulation is done through financial accounting & cost accounting system
a. i & iv
b. ii & iii
c. i, ii & iii
d. i, iii & iv
Show Answer

Answer (D)
54. M/s Jacob ltd is committed to supplying 24000 bearings per annum to the EBQ is:
a. 3200 units
b. 3600 units
c. 24,000 units
d. 324 units
Show Answer

Answer (B)
55. Arrange the following steps of budgetary control include.
i. Appointment of the budget committee

ii. Determination of budgeted period
iii. Establishment of budget centre
iv. Preparation of organizational chart
v. Determination of key factors
vi. Preparation of budget manual
a. i, ii, iv, iii, vi, v
b. ii, iii, iv, vi, v, I
c. iv, iii, I, vi, ii, v
d. iv, I, vi, v, ii, iii
Show Answer

Answer (C)
55. The following information is given: Standard quantity – 250 units. Actual quantity – 260 units. Standard price Rs.5 per unit, Actual price Rs.5.5 per unit. Calculate material variances.
The material variance is –
a. Rs.150 (A)
b. Rs.180 (A)
c. Rs.30 (F)
d. Rs.80 (A)
Show Answer: Answer (B)

B3.E8 R5 WIRELESS & MOBILE COMMUNICATION

Practical Assignments

Assignment 1: Familiarization of MatLab – Generate wave forms and implements equations using Matlab.

Assignment 2: Simulate the Analog Modulation techniques (AM) by using simulation tools.

Assignment 3: Simulate the Analog Modulation techniques (FM) by using simulation tools.

Assignment 4:Simulate the Analog Modulation techniques (PM) by using simulation tools.

Assignment 5: Simulate the Digital Modulation techniques (ASK) by using open source simulation

Assignment 6: imulate the Digital Modulation techniques (FSK) by using open source simulation tools.

Assignment 7:Simulate the Digital Modulation techniques (PSK) by using open source simulation tools.

Assignment 8: Simulate the Advanced Digital Modulation techniques (BPSK) used in Wireless and mobile communication.

Assignment 9: Simulate the Advanced Digital Modulation techniques (QPSK) used in Wireless and mobile communication.

Assignment 10: Simulate the Advanced Digital Modulation techniques (MSK) used in Wireless and mobile communication.

Assignment 11: Simulate the Advanced Digital Modulation techniques (GMSK) used in Wireless and mobile communication.

Assignment 12: Simulate various Wireless Communication - Channel models .Plot all the properties.

Assignment 13: Implement Simulation model using Matlab simulink for GSM transceiver.

Assignment 14: Implement Simulation model using Matlab simulink for CDMA (IS95) transceiver.

Assignment 15: Familiarize the AT commands of a GSM Modem.

Assignment 16: Basic Network Simulation

Introduction | Platform required to run network simulator | Backend Environment of Network Simulator | Basics of Tcl Programming for NS-2 | Agents and applications | Tracing

Assignment 17: LAN Simulation

Local Area Network | LAN Topologies | MAC Protocols | Taking turns | Ethernet | Ethernet Frame Structure | Ethernet Versions | Simulating a LAN using Network Simulator 2/3

Assignment 18: Network performance evaluation

Network Performance Evaluation | Performance Evaluation Metrics | Parameters Affecting the Performance of Networks | Performance Evaluation Techniques | Network Performance Evaluation using NS-2/3

Assignment 19: Simulating WiFi Network

Wi-Fi Networks | IEEE 802.11 Standards | Hardware Requirements for Wi-Fi | How to connect to the Wi-Fi Networks? | Advantages of Wi-Fi | Limitations | MAC Protocols | Use of RTS/CTS to Exchange Data | Issues in Wi-Fi Networks | The Hidden Terminal Problem | Solution of Hidden Terminal Problem | Exposed Terminal Problem | Solution to the Exposed Terminal Problem | Simulating a Wi-Fi using Network Simulator 3

Assignment 20: Simulating WiMAX Network

WiMAX Network | Standards | Comparison of Wi-Fi and WiMAX | How WiMAX works ? | Limitations of WiMAX | Modulation Shemes | Here some terminology,expression and table are given below | Difference between low symbol rate and high symbol rate | WIMAX module for NS-2/3 | How to download and install patch for WIMAX? | Addressing Format in ns2 | The Default address format | The Hierarchical address format | Wireless (New) Trace File Format | Description of New Trace File Format | Wireless Trace File Format

Assignment 21: Simulating a Mobile Adhoc Network

Ad Hoc Network | Mobile Ad-hoc NETwork (MANET) | Routing | Routing in MANET | Routing protocols for MANET | Destination-Sequenced Distance-Vector (DSDV) algorithm: | Dynamic source routing (DSR) | Application of MANET | Advantages | Disadvantages | Simulating a MANET using Network Simulator 2/3

Assignment 22: Simulating WSN

Wireless Sensor Networks | Basic Characteristics of WSNs | Operating Systems for WSNs | Differences with Mobile Ad hoc Networks | Types of Wireless Sensor Networks | Routing protocols for WSNs | Clusters and Cluster heads in WSNs | The LEACH Protocol | Operation of LEACH | Discussions on LEACH | Applications of WSNs | Simulating a WSN using Network Simulator 2/3

Assignment 23: Setting up of Bluetooth Network

Bluetooth Network | Who started Bluetooth ? | Bluetooth vs Wi-Fi | Bluetooth – Power Classes | Bluetooth - Versions | How does Bluetooth work ? | Networking of Bluetooth | How to connect Bluetooth ? | Simulating Bluetooth Network with NS-2/3

Assignment 24: Setting up of Zigbee Network

ZigBee Network | IEEE 802.15.4 and ZigBee | ZigBee vs. Bluetooth | Features & Characteristic of ZigBee Technology | Application of ZigBee Technology | Component of IEEE 802.15.4 LR-WPAN | Network Topologies | ZigBee Architecture | The Superframe structure | Nodes Configuration | Energy Model.

Assignment 25: Families the AT commands of Wireless Modems

Bluetooth: Explore - How to pair between devices and Connect between modems

Zigbee: explore different supported topologies and data transmission between devices

WiF- : Explore and create topologies such as adhoc and infrastructure modes WiFi with help of Modem and APs.

B3.E9-R5 BLOCKCHAIN TECHNOLOGY

Assignment 1.

Write a Solidity contract with function calculate (int, int) which returns sum, product, division, subtraction, exponential and modulus of the two numbers passed. Check that the second number cannot be zero.

Assignment 2.

Write a solidity contract in which an integer array to be taken. Write functions addtoarray(int), removefromarray(), getlength and removeindex(int).

Assignment 3.

Write a solidity contract bank having customerid, cutomername, accounttype, balance. Make necessary constructor and functions to add a customer, search a customer with customerid, deposit an withdraw amount and update the balances accordingly.

Assignment 4.

Install Node JS web server. Write a small application which opens a home page which consists of a Form with some input data and submit button.

Assignment 5.

Install Hyperledger Fabric Network on a Linux Machine with Two peer and One Orderer Nodes.

Assignment 6.

On above Hyperledger Fabric Network, Create A channel and run chaincode.

Assignment 7.

Use case: Make a Chain Code for Storing of an car as an asset. This should have following attributes: AssetId, Owner, color, model, price.

Assignment 8.

Develop a Client Application in HTML/Java Script which connects with chaincode to do a transaction related to Car Asset.

Section 4:

Sample Question Papers

B0.1-R5: BASIC MATHEMATICS

Model Question Paper

Note:

1. Answer question 1 and any four questions from 2 to 6.

2. Parts of the same question should be answered together and in the same sequence.

Time allotted: 3 hours **Total Marks :100**

1.

(a) In a G.P, the second term is 12 and the sixth term is 192. Find the 11th term. (4)

(b) Let A=$\begin{bmatrix} 1 & 2 \\ -1 & 0 \end{bmatrix}$ and B=$\begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix}$.

Find whether A+B=B+A is true or not? (2)

(c) Let A=$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

Find Inverse of A ? (4)

(d) Find the coordinates of the midpoint of the segment whose endpoints are (4, 0) and (-2, 4).

(2)

(e) 0.4i+0.8j+ck represents a unit vector, find value of c? (3)

(f) Evaluate $\lim_{x \to 0} \frac{x^2-100}{x-10}$ (3)

(g) The function

$f(x) = e^x$ if $x <= 1$

$ax + b$ if $x > 1$

is continuous at x=1. Find value of a and b. (4)

(h) Determine if the following series is convergent or divergent. If it converges determine its value. $\sum_{n=1}^{\infty} n$ (4)

(i) Evaluate the integral $\int (4x^6 - 7x + 3)\, dx$ (2)

2.

a) If x, 2y, 3z are in A.P. where the distinct numbers x, y, z are in G.P., then find common ratio of the G.P.?
(4)

b) Solve the following system of equations

$$2x + 5y + 2z = -38$$
$$3x - 2y + 4z = 17$$
$$-6x + y - 7z = -12$$ **(7)**

(c) Find the equation of the line, if the perpendicular drawn from the origin makes an angle 30◦ with x-axis and its length is 12.
(7)

3.

a) Obtain the equation of the circles with radius 5 cm and touching x-axis at the origin
(4)

b) Find Value of Unit Vector in the direction of A=5i-12j
(5)

c) Find $\frac{dy}{dx}$ $when\ y = \frac{(x+2)^{3\ln(x)}}{\sqrt{(x^2+1)}}$ (9)

4.

a) Find $\lim_{h\to 0} \frac{sin^7\left(\frac{\pi}{6}+\frac{h}{2}\right)-\left(\frac{1}{2}\right)^7}{h}$ (4)

b) A balloon is rising at a constant speed 4m/sec. A boy is cycling along a straight road at a speed of 8m/sec. When he passes under the balloon, it is 36 metres above him. How fast is the distance between the boy and balloon increasing 3 seconds later? (7)

c) Find the value of $\int 2x \cos(x^2 - 5)$. (7)

5.

a) Find $\int_0^1 \frac{1}{1+x^2} dx$ (4)

b) Find the integration of $\int \frac{e^{\tan^{-1} x}}{1+x^2} dx$ (7)

c) Find $\int_0^{\pi/4} (sec^2\, t\, 2sec(t)tan(t)dt$ (7)

6.

a) Find $\int_0^1 \frac{1}{4+x^2} dx$ (4)

b) Find the integration of $\int_2^5 \frac{6z^5 - 8z^4 + 2z^2}{z^4} dz$ (7)

c) Let a, b and c be vectors with magnitudes 3, 4 and 5 respectively and a + b + c = 0, then find the values of a.b + b.c + c.a ?
(7)

B1.1-R5: MANAGEMENT FUNDAMENTALS & INFORMATION SYSTEMS

Time:03 Hrs. **Total Marks: 100**

Note: Question number 1 is compulsory. Attempt any four questions from Q2 to Q7

Q1 Explain the followings.

i. Vision and mission.
ii. Levels of management.
iii. Time management
iv. ERP Market
v. RAD model
vi. Transactional Processing System
vii. Control Process.

(7 X 4=28)

Q2 i). Explain various functions of management.
ii). Explain system based approach towards management.
iii). What are six pillars of classical organizational theory?

(3 X 6=18)

Q3 i). Explain the importance of motivation in organizations and also describe the types of motivation.
ii). Explain SWOT analysis. Why management needs SWOT analysis? What questions must be answer in SWOT analysis?
iii). Explain formal and informal organization in detail.

(3 X 6=18)

Q4 i). Explain the concept of stress at work. As a manager, what steps you will take to prevent and manage stress in the organization?
ii) What are major types of information systems at various level of management?

(6,12)

Q5 i). Explain the concept of stress at work. As a manager, what steps you will take to prevent and manage stress in the organization?
ii). What is GDSS? What are its components? Explain the role of GDSS in management.
iii). What are possible sub-systems of payroll system?

(3 X 6=18)

Q6 i). What is supply chain management. What are its modules?
ii). Explain in detail SAF.
iii). What are tools of information security?

(3 X 6=18)

Q7 i). Explain in detail the system vulnerability.
ii). Explain the stages of project management.
iii). Explain the modules of educational ERP.

(4, 7,7)

B1.2-R5: DISCRETE STRUCTURES

Note:

1. **Answer question 1 and any four questions from 2 to 6.**
2. **Question 1 is of 28 marks and the rest are of 18 marks each.**
3. **Parts of the same question should be answered together and in the same sequence.**

Time allotted: 3 hours **Total Marks :100**

Q1.

(a) Determine whether each of the following is true or false and explain why. Note that ∅ stands for the empty set. (4)

I. $\emptyset \subseteq \emptyset$
II. $\emptyset \in \emptyset$
III. $\emptyset \in \{\emptyset\}$
IV. $\emptyset \subseteq \{\emptyset\}$

(b) What is tautology and predicates? Explain with suitable examples. (4)

(c) Find complexity of following function? (4)

```
int fun (int n)
{
 int count = 0;
 for (int i = n; i > 0; i /= 2)
    for (int j = 0; j < i; j++)
       count += 1;
 return count;
}
```

(d) A graph G has 21 Edges, 3 vertices of degree 4 and other vertices are of degree 3. Find the number of vertices in G. (4)

(e) How many permutations of letters of the word APPLE are there? (4)

(f) What is memorization in Dynamic Programming? Explain with suitable example. (4)

(g) Explain the concept of average case time complexity? What is the average case time complexity for finding the height of the binary tree? (4)

Q2.

(a) If R is a relation "Less Than" from A = {1,2,3,4} to B = {1,3,5} then find RoR^{-1}. (6)

(b) Show that $(P \rightarrow Q) \vee (Q \rightarrow P)$ is a tautology. (6)

(c) What is recurrence for worst case of QuickSort and what is the time complexity in Worst case?

(6)

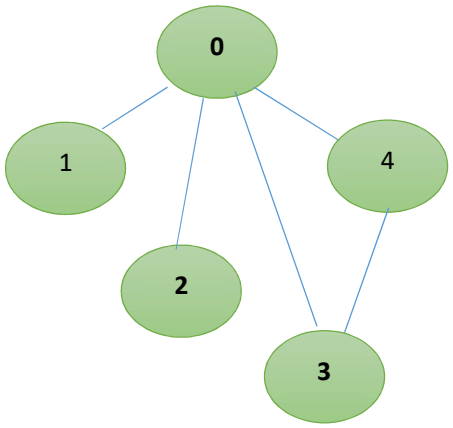
Q3.

(a) What is the Complexity of an Algorithm, explain difference between Time and Space Complexity. (6)

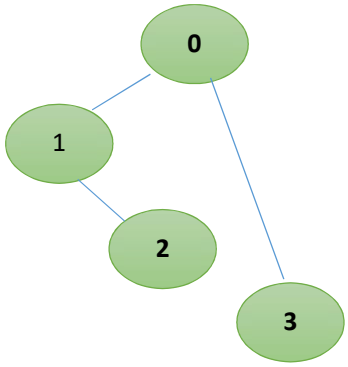
(b) Write an algorithm to reverse a string. For example, if my string is "apple" then my result will be "elppa". (4)

(c) Given two connected undirected graphs. Perform a Depth First Traversal of the graph. (8)

A

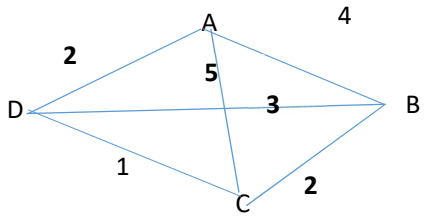


B



Q4.

(a) What is Minimal Spanning Tree? Write an appropriate algorithm to find minimal spanning tree of following graph? (10)



(b) Write an algorithm to check whether the graph contains a cycle or not. Your function should return true if the given graph contains at least one cycle, else return false. (8)

[Input: n = 4, e = 6

0 -> 1, 0 -> 2, 1 -> 2, 2 -> 0, 2 -> 3, 3 -> 3]

Q5.

(a) A Box contains 12 red and 12 blue balls, all unmatched. A person takes balls out at random in the dark. How many balls must he take out to be sure that he has at least two blue balls? (10)

(b) Solve the Recurrence relation $\boldsymbol{a_n = 5a_{n-1} + 7n; a_1 = 5}$ (8)

Q6.

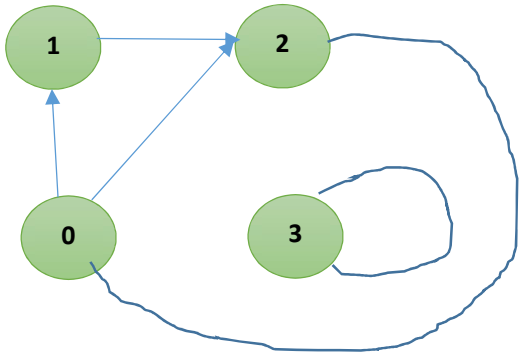
(a) What is Dynamic Programming.? Explain with a suitable example. (6)

(b) What is difference between recursion and dynamic programming? Explain with a suitable example. (4)

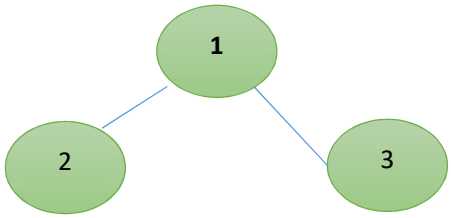
(c) Explain the concept of Sub problems and overlapping subproblems using appropriate example.

(8)

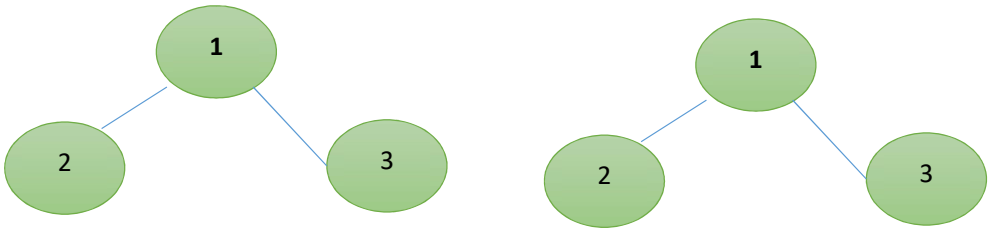
1. Given a directed graph, write a python function to check whether the graph contains a cycle or not. Your function should return true if the given graph contains at least one cycle, else return false.



2. Write a Python Code to find height of a binary tree



3. We have two Binary trees. Write a Python Code to check whether these are identical or not?



4. Given an M × N matrix of integers where each cell has a cost associated with it, Write a python code to find the minimum cost to reach the last cell (M-1, N-1) of the matrix from its first cell (0, 0). We can only move one unit right or one unit down from any cell, i.e., from cell (i, j), we can move to (i, j+1) or (i+1, j).
5. Write a Python code to solve $a_n=5a_{n-1}+7n$, a1=5.
6. Write a Python code to expand $(1+x)^5$.
7. Write a Python code to check whether a graph is planar ?

B1.3-R5 SOFTWARE ENGINEERING

TIME: 3 HOURS TOTAL MARKS: 100

Answer question 1 and any EIGHT questions from 2 to 10.

Scenerio1:

ABC Computer Institute is a computer training institute conducting some computer courses. They have new intakes every three months. A candidate is given an Entrance test before admission. A candidate must score at least 50 out of 100 marks to get admission to the course. If a candidate gets more than 90 marks, the candidate will get a discount of 10% on the fees. This test can be conducted on any working day before the new term begins. An examiner is responsible for conducting the test and registering the candidate who passes the entrance test. Even though the institute has enough computers, the institute still prefers to conduct paper-based tests.

Entrance test

A test consists of 100 multiple choice questions in General English and Mathematics. There is only one correct option for each question. A total of 100 minutes is allotted for each test. A candidate needs to plan their timing during the test as there is no electronic timer or counter available. From time to time, an examiner reorganizes the questions for the tests. An examiner removes some questions with a black marker pen and adds new handwritten questions on the test paper.

An examiner manages the marking and results of the tests daily. An examiner marks a test script immediately after a test. Sometimes, an examiner gives the test result on the same day (if there are not many candidates taking the test). However, the candidates may have to wait for 1 to 2 days for the results. As the business expands, the manual handling of the Entrance test cannot cope with the increasing numbers of candidates. The institute's management would like to engage you in analyzing and designing a solution for the handling of candidate and Entrance tests.

1. Give the difference between the validation and verification process with an example. [4]

2. [4+8=12]
   a. Describe a knowledge gap in the solution space.
   b. Prepare a **domain model** for the proposed system at Computer Institute based on scenerio1.

3. [2+4+6=12]
   a. Discuss a goal for each actor identified from the scenario
   b. Write a detailed description of UseCase: **Delete a Candidate.**
   c. Draw an Activity Diagram to show the workflow of Edit Question in the proposed system.

4. [3+5+4=12]
   a. Give any five characteristics of a good test case.

b. Give the difference between Boundary testing and sequence testing with one example of each.
c. Consider the condition illustrated in the scenerio1, and write **two** test cases for the White Box Testing.

5. [4+4+4=12]

a. A software team is developing a web-based e-commerce application. The team has a very good understanding of the requirements. However, the requirements of this application are frequently changing and need lots of clarification from the customer. What will be a suitable development methodology for such development, and why?
b. Give three reasons why Change Management is an important aspect of a software project.
c. What are the attributes of good software?

6. [2+6+4=12]

a. Give the difference between Scheduling based on Time-boxed and Activity based.
b. Draw a sample AON and AOA diagrams with examples.
c. Brief the process of Cleanroom Software Engineering

7. [4+4+4=12]

a. Give the difference between a test case and a test script.
b. Discuss the Internal quality factors and external quality factors.
c. Brief the process of SCRUM

8. [4+4+4=12]

a. Give the difference between Risk drivers and Project forces
b. Discuss the object-oriented design
c. A team takes 100 hours to finish a project. They spent 5hours having a party. Calculate the Ideal Time and real time.

9. Answer the following questions as per the given scenario [6+3+3=12]

a. How can the Scrum method apply to the design and development of such a project? Explain with suitable examples.
b. Will Scrum always work? Justify your answer
c. Give the difference between 'use case and user story.'

10. [3+9=12]

a. Explain a test case with an example
b. Consider the condition illustrated in the scenerio1, and write **three** test cases for the Black Box Testing.

Scenerio2

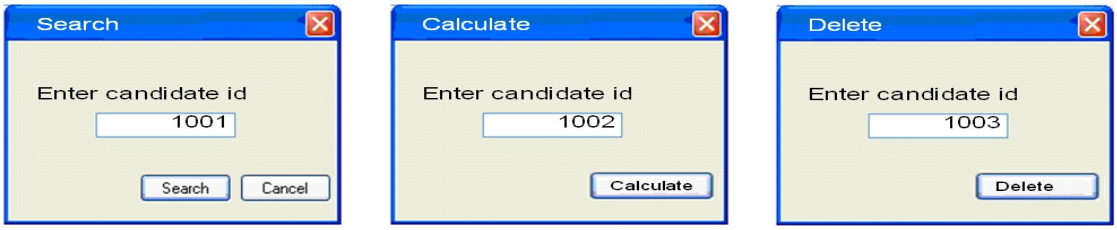


Figure 1: Screens for searching, calculating and deleting the candidate

Figure 2: Output for search, calculating and deleting the candidate

Search Screen: The examiner uses it to search for a candidate.

Calculate Screen: The examiner uses it to recalculate the test result if there is any request from a candidate.

Delete Screen: The examiner uses it to delete a candidate's details.

Table 1: Content of test result file

	Candidate id	Marks Obtained	Display Result	Display Earn discount %
1	1001	95	Pass	10
2	1002	45	Fail	0
3	1003	95	Pass	0

B1.4-R5: OPERATING SYSTEMS

NOTE:

1.Answer question 1 and any FOUR questions from 2 to 7.

2.Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 100**

1.

a) How can one distinguish between Processes, Threads and Jobs ?

b) What are types of Embedded Sysstems?

c) What is a virtual memory space? How is it different from a physical memory space?

d) Distinguish between Demand Paging and normal Paging.

e) What does Process Virtualization do? What security threat does it address ?

f) What is Virtualisation and what is role of docker containers.

g) How is swap space management done in Linux.

(7 x 4)

2.

a) Describe in brief, the different attributes associated with any file in a typical computer system along with the relevance/usefulness of each of these attributes.

b) What is Hypervisor? Define the two types of Hypervisor. Give Examples of each type.

c) What are ACL's? What are its types?

(6+8+4)

3.

a) Why are spinlocks not appropriate for single-processor systems but are often used in multiprocessor systems. Explain briefly.

b) Consider the following snapshot of a system:

Allocation	Max	Available
A B C D	A B C D	A B C D

P0	0 0 1 2	0 0 1 2	1 5 2 0
P1	1 0 0 0	1 7 5 0	
P2	1 3 5 4	2 3 5 6	
P3	0 6 3 2	0 6 5 2	
P4	0 0 1 4	0 6 5 6	

Answer the following using the banker's algorithm:

(i) What is the content of the matrix Need ?

(ii) Is the system in a safe state ?

(iii) If a request from process P1 arrives for resources (0,4,2,0), can the request be granted immediately ?

(6+12)

4.

a) Explain the basic differences between a security/protection policy and protection mechanism as existing in any contemporary computer system.

b) Explain SELinux. Why is it required?

c) What is a password? Why is it used? Describe the various types of password validation techniques as used in any computer system.

(4+6+8)

5. Consider the following page reference string:

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.

a) How many page faults would occur for the following page replacement algorithms, assuming two, four, seven frames? Assume all frames are initially empty.

- LRU replacement
- FIFO replacement
- Optimal replacement

b) Could a RAID level 1 organization achieve better performance for read requests than a RAID level 0 organization (with nonredundant striping of data)? If so, how ?

(12 +6)

6.

a) A disk has 1000 cylinders, numbered 0 to 999. The drive is currently serving a request at cylinder 135, and the queue of pending requests is:

89, 470, 913, 775, 948, 509, 33, 11, 134, 230

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for Elevator and C-Look disk-scheduling algorithms?

Previous request was at cylinder 100. Draw the head movement diagrams for each scheduling algorithm.

b) Briefly discuss the differences between Partitions, Volumes and Multi-Partition.

c) In Producer-Consumer problem, two processes share a common, fixed-size buffer. The problem with that approach is that a wakeup sent to a process is lost. Semaphores solve the lost-wakeup problem. How that problem can be solved with the help of semaphore?

(8+5+5)

7.

a) State the necessary conditions for a deadlock to occur with examples.

b) Suppose that the following processes arrive for execution at the times indicated. Each process will run for the amount of time listed. In answering the questions, use non-preemptive scheduling, and base all decisions on the information you have at the time the decision must be made.

Process	Arrival Time	Burst Time
P1	0.0	8
P2	0.4	4
P3	1.0	1

What is the average turnaround time for these processes with the FCFS scheduling algorithm?

What is the average turnaround time for these processes with the SJF scheduling algorithm? The SJF algorithm is supposed to improve performance, but notice that we chose to run process P1 at time 0 because we did not know that two shorter processes would arrive soon.

Compute what the average turnaround time will be if the CPU is left idle for the first 1 unit and then SJF scheduling is used.

c) Show that, if the wait() and signal() semaphore operations are not executed atomically, then mutual exclusion may be violated.

(3+10+5)

B 1.5 R5 DATA COMMUNICATION AND COMPUTER NETWORKS

Time:03 Hrs. **Total Marks: 100**

Note: - Answer all(a-g) from Q1 and attempt any four questions from Q2 to Q7

Q 1.

a. Explain Inter-network, Intra-network, Network Segmentation, Collision, and Broadcast Domains.
b. How can we distinguish a multicast address in IPV6 addressing?
c. Calculate the baud rate for the bit rate of 2000 bps and the modulation used is FSK.
d. A line has a signal-to-noise ratio of 1000 and a bandwidth of 4000 kHz. What is the maximum data rate supported by this line?
e. Explain Maximum transmission unit, Path MTU Discovery (PMTUD) and Maximum Segment Size (MSS)
f. What is SD-WAN (Software-Defined Wide Area Network)?
g. Explain 3-Way Handshake Protocol. (7x4)

Q 2.

i. Explain types of data protocols and network protocols used in IoT
ii. What is Content Delivery Network (CDN) and list the types of CDN techniques
iii. Explain Network Function Virtualization (NFV) and Intent-based networking (IBN). (6+6+6)

Q 3.

i. Explain different types of addresses used to uniquely identify a service or node/device at Transport, Network, Application and Data Link Layer.
ii. What are the 03 categories of Logical port ?
iii. Compare TCP and UDP Protocol. Also explain the circumstances, when UDP is chosen as the preferred protocol over the TCP protocol.
iv. Explain the steps involved in computing the checksum for a given message frame Data Polynomial D(x) = 11001010101, Generator polynomial G(x) =x4 + x3 + x + 1 (4+3+4+7)

Q 4.

i. What is Pulse Code Modulation? obtain a pulse coded modulated wave from an analog waveform?
ii. Describe sampling, quantizing, and encoding in analog to digital transmission.
iii. What is the difference between Circuit Switching and Packet Switching?
iv. List and Explain flow control mechanisms available in Transport Layer (4+4+3+7)

Q 5.

i. What are Sockets? List different types of Socket Methods used in python.
ii. List and explain two levels of access to network programming in Python.
iii. Explain SOCK_STREAM and SOCK_DGRAM
iv. List and describe Server, Client and General methods used in python. (4+4+4+6)

Q 6.

i. What do you mean by QoS? Describe and compare Integrated Service and Differential Services.
ii. Explain Voice Over IP (VOIP) and list different VOIP protocols
iii. What is the different type of service used in Multimedia Application and list the

performance requirement of Multimedia Application
(6+5+4)

Q 7.

i. Differentiate static routing and dynamic routing. Also describe any dynamic routing algorithm.

ii. What are the salient features of IPv6 address space? Explain different types of Transition mechanism
for IPv4 to IPv6

iii. Explain BGP and OSPF Routing Protocol. (5+7+6)

B2.1-R5: COMPUTER BASED STATISTICAL AND NUMERICAL METHODS

NOTE:

1. Answer question 1 and any four questions from 2 to 6.

2. parts of the same question must be answered in sequence and together.

TOTAL TIME: 3 Hours **TOTAL MARKS: 100**

Q1.

(a). Two competing software companies are after an important contract. Company A is twice as likely to win this competition as company B. Find the probability to win the contract for A and B?

(4)

(b). In a recent production, 5% of certain electronic components are defective. We need to find 12 non-defective components for our 12 new computers. Components are tested until 12 non-defective ones are found. What is the probability that more than 15 components will have to be tested? (4)

(c). Salaries of entry-level computer engineers have Normal distribution with unknown mean and variance. Three randomly selected computer engineers have salaries (in INR 1000s): 30, 50, 70. Find 90% confidence interval for the average salary of an entry-level computer engineer. (4)

(d). Calculate the regression coefficient and obtain the lines of regression for the following data

X	1	2	3	4	5	6	7
Y	9	8	10	12	11	13	14

(4)

(e.) What is meant by precision? Can we say an instrument of high precision is accurate? Explain with suitable example. (4)

(f). Write these equations in matrix form: (4)

$$6x - 2y + 3z = 12,$$

$$x + y + z = 8,$$

(g). With the help of suitable example, explain differences between algebraic and transcendental equations.? (4)

Q2.

(a). Suppose that a shuttle's launch depends on three key devices that operate independently of each other and malfunction with probabilities 0.01, 0.02, and 0.02 respectively. If any of the key devices malfunction, the launch will be postponed. Compute the probability for the shuttle to be launched on time, according to its schedule. (6)

(b). A computer virus is trying to corrupt two files. The first file will be corrupted with probability 0.4. Independently of it, the second file will be corrupted with probability 0.3.

(i) Compute the probability mass function (pmf) of X, the number of corrupted files.

(ii) Draw a graph of its cumulative distribution function (cdf). (6)

(c). Ninety percent of flights depart on time. Eighty percent of flights arrive on time. Seventy-five percent of flights depart on time and arrive on time.

(i) You are meeting a flight that departed on time. What is the probability that it will arrive on time?

(ii) You have met a flight, and it arrived on time. What is the probability that it departed on time?

(iii) Are the events, departing on time and arriving on time, independent?

(6)

Q3.

(a). A manager evaluates effectiveness of a major hardware upgrade by running a certain process 50 times before the upgrade and 50 times after it. Based on these data, the average running time is 8.5 minutes before the upgrade, 7.2 minutes after it. Historically, the standard deviation has been 1.8 minutes, and presumably it has not changed. Construct a 90% confidence interval showing how much the mean running time reduced due to the hardware upgrade. (6)

(b). A candidate prepares for the local elections. During his campaign, 42 out of 70 randomly selected people in town A and 59 out of 100 randomly selected people in town B showed they would vote for this candidate. Estimate the difference in support that this candidate is getting in towns A and B with 95% confidence. Can we state affirmatively that the candidate gets a stronger support in town A? (6)

(c). Calculate the two regression equations of X on Y and Y on X from the data given below, taking deviations from an actual means of X and Y. Estimate the likely demand when the price is Rs.20. (6)

Price (Rs)	10	12	13	12	16	15
Amount demanded	40	38	43	45	37	43

Q4.

(a). Find the means of X and Y variables and the coefficient of correlation between them from the following two regression equations: (6)

$$2Y - X - 50 = 0$$

$$3Y - 2X - 10 = 0.$$

(b). There are two series of index numbers P for price index and S for stock of the commodity. The mean and standard deviation of P are 100 and 8 and of S are 103 and 4 respectively. The correlation coefficient between the two series is 0.4. With these data obtain the regression lines of P on S and S on P. (6)

(c). Use Gaussian elimination with partial pivoting to solve the following (given as the augmented matrix): (6)

$$\left[\begin{array}{ccc|c} 3 & 1 & -4 & 7 \\ -2 & 3 & 1 & -5 \\ 2 & 0 & 5 & 10 \end{array}\right]$$

Q5.

(a). Find first approximation to a real root of the equation $x^3 - 3x^2 - 2 = 0$ by regula falsi method between 3 and 4.? (6)

(b). Given the values for x and f(x) in Table below, use the trapezoidal rule to estimate the integral from x = 1.8 to x = 3.4 (6)

x	f(x)		x	f(x)
1.6	4.953		2.8	16.445
1.8	6.050		3.0	20.086
2.0	7.389		3.2	24.533
2.2	9.025		3.4	29.964
2.4	11.023		3.6	36.598
2.6	13.464		3.8	44.701

(c). Find the integral of e^{-x^2} between x = 0.2 and x = 2.6. Compare the results at varying values for h with the trapezoidal rule, Simpson's 1/3rd rule, and Simpson's 3/8th rule. (6)

Q6.

(a). A sample of 6 measurements 2.5, 7.4, 8.0, 4.5, 7.4, 9.2 is collected from a Normal distribution with mean μ and standard deviation σ = 2.2. Test whether μ = 6 against a two-sided alternative $H_A: \mu \neq 6$ at the 5% level of significance. (6)

(b). The refractive index (μ) of water is found to have the values 1.29, 1.33, 1.34, 1.35, 1.32, 1.36, 1.30 and 1.33. Calculate the mean value, absolute error, the relative error and the percentage error.

(6)

(c). The number of concurrent users for some internet service provider has always averaged 5000 with a standard deviation of 800. After an equipment upgrade, the average number of users at 100 randomly selected moments of time is 5200. Does it indicate, at a 5% level of significance, that the mean number of concurrent users has increased.? Assume that the standard deviation of the number of concurrent users has not changed. (6)

B2.2 R5 PROFESSIONAL AND BUSINESS COMMUNICATION

NOTE:

1. **Answer question 1 and any four questions from 2 to 7.**
2. **Parts of the same question must be answered in sequence and together.**

TOTAL TIME: 3 Hours **TOTAL MARKS: 100**

1. (7 x 4)

a) What are pre-interview preparations to be done?
b) How to create effective resumes?
c) Enumerate features of a good web site.
d) Bring out the importance of ON-Line Help systems.
e) Give salient etiquette of electronic communication – emailing and chatting
f) Web 2.0 Tools and their relevance in social networking.
g) How has PC become the most powerful tool of communication for the modern business?

2. (8+5+5)

a) Describe the various communication styles. Illustrate by examples.
b) What steps would you follow to improve your communication?
c) How can you communicate clearly and effectively? Highlight the use of body language.

3. (8+5+5)

a) What are the basic writing skills? Give illustrations.
b) Discuss the basic guidelines for writing effective business letters.
c) How to write reports and structure memos? Write a sample of each.

4. (5+5+4+4)

a) List the guidelines for improving the listening skills?
b) Bring out reasons as to why it is important to practice effective listening techniques.
c) What are the do's & don'ts of listening?

d) How to make others to listen you?

5. (5+5+4+4)
   a) How to plan for a presentation? Enumerate the features of a good presentation.
   b) How to organize a persuasive presentation?
   c) List the steps to analyze the audience before and during the presentation?
   d) How to handle questions effectively?
6. (8+5+5)
   a) Discuss how one can be a good team player? Assume you are a team leader, what strategies would you adopt to help your team work together more effectively and efficiently?
   b) How to conduct a negotiation? How to establish your terms of agreement?
   c) Discuss the essence of communication technology in your workplace.
7. (5+5+4+4)
   a) What steps to follow to create first impressions and impact?
   b) How to understand the supervisor Styles?
   c) How to manage physical culture?
   d) How to avoid clashes during group discussion?

B2.3 R5 ADVANCED DATABASE TECHNOLOGIES

TIME: 3 HOURS **TOTAL MARKS: 100**

Answer question 1 and any SIX questions from 2 to 9.

1. (2x5=10)
   a. Rise of Open source databases
   b. Future of Database security
   c. Query Optimization process
   d. Data Cube and data marts
   e. R trees

2. [5+5+5=15]
   a. Explain the components of a complete database system
   b. What is a distributed database system? Explain.
   c. Write a note on different types of database users

3. [5+6+4=15]
   a. What is an integrity constraint? Explain domain constraints and Foreign key/ referential constraints.
   b. Define Normalization. Explain four forms of Normalization.
   c. Explain the DML and DCL.

4. [8+7=15]

a. What are the limitations of the Relational Model? Compared to the relational model, what are the motivation and advantages of semantic and object-oriented database models?
b. What are the main features of the various semantic database models and their relative comparison of features?

5. [7+8=15]
a. What are the comparative features of various prominent OODBMS products? Distinguish the capabilities of OODBMS & ORDBMS products with examples.
b. If you run the following DDL script: How many entries are created in TABLES, TAB_COLUMNS, CONSTRAINTS and CONS_COLUMNS?

```
CREATE TABLE DELIVERY
    (DELIVERYID   NUMBER,
     ORDLINEID    NUMBER,
     DELIVERYDATE  DATE,
     DELIVERQTY   DECIMAL(4),
     CONSTRAINT PK_DELIVERY PRIMARY KEY (DELIVERYID),
     CONSTRAINT FK_DELIVERY_ORDLINEID FOREIGN KEY
(ORDLINEID) REFERENCES ORDLINE);
```

6. [6+5+4=15]
a. Explain the ACID with an example. What problems occur if a transaction is only partially completed?
b. What causes a Transaction to Commit or Rollback?
c. What is a checkpoint? What is its purpose?

7. [5+5+5=15]
a. Give the difference between a Transaction Manager and a File Manager
b. Give an example of a transaction that must have more than one SQL statement to take the database from one consistent state to another.
c. What is the impact of ON DELETE CASCADE in a Foreign Key constraint? Explain with example

8. [5+5+5=15]
a. Give an example of a lost update.
b. What is the difference between serial and serializable execution?
c. Why the log file grows very quickly? What are the uses of Log Records during system failure?

9. [4+6+3+2=15]
Design the data warehouse for a new wholesale ABC company which deals with varieties of products. The company has promotion schemes to promote the products. The data warehouse has to allow analyzing the company's situation at least concerning the products, promotions, stores, customers and time. The company is interested in learning the quantity sold, promotion scheme and sales amount of the product. Assume the possible attributes for any dimensions.
a. Give names of fact tables with important keys and dimension tables and measures of such DW.

b. Design the DW star schema showing the necessary relationships

c. Please give the name of two data mart and provide their benefits
d. What are the possible results (s) you can use aspect after using Rollup and Drilldown functions

B2.4 R5 COMPUTER GRAPHICS AND MULTIMEDIA

NOTE :

1. Question no 1 is compulsory, answer any 04 from Q2 to Q7.
2. Parts of the same question should be answered together and in the same sequence.

Q1.
a) Explain Raster Scan System
b) Discuss Matrix representation
c) What is text clipping
d) Explain Bezier and B-Spline surfaces
e) Explain Parallel Projection and its various types
f) What is MIDI? How is a basic MIDI message structured
g) What are the components of a typical sound card? Explain briefly.
(7x4)
Q2

a) Explain about different line drawing algorithms

b) Derive Bresenham circle algorithm with radius.
c) Explain Input devices
(3x6)

Q3
a) How to calculate the inverse of a matrix? Explain with relevant examples
b) Find the equation of a circle passing through the three points P1(1,2), P2(3,0) and P3(0,-4).
c) Explain the Cohen-Sutherland Line clipping algorithm for 2D. (3x6)

Q4
a) Clip the line with endpoints (0, 60) and (60, 120) against a window with lower left corner and upper right corners (10, 10) and (110, 110) using midpoint subdivision method.
b) Explain the Bezier technique for generating curves with examples.
c) Explain shading algorithms? (3x6)

Q5 Explain the following
a) Flood fill algorithm
b) 3D scaling
c) Vectors and Co-ordinate System (3x6)

Q6
a) Write short notes on matrix representation and homogenous coordinates
b) Draw a flowchart illustrating the logic for the Sutherland-Hodgman polygon clipping algorithm.
c) Differentiate between Morphing and Tweening
(3x6)

Q 7
a) Define animation and what are its different uses
b) What do understand by Keyframes and Tweening
c) What are the various types of Audible Sounds
(3x6)

B2.5-R5 IOT & CLOUD SERVICES

Note:

1. Answer question 1 and any **FOUR** questions from 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 100**

1.

a) What is FOG computing.
b) How SMQTT is better than MQTT protocol.
c) OAuth2 access management protocol.

d) Discuss the role of three- stage pipeline in ARM Cortex-M3.
e) How DNS system helps to navigate Internet efficiently.
f) Give important security concerns related to IoT devices.
g) What is the role of web server in Internet?

(7 x 4)

2.

a) Describe the evolution and main trends of the microcontroller market until the appearance of ARM Cortex core micro controllers.
b) How Classless Inter-Domain Routing (CIDR) efficiently handle the IP address management. Discuss.
c) What is the role of bigdata in cloud environment?

(7, 6, 5)

3.

a) Describe the architecture of low power ARM Cortex M3 Processor. How it is advantageous as compared to ARM family.
b) Explain briefly working of any two IoT transport layer protocols.
c) Compare the different Bluetooth generations.

(7,6,5)

4.

a) What do you mean by RESTful services in relation to IoT connectivity? How they are beneficial for the IoT communication.
b) How mesh network is managed under Zigbee standard.
c) Discuss how IoT improves the Food supply chain tracking.

(7,6,5)

5.

a) Discuss and compare IoT connectivity standards – LoRaWAN vs NB-IoT
b) Explain the different security threats faced by typical IoT system.
c) What is meant by predictive maintenance in IIoT ecosystem?

(6,7,5)

6.

a) Discuss the security aspects in opensource IoT cloud platforms.
b) Explain the role of 6LoWPAN protocol in IoT and M2M communication.
c) What is edge computing in IoT ecosystem?

(7,7,4)

7. Write short notes on any three of the followings

a) IPv6
b) Edge computing
c) IoT reference model Architecture
d) 6LoWPAN

(6 x 3)

B3.1 R5 SOFTWARE PROJECT MANAGEMENT

TIME: 3 HOURS TOTAL MARKS: 100

Answer any TEN questions.

1. (2x5=10)
   a. Give the names of the internal factors and the external factors involved in SWOT analysis?
   b. List the four different facilitating functions to Project Management
   c. Milestones are very important in any project planning. Justify your answer.
   d. Should we create WBS before scheduling a project, even if the project is very small? Justify your answer.
   e. What are the principal risk drivers?

2. (2x5=10)
   a. Define a slack. Give difference between the two types of float.
   b. Give at least two differences between the Scheduling Techniques- Time-boxed and Activity based.
   c. What is different between a direct and indirect software measures?
   d. What problems arise when using LOC as software metric?
   e. Give any two main purposes of the Change Management.

3. Consider the following scenario and answer the following question [3+7=10]

Smith's Car Park Operators provide parking management services to a local authority. This involves services for ten car parks, two of them multi-storey, plus on-street parking including taking enforcement such as issuing parking tickets. The company's control room is at the town centre multi-storey car park. To service this contract, the company employs 40 people, full-time and part-time. Eight do mainly clerical jobs using computers and the rest are parking attendants (PAs) working shifts of 6.00-14.00, 14.00-22.00 and 22.00-6.00, seven days a week. Four of the car parks are open at night, including both multi-storey car parks, and eight staff work nights. Some nights are very cold. The manager is also planning to computerise the whole system with GPS capabilities to monitor the parked cars, free parking slots, locations of the PAs. All PAs has an id card in which a chip is attached for easily located by GPS system.

You have been a task to make a report to have following contains.
   a. Provide a list of risk that PAs are facing.
   b. Provide a WBS to develop the new computerize system.

4. [2+2+6=10]
   a. John has been given a task to review a module. He got a WBS of this task. Give any four key information that John may get from this WBS.
   b. Explain what is meant by a 'successful' project.
   c. Identify the Critical Path of the following project using the Critical Path Method.

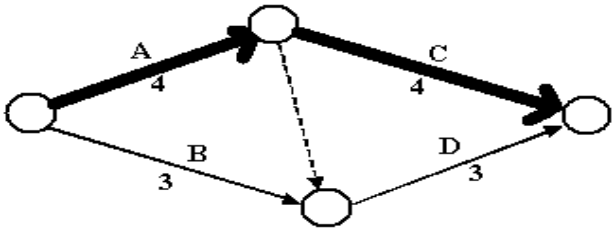
Activity ID	Dependencies	Duration(Weeks)
A		4
B		8

C		7
D	A	15
E	B	6
F	B	12
G	C	9
H	G, L	11
I	D,E	3
J	F	10
K	H	5
L	F	0

5. [4+3+3=10]
   a. You have been assigned as a new project manager for a new software development project. How will you setup risk mitigation strategies Likelihood reduction and Risk transfer for this project?
   b. Give any three important ideas that a Manager can know from a Gantt chart.
   c. Give any two important ideas that a Manager can know from a Progress reviews report

6. [4+3+3=10]
   a. In the context of software quality explain what is covered by the following software characteristics and outline measurable factors that can be used to determine a software product's quality with respect to each characteristic: i) reliability, ii) efficiency, iii) usability , and iv) maintainability.
   b. Manager use many project tools and chart to managed a project. What are purposes of using a Burn-down chart? Give significance of it axis.
   c. Give any two benefits of using SCRUM.

7. [2+4+4=10]
   a. Can a Manager increase the project risk? Justify your answer.
   b. Software projects measured using different metrics. Give any four important reasons for using the software metrics.
   c. In the diagram below the critical path of a project consists of the activities A and C, resulting in minimum project duration of 8 months.
      (a) Find the total float for B and D.
      (b) Find the free float for B and D.



8. [5+5=10]

a. You have been assigned as a new project manager for a new software development project. How will you setup different types of risk mitigation strategies for this project? Hints: Risk prevention/avoidance, Likelihood reduction, Impact reduction, Risk transfer.

b. A team is developing a COBOL program for a Toyota company which is going to have around 30'000 lines of code. This program has 30 subprograms each with app. 1'000 lines of code. 15 people are involved in the development and plan to complete it within 15 days. In first two days they could complete 2 subprograms and encounter 2 defects during testing.
Define relevant direct and indirect measures (Module Defect Density) for this project.

9. [6+4=10]

a. Draw a control flow graph and calculate McCabe's Cyclomatic number for the following source code.

```
0. {
1. a=1;
2. while (a<b) {
3. c = a+1;
4. while (c<=a) {
5. if (X[a]<X[c])
6. swap(X[a],X[c];
7. c=c+1; }
8. a=a+1;
9. }
```

b. Describe the various issues involved in managing software development. How can a risk in a software development be tackled?

10. [4+3+3=10]

a. Describe the software processes as per IEEE standard
b. Explain the different stages of a project management life cycle.
c. Describe the role of project management plan.

11. [6+4=10]

a. How can we estimate the cost of a software? Explain COCOMO model.
b. Explain the role of Work Breakdown Structure (WBS) in managing the project activities.

12. [5+3+2=10]

a. Draw activity network for the following activities for a certain software projects.
b. Find earliest start (ES) time, earliest finish (EF) time, latest start (LS) time, latest finish (LF) time and slack time (ST) for each activity.
c. Find the critical path.

Activity no.	Activity name Duration	Duration in days	Immediate predecessor
1	Requirement Specification	35	-
2	Database Design	25	1

3	GUI Design	30	1
4	Coding	30	1
5	Documentation	35	2
6	Integration	25	3
7	Testing	120	5,6

B3.2 R5 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Note:

3. Answer question 1 and any **FOUR** questions from 2 to 7.
4. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 100**

1.

h) List some application of AI.
i) What is Artificial Intelligence? Explain.
j) Differentiate between OLAP and OLTP.
k) Illustrate how AI can be useful in i) health care sector ii) automobile sector.
l) Briefly explain key advantages and disadvantages of AI.
m) Explain the use of AI in data analytics
n) Define learning agents. **(7 x 4)**

2.

a) What is a NumPy Ndarray? How they are different from lists? How do you declare an empty numpy Ndarray? Declare an Ndarray of shape (4,3) and reshape the array to shape (3,4).
b) Take two NumPy arrays having two dimensions. Concatenate the arrays horizontally and vertically using appropriate functions.
c) How do you declare a dataframe using dictionary? Explain with proper example. Also explain slicing in dataframe with example.
d) Explain various types of graphs which can be constructed using Matplotlib with suitable example. **(8,3,4,3)**

3.

a) How do you pre-process data for machine learning? Discuss some pre-processing techniques used to prepare the data in python with suitable example.

b) What are Machine Learning and its types? Differentiate between supervised and unsupervised machine learning with suitable example.

(9,9)

4.

a) What are the various metrics to analyse the performance of machine learning models? Explain evaluation metrics to assess the performance of regression model.

b) How missing values are handled in machine learning? Explain.

c) What is a difference between training set and test set? Why do we split on the dependent variable only? **(9,5,4)**

5.

a) Describe in brief Neural Network using Tensor Flow. Explain Artificial Neural Networks and Model.

b) Define Cross Validation.

c) Explain Convolution Neural Network (CNN).

(9,4,5)

6.

a) What is Perceptron? Briefly explain the working of single layer perceptron and multi-layer perceptron.

b) How face recognition and detection is done using OpenCV?

c) Explain Feed Forward Neural Network.

(9,5,4)

7. Write short notes on the followings

e) Natural Language Processing and its applications

f) Sentiment analysis and text classification

g) Confusion Matrix **(6 x 3)**

B3.3 R5 WEB TECHNOLOGIES

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/**OMR SHEET**, 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)

Each question below gives a multiple choices of answers. Choose the most appropriate one.

1. What is garbage collection in the context of Java?
   A. The operating system periodically deletes all of the java files available on the system.
   B. Any package imported in a program and not used is automatically deleted.
   C. When all references to an object are gone, the memory used by the object is automatically reclaimed.
   D. The JVM checks the output of any Java program and deletes anything that doesn't make sense.

2. You read the following statement in a Java program that compiles and executes.
submarine.dive(depth);

What can you say for sure?

   A. depth must be an int
   B. dive must be a method.
   C. submarine must be the name of a class
   D. submarine must be a method.

3. Which of the following statements is true?

A. All operators in java may be overloaded.
B. A constructor is inherited.
C. From a constructor you can call the classes superclass constructor.
D. A class must have a public constructor.

4. Which of the following statements is false?
   A. An instance of an int is the same size on all machines that a java program is run on.
   B. The operator == should not be used to compare strings.
   C. You can override a base class method in a derived class.
   D. You must define a constructor in a class.

5. What is the scope of stateless bean?
   A) Global-session
   B) singleton
   C) prototype
   D) request

6. Which of the following function is not there in Model View Controller
   A) beforeFilter()
   B) afterFilter()
   C) beforeRender()
   D) afterRendering()

7. The View in MVC is responsible for
   A) Displaying data
   B) Providing interface between view and model
   C) Business logic
   D) None of these

8. Annotation which decorates the PostageServiceBean
   A. @Wire
   B. @Autowire
   C. @Mention
   D. @Interceptors

9. Which class acts as IoC Container?
   A. ApplicationContext
   B. ServletContext
   C. DispatcherServlet
   D. None of the Above

10. Given the following piece of code:
    public interface Guard{
    void doYourJob();}
    abstract public class Dog implements Guard{}
Which of the following statements is correct?

A. This code will not compile, because method doYourJob() in interface Guard must be defined abstract.
B. This code will not compile, because class Dog must implement method doYourJob() from interface Guard.
C. This code will not compile, because in the declaration of class Dog we must use the keyword extends instead of implements.
D. This code will compile without any errors.

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

1. A concrete class or an abstract class can only be a parent class.
2. Can value and ref both can be injected together in a bean?
3. SessionFactory is a thread-safe object.
4. Computing the derived object may change the state of the object.
5. The % (modulo) operator can be used with floating point operands.
6. A *static* method can be invoked by simply using the name of the method alone.
7. Spring framework itself also offers a remoting technology called HTTP Invoker.
8. DAO methods must be made transactional.
9. Interface can Inherit one or more Interfaces.
10. Is it necessary to use hibernate.cfg.xml for configuration in hibernate?

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

X	Y
1. Abstraction	a) Can be done using Object.Method Prototype.
2. Encapsulation	b) a-part-of relationship
3. Message Passing	c) Action
4. Runtime	d) is a relationship
5. destructor	e) This information provides us the direction of inheritance
6. Aggregation	f) Normal objects
7. Association	g) Dynamic Binding
8. Actors	h) Is a way to provide transparent access to Essential Details
9. Generalization	i) Explicit objects
10. Event	j) Can be related to Data Hiding in programming.
	k) This information will guide us in designing classes
	l) Functions are automatically called when derived class object gets destroyed

Fill in the blanks in below, by choosing appropriate words and phrases given in the list below:

Event	AOP	object-Code	Short-lived, single threaded object	Core container

boolean	@Stateless	object	Long-lived, multi threaded objects	polymorphism
@Interceptors	Action filters	Configuration	ConnectorServerFactoryBean	Authorization filters

1. In dynamic model _____ represent interval of time.
2. _____object is used to create SessionFactory object in hibernate.
3. Spring allows you to create a JMX connector server through_____.
4. _____ spring module provides the capability of DI or IOC.
5. _____ is the cosmic super class.
6. Java compiler produces an intermediate code which is known as _____.
7. _____ help to execute logic while MVC action is executed or its executing
8. _____ means the ability that one thing can take several different forms.
9. _____ is the data type returned by all relational operators.
10. Persistent objects and collections in hibernate are _____.

PART TWO

(Answer any FOUR questions)

Ques 1:

a. Mention in brief four aspects of Object Oriented Design and Programming.
b. Encapsulation "protects" the abstractions. Justify the statement.
c. How can encapsulation and polymorphism improve reusability?
d. What are the challenges in designing with inheritance (single/multiple both)?

(4+4+4+3)

Ques 2:

a. Explain hibernate architecture with diagram.
b. What is the N+1 SELECT problem in Hibernate? What are strategies to solve the N+1 SELECT problem in Hibernate?
c. What is the difference between the save() and persist() method in Hibernate? Explain with example

(4+7+4)

Ques 3:

a. Write a short note on java access specifiers with examples.
b. Packages and interfaces form a very important concept in Java. Which are the advantages and disadvantages of package and interface?

c. The Pattern class defines an alternate compile method that accepts a set of flags affecting the way the pattern is matched. Explain any four flags of Pattern class.

(4+5+6)

Ques 4:

a. What is autowiring and name the different modes of it? What are the limitations of autowiring?
b. Explain Inversion of Control (IOC). What are the roles of an IOC (Inversion of Control) Container?
c. How is the configuration metadata provided to the Spring container? Explain with example.

(6+4+5)

B3.E1-R5 DIGITAL MARKETING

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.**

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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 answer. Choose the most appropriate one and enter in the "tear-off" answer sheet attached to the question paper, following the instructions therein.

1.1 Which is not a technique of Digital Marketing?
a) Social Media Marketing
b) Search Engine Marketing
c) Search Engine Optimization
d) None

1.2 The term Digital Marketing was first used in the_____
a) 1999
b) 1990
c) 1980
d) 2010

1.3 Which of the following is the correct depiction of Digital Marketing?
a) E-mail Marketing
b) Social Media Marketing
c) Web Marketing
d) All of the above

1.4 Sales Promotion includes ____
a) Advertise
b) Publicity
c) Selling
d) All of the above

1.5 _____ is an example of business-to-business services offered by Google application running as part of a customer's website.
a) Google Search application providing online website search
b) Google Apps Business Application
c) YouTube Brand Channel
d) Google AdWords click sponsored link advertising

1.6 Which one is the best way to make money digitally?
a) Having products on your website
b) Good marketing ideas by dreaming
c) Selling stuff offline
d) Works the night shift

1.7 Which of the following is a type of Digital Marketing activity?
a) Email Marketing
b) Social Marketing
c) Video Marketing
d) All of the above

1.8 Which of the following is a traditional form of Digital Marketing?
a) Television
b) Radio
c) Banners
d) All of the above

1.9 Marketing that moves away from a transaction-based effort to a conversation (i.e. two-way dialogue) and can be described as a situation or mechanism through which marketers and a customer (e.g. stakeholders) interact usually in real-time is known as:
a) Direct Marketing
b) Electronic Marketing
c) Interactive Marketing
d) Indirect Marketing

1.10 Digital marketing includes_____
a) Voice broadcast
b) Podcast
c) Fax
d) Both A and B

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

2.1 Social Media Marketing is a type of Digital Marketing.
2.2 A website's Front or Home Page should not include links to the other websites.
2.3 Google Keyword Planner is best used for Direct Marketing.
2.4 A detailed stated version of shortlisted new ideas in meaningful consumer terms is best classified as concept.

2.5 Traditional marketing can occur electronically and online.
2.6 Non-personal communication channels, magazines, direct mail and newspapers are not considered as broadcast media.
2.7 Technology will not feature in the development of these relationships, this is known as a Low Tech, High Touch Transactional relationship.
2.8 Website functions like capturing email addresses of visitors are the most important.
2.9 Bookmarking sites help to increase traffic.
2.10 Page view and page impression are not the same.

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

	X	Y
3.1	The practice of crafting strategies that shape or influence the public perception of an organization, individual or other entity on the Internet	A. Grey Hat
3.2	It is a form of marketing focused on creating, publishing, and distributing content for a targeted audience online	B. Podcast
3.3	An online program or software that helps users to search for information on world wide web	C. Niche
3.4	Advertising refers to the "sponsored result" on the search engine results pages (SERP)	D. Link Building
3.5	These objectives are often the most suitable when firms operate in a market dominated by a major competitor and where their financial resources are limited	E. ORM
3.6	An episodic series of digital audio files that a user can download to a personal device for easy listening	F. Content Marketing
3.7	The website links that are stored for future references.	G. Bulk e-mail concept
3.8	SEO involves looking for ways to improve user experience ethically and genuinely	H. Search Engine
3.9	The process of writing a blog	I. Affiliate
3.10	The act of sending one email campaign to a large group at once	J. Blogging
		K. Analytics
		L. White Hat
		M. Bookmark
		N. Traffic
		O. CTR
		P. Paid search or Pay- Per-Click (PPC)

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

(a)	Google Analytics	(b)	UTM Parameters	(c)	Niche Research
(d)	Bookmark	(e)	Affiliate	(f)	Keyword
(g)	Black	(h)	Traditional	(i)	PPC
(j)	Philip Kotler	(k)	Email Marketing	(l)	Payment mode
(m)	SEO	(n)	Marketing	(o)	Bulk Email
(p)	White Hat	(q)	Back Link	(r)	On-Page
(s)	ORM	(t)	CRM integration	(u)	CTA

4.1 Business card is an example of _____ marketing.
4.2 The entire SEO works on _____
4.3 Companies communicates with their audience through_____
4.4 Changes are visible to users in _____SEO.
4.5 Manipulating Google's algorithm to improve websites ranking is _____hat SEO.
4.6 _____is always been about connecting with your audience in the right place and on the right time.
4.7 _____is used by the companies to give payments to their affiliates.
4.8 To analyse the traffic coming to the Website, _____tool is used.
4.9 _____is the father of Modern Marketing.
4.10 _____connects each application with your CRM platform so data can flow to, from, or between them.

PART TWO
(Answer any FOUR questions)

5.

a. Define Digital Marketing? Explain the types of web presences. Also explain the basic terminologies in Digital Marketing.
b. What are the 4P's of Digital Marketing? Define some key factors for digital presence.

(9+6)

6.

a. Discuss the back links in digital marketing.
b. What is Off/On page optimisation? Explain.
c. What is SEO? What are the SEO techniques? Explain SEO Myth busters.

(3+5+7)

7.

a. What is Search Engine Marketing (SEM), PPC campaigns and Link Building?
b. Explain the term Bid Management Plan.

(12+3)

8.

a. What is SMM? Explain the term Niche Research.
b. What is Affiliate Marketing? Differentiate between AdSense and AdWord.

(6+9)

9.

1) What is Web Analytics? Explain.
2) What is ORM? Explain the term CTA.

(9+6)

B3.E2-R5 SYSTEM MODELLING & COMPUTER SIMULATION

Time:03 Hrs. Total Marks: 100

Note: - Answer all(a-g) from Q1 and attempt any four questions from Q2 to Q7

Q 1. (7x4)

Explain when simulation is the appropriate tool and when it is not appropriate. Discuss the advantages and disadvantages of simulation.

Differentiate between discrete and continuous systems. Provide examples for each.

Calculate the steady-state probability for a state in a Markov process with the following transition matrix:

[■(0.7&0.3@0.4&0.6)]

A system has a signal-to-noise ratio of 500 and a bandwidth of 2000 kHz. What is the maximum data rate supported by this system?

Explain the concepts of the Event-Scheduling / Time-Advance Algorithm in discrete-event simulation.

Describe the Poisson process and its importance in simulation modelling.

Explain the steps involved in manual simulation using event scheduling.

Q 2. (6+6+6)

Discuss the various statistical models used in simulation. Explain discrete and continuous distributions with examples.

Describe the characteristics of queuing systems. Explain long-run measures of performance for queuing systems.

Explain the significance of empirical distributions in simulation and how they are used in modelling.

Q 3. (4+3+4+7)

Discuss the process of random-number generation. What are the properties of good random numbers?

Explain the techniques for generating pseudo-random numbers. Describe the tests for random numbers.

Explain the inverse transforms technique for random-variant generation with an example.

Describe the acceptance-rejection technique for random-variant generation. Provide a numerical example.

Q 4. (4+4+3+7)

What is input modeling in simulation? Discuss the steps involved in data collection and identifying the distribution with data.

Explain parameter estimation and goodness of fit tests in input modeling.

Describe the process of fitting a non-stationary Poisson process.

Describe the process of fitting a non-stationary Poisson process.

Q 5. (4+4+4+6)

What is the significance of estimating absolute performance in simulations? Explain the different types of simulations with respect to output analysis.

Describe the measures of performance and their estimation in simulation studies.

Discuss the process of output analysis for terminating simulations.

Explain the concept of output analysis for steady-state simulations. Describe the Markov process in this context.

Q 6. (4+4+3+7)

Explain the importance of verification and validation in simulation modeling. Discuss the steps involved in model building, verification, and validation.

Describe the techniques used for calibration and validation of simulation models.

Explain optimization via simulation. Provide examples of how simulation can be used for optimization.

Discuss the tools available for simulation results analysis and viewing. Describe the different display forms used in simulation results.

Q 7. (5+7+6)

What are the properties of random numbers? Explain the techniques used for generating pseudo-random numbers.

Discuss the importance of randomness in simulation modeling. Describe the different tests used for random numbers.

Explain the role of dynamical, finite state, and complex model simulations in system modeling. iv. Describe the different types of simulations based on graph or network transitions, actor-based simulations, mesh-based simulations, and hybrid simulations.

B3.E3-R5 DISTRIBUTED AND PARALLEL COMPUTING

Time: 03 Hrs. **Total Marks: 100**

Note: - Answer all questions from Q1 to Q4

Module 1: Introduction to Distributed and Parallel computing Technologies (3x6) + (1x2)

Q1.

a) Explain the relationship between soft computing and high-performance computing (HPC). (2)
b) Discuss briefly about neural network in soft computing. (6)
c) Define a distributed system and explain its advantages over centralized systems. (6)
d) Explain the concept of parallel computing. (6)

Module 2: Distributed computing (3x10)

Q2.

a) Define Remote Procedure Call (RPC) and explain its role in distributed computing. (10)
b) Describe the architecture of a distributed file system (DFS). (10)
c) Discuss the need and purpose of distributed mutual exclusion in distributed systems. (10)

Module 3: Parallel Computing (3x8) + (1x1)

Q3.

a) Explain differences between parallel computing paradigms: Data Parallelism, Task Parallelism, and Pipeline Parallelism. (8)
b) Define a shared address space system and explain its key characteristics, How does it differ from a distributed memory system. (8)
c) Explain the different types of PRAM models: EREW, CREW, and CRCW. (8)
d) Explain the Pros and Cons of PRAM model in parallel computing (1)

Module 4: Edge Computing (3x8) + (1x1)

Q4.

a) Define edge computing (1)
b) Discuss the role of edge devices in edge computing. What are the typical characteristics and capabilities of these devices? (8)
c) Explain the concept of Fog and Edge Computing (FEC) and its advantages using the SCALE framework (8)
d) Discuss briefly about data management in fog computing. (8)

B3.E4-R5 DATA WAREHOUSING AND DATA MINING

TIME: 3 HOURS **TOTAL MARKS: 100**

Answer question 1 and any SIX questions from 2 to 8.

1. **[3+3+4=10]**
   a. Give the purposes of each of the steps required in ETL in a DW.
   b. Compare and contrast the outputs of classification and Clustering
   c. Differentiate Usages mining and content mining

2. **[4+5+6=15]**

Suppose that a data warehouse consists of the three dimensions time, doctor, and patient, and the two measures count and charge, where a charge is a fee that a doctor charges a patient for a visit.

   a. Draw a sample of basic DW architecture showing possible layers (Tiers). Show the possible input data of the layers.
   b. Design the DW star schema showing the necessary relationships.
   c. Write pseudo query for the following queries:
      i. Starting with the base cuboid [day, doctor, patient], what specific OLAP operations should be performed in order to list the total fee collected by each doctor in 2015?
      ii. To obtain the same list, write an SQL query assuming the data are stored in a relational database with the schema fee (day, month, year, doctor, hospital, patient, count, charge).

TID-->	1	2	3	4	5	6	7	8
Items>	A,C,B	A,C,D,E	C,A,B	A,B,C	A,B,C,D	A,B,C	A,B,D	B,C,E

3. Consider the given table. If minimum support is <50% and minimum confidence<60%, determine the frequent itemsets and association rules using the apriori algorithm. Show the detailed steps to do so. **[10+5=15]**

TID-->	1	2	3	4	5	6	7	8
Items>	A,C,B	A,C,D,E	C,A,B	A,B,C	A,B,C,D	A,B,C	A,B,D	B,C,E

4. Consider the given table. Draw the FP-tree with the item in descending ordering for min support>50%. (You may prepare a draft version(s) of the tree before getting the final version). **[10+5=15]**

5. Take your appropriate data sets. Specify a Classifier. Developed a basic algorithm for inducing a decision tree from the training tuple.
[3+5+10=15]

6. **[4+6+5]**
   a. Perform Binning operation (4,8,15,21,21,24,25,28,34)
   b. Consider the given table. If minimum support>50% and minimum confidence>60%, Determine the frequent itemsets and association rules using the apriori algorithm. Show the detailed steps to do so.

TID	ITEMS
100	{A, C, D, G}
200	{A, B, C, O}
300	{A, B, F, W}
400	{B, K, S, P}
500	{A, B, C, P}

   c. Consider the following eight points (with (x, y) representing location) into three clusters. Use the *k-medoids* algorithm to show how Clustering is performed.
   A1(2, 10), A2(2, 5), A3(8, 4), B1(5, 8), B2(7, 5), B3(6, 4), C1(1, 2), C2(4, 9)

7. **[4+6+5]**
Suppose the data for analysis include the attribute age. The age values for data tuple are:

13,15,16,16,19,20,20,21,22,22,25,25,25,25,30,33,33,35,35,35,35,36,40,45,46,52,70.

   a. What are the mean, median and mode of the data.
   b. Find the first quartile (Q1) and third quartile (Q3) of the data.
   c. Give the fine number summary of the data.

8. [6+4+5=15]
   a. Explain the process and basic architecture used in ROLAP and MOLAP.
   b. Slicing, Dicing operations
   c. How does Web Content Mining and Focused Crawler used while designing a 'web mining' application?

B3.E5-R5 SOFTWARE TESTING AND QUALITY ASSURANCE

TIME: 3 HOURS TOTAL MARKS: 100

Answer question 1 and any SIX questions from 2 to 8.

13. (2x5=10)
   a. System Testing
   b. What is equivalence partitioning as it applies to software testing?
   c. Boundary Value Analysis
   d. Black box vs. white box testing
   e. Acceptance Testing

14. (5+5+5)
   a. How does software differ from the artifacts produced by other engineering disciplines?
   b. How do software process metrics differ from software project metrics?
   c. What is meant by the term software reliability?

15. (10+5)
   a. What are the names of the five levels of the SEI Capability Maturity Model? In your own words, briefly describe each.
   b. Describe the change control process for a modern software development project.

16. (10+5)
   a. What is the difference between testing Techniques and tools? Give examples. The Quality control activities are focused on identifying defects in the actual products produced; however, your boss wants you to identify and define processes that would prevent defects. How would you explain to him to distinguish between QA and QC responsibilities?
   b. Describe the process used in the UML (unified modelling language) approach to object-oriented design.

17. Short notes [5+6+4]
   a. The process involved in CMM level3 and level4.
   b. Main purposes of the Change Management.
   c. Benefits of Scrum.

18. Answer the following [5+5+5]
   a. A team is developing a COBOL program for a Toyota company that will have around 30’000 lines of code. This program has 30 subprograms, each with an app. 1’000 lines of code. 15 people are involved in the development and plan to complete it within 15 days. In the first two days, they could complete 2 subprograms and encounter 2 defects during testing. Define relevant direct and indirect measures (Module Defect Density) for this project.
   b. Consider the following pseudo code and draw a control flow graph (CFG)

```
a = Read b
c = 0
while (a > 1) {
If (a^2 > c)
```

```
c = c + a
a = a - 2
}
```

c. What are the essential components Requirements Traceability Matrix [RTM]? Explain with examples

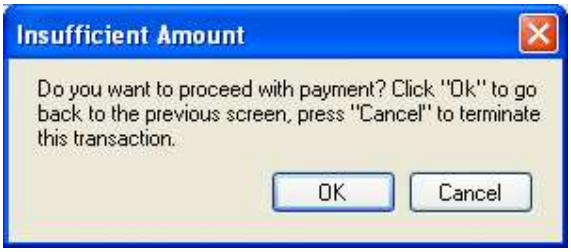
19. Answer the following [9+6]

a. For the partial payment process illustrated in Scenario1, write three test cases for Black Box Testing

Scenario 1

Step 1: The cashier enters the customer order number to search for the amount due for making payment.

Step 2: The system displays the order amount due based on the order number. The cashier enters the amount received from the customer and submits it for further processing.



Step 3: The system prompts the errors due to the insufficient amount received for paying an order. Cashiers may re-enter the amount received or cancel the entire payment transaction.

Table 1: Details in Order file of the existing system

	Order No.	Amount Due (Rs)
1	012345	38.00
2	012344	27.00
3	012343	69.00

b. A team takes 100 hours to finish a project. They spent 5hours having a party. Calculate the Ideal Time and real time.

20. Answer the following [3+2+2+2+3+3]
    a. Give the names of the internal and external factors involved in SWOT Analysis?
    b. Milestones are very important in any project planning. Justify your answer
    c. Should we create WBS before scheduling a project, even if the project is very small? Justify your answer.
    d. Give the difference between Ideal time and Ideal effort.
    e. One programmer coded and tested a 300-line program taking 3 days. During testing, s/he encounters 3 defects. Find out any two direct and indirect measures of this program.
    f. Give any five characteristics of a good test case.

B3.E6-R5 DIGITAL IMAGE PROCESSING (WITH AR/VR)

TIME: 3 HOURS TOTAL MARKS: 100

Answer question 1 and 2 and any FOUR questions from 3 to 8.

Q.1. [6x2=12]

a) What is Bit Plane Slicing? What effects will be there is LSB details from the image is removed?
b) Compare Low pass filtering in spatial domain & frequency domain
c) Calculate memory required to store 1024x768, 8bit grayscale image and RGB image.
d) Explain brightness adaptation and discrimination.
e) How you can inverse the image using Discrete Fourier Transform. Give the steps.
f) Explain Image Enhancement by Arithmetic and Logic Operation

Q.2. [4x3=12]

a) Write down any three primitives of Aframe with examples
b) Demonstrate any two applications of Augmented Virtual Reality
c) Write down the steps in creating an AR application using unity

Q.3. [6x3=]

a) Explain Image Segmentation process
b) Show Image Transformations with an example
c) Explain the Object detection process

Q.4. [6x3=]

a) Explain fundamental steps in Digital Image Processing.
b) Describe methods for image acquisition using single sensor, sensor strip and sensor array.
c) How smoothing can be done in frequency domain? how edge detection can be done in frequency domain?

Q.5 [6x3=]

a) Explain Fidelity criteria.
b) Explain Adaptive mean filter for image restoration and compare with mean filter.
c) Describe Spatial resolution & Gray level-Resolution. Also show how image content are affected with change of both.

Q.6 [6x3=]

a) Explain Un-sharp Masking & High Boost Filtering.
b) Compare RGB, CMYK and HIS color models.
c) How Histogram processing used for colored image? Explain with example.

Q.7 [8+10=]

a) If source of image (data) is known, it is easy get detect redundancy for images. Justify the statement. Explain various types of redundancy related to image data
b) Generate Huffman code for Following set of data:

33 33 33 21 17 21 21 53
43 33 43 53 33 21 21 21
21 33 21 33 17 33 33 17

17 43 33 33 21 43 33 43
21 17 21 21 17 21 17 33

Q.8 [6x3=]

a) Explain Basic Thresholding method to decide a threshold T. for images having Bimodal histogram.

b) Explain homomorphic filtering process in frequency domain.

c) Explain simultaneous contrasts and Mach bands.

B3.E7 R5 ACCOUNTING AND FINANCIAL MANAGEMENT

Sample Paper-I

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

SECTION-A

1. Explain the concepts and convections of accounting.
2. From the following balances, prepare the profit and Loss account and Balance sheets of XYZ traders as on March 31, 2021.

Debit Balances	Amount Rs.	Credit balances	Amount Rs.
Drawings	6,300	Capital	1,55,000
Cash at bank	14,000	Discount received	3,150
Bill receivable	1,900	Loans	10,000
Land and Building	42,600	Purchases return	2,500
Furniture	5,140	Sales	2,90,000
Discount allowed	4,000	Reserve for bad debts	5,650
Bank charges	200	Creditors	18,670
Salaries	6,520		
Purchases	2,05,000		
Stock (opening)	60,000		
Sales Return	1,910		
Carriage	5,190		
Rent and Taxes	7,750		
General expenses	3,610		
Plant and Machinery	31,700		
Book debts	82,840		
Bad debts	1,460		
Insurance	4,850		
	4,84,970		4,84,970

SECTION-B

3. Define Financial Management Describe in brief various functional areas of Financial Management.

4. Below given is the Profit account and Balance Sheet of Jeet Electronics.

Particulars	Amount (Rs.)
Sales	7,50,000
Interest Income	15,000
Gain on sale of investments	45,000
Total income 1st March 2013	8,10,000

Expenses	
Cost of Goods sold	5,25,000
Depreciation	60,000
Selling and Administrative Expenses	35,000
Interest Expense	15,000
Loss on Sale of Plant and Machinery	20,000
Total Expense	6,55,000
Profit Before income Rs.	1,55,000
Profit Before income tax	77,500
Less income Tax	77,500
Profit after Tax	77,500

Balance sheet of ABC Electronics As on 31st March, 2021

Particulars	**Amount(Rs.)**
Sales	7,50,000
Interest Income	15,000
Balance sheet of Jeet Electronics Gain on sale of Investments	45,000
Total Income March 2013	8,10,000
Expenses	
Cost of Goods sold	5,25,000
Depreciation	60,000
Selling and Administrative Expenses	35,000
Interest Expense	15,000
Loss and Sale of Plant and Machinery	20,000
Total Expenses	6,55,000
Profit Before Income Tax	1,55,000
Less Income Tax	77,500
Profit after Tax	77,500

Balance sheet of ABC Electronics As on 31st March, 2021

Particulars	**2013**
Sources of Funds	
Shareholder's Funds	
Equity share capital	1,85,000
Profit and Loss Account	80,000
Total Shareholder's Funds	2,10,000
Loan funds	
Current Liabilities	30,000
Bills Payable	1,30,000
Creditors	1,60,000
Total Current Liabilities	6,35,000
Total	
Application of Funds	1,90,000

Fixed Assets	90,000
Investments	
Current Assets	
Inventories	1,25,000
Debtors	95,000
Cash	1,45,000
Total	**6,45,000**

You are required to calculate Profitability and solvency ratios.

SECTION-C

5. What do you mean by Marginal Costing? Also explain the nature and importance of Marginal Costing?
6. How does standard costing help in controlling production cost? Also discuss in brief various kings of variances.

SECTION-D

7. Compare and contrast any two computer programs meant for maintenance of financial accounts.
8. How computer based auditing is different from manual auditing? Also explain the process of computer based audit.

SECTION-E

9. Write note on each of the following:

(a) Money Measurement Concept
(b) Financial Statements
(c) Return on Equity Ratio
(d) Cash from financing activities
(e) Angle of incidence
(f) Break Even point
(g) Flexible Budget
(h) Variable Cost
(i) Representative Personal Account
(j) Fund Flow Statement.

Sample Paper-II

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

SECTION-A

(10 X 2=20)

Q1.

(a) Define accounting as an information system.
(b) Name various tools used in financial analysis.
(c) Differentiate between cost accounting and management accounting.
(d) Name various financial statements prepared by an organization.
(e) What are the duties of management accountant.
(f) Differentiate between absorption costing and marginal costing.
(g) Explain activity based costing.
(h) Name any five concepts of accounting.
(i) What is budgetary control?
(j) Discuss various assumptions used in break-even analysis.

SECTION-B

(4 X 10=40)

Q2. Explain the relationship between financial accounting and management accounting.

Q3. Explain zero base budgeting in detail.

Q4. The sales turnover and profit during two periods were as follows:

Period	Sales	Profit
1	20 lakh	2 lakh
2	30 lakh	4 lakh

Calculate

(a) P/V ratio.
(b) The sales required to cash profit of Rs. 5 lakh.
(c) The profit when sales are Rs. 10 lakh.

Q5. Write a short note on price level accounting concept bringing out its merits and demerits.
10 marks

Q6. What do you mean by responsibility accounting? What are its merits and demerits.
10 marks

Q7. Following are the ratios to trading activities of National Traders Ltd.

Debtors velocity 3 months
Stock velocity 8 months
Creditors velocity 2 months
Gross profit ratio 25%

Gross profit for the year ended 31st Dec. 2007 amounts to Rs. 400000. Closing stock of the year is Rs. 10000 above the opening stock. B/R amounts to Rs. 25000 and B/P to Rs. 10000. Calculate

(a) Sales
(b) Debtors
(c) Closing Stock
(d) Creditors.

20 marks

Sample Paper-III

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

SECTION-A 22 marks

Q1.
(a) What are Real and nominal accounts?
(b) What is going concern concept?
(c) What is a day-book?
(d) What is a ledger?
(e) What is triple column cash-book?
(f) What is cash discount?
(g) What is suspense account?
(h) What are purchase returns?
(i) Explain liquidity ratio?
(j) What is the meaning of fund?
(k) What is prime cost?
(l) What is marginal cost?
(m) What is variance analysis?
(n) What is debt?
(o) What is a sub-module?

SECTION-B
Each Question Carries 07 Marks

Q2. What is meant by accounting convention? Give various accounting conventions?

Q3. What is a trial balance? How is it prepared?

Q4. From the following entries, make a journal, prepare ledger and trial balance:

(a) X started business with a capital of Rs. 50000.
(b) X purchases goods for cash Rs. 10000.
(c) He sold good on credit to Y for Rs. 5000.
(d) X paid for rent of the shop Rs. 500.
(e) Three months later, Y became insolvent, paying 50 paise a rupee?

Q5. What is financial management? How is it different from financial accounting?

Q6. What is long term solvency? How is it measured?

Q7. What is the meaning of a fund? Differentiate it from cash?

Q8. What is the scope of marginal costing in today times?

Q9. What are the limitations of break even analysis?

Q10. What is the standard costing? Give its scope?

Q11. What is meant by computerized accounting? What are its advantages?

Q12. How the error control can be exercised through the computerized accounting?

Q13. How the self-audit is possible in the computerized accounting?

Sample Paper-IV

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

SECTION –A
40 MARKS

EXPLAIN THE FOLLOWING TEREMS:

1. Long run cost curve.
2. Extension in demand.
3. Monopolistic competition
4. Selling costs
5. Average variable cost
6. Inelastic demand
7. Equi marginal utility
8. Diseconomies of scale
9. Price discrimination
10. Kinked demand curve

SECTION B
EACH QUEATION CARRIES 10 MARKS

1. Discus the nature ans scope of economies. What is difference macro and micro economics?
2. Discuss the law of diminishing marginal utility. What are the exception to the law?
3. What are the determinates of elasticity of demand? How can the elasticity of demand be measured?
4. Discuss the law of variable proportions with suitable example.
5. How can the price and output be determined under monopolistic competition? Discuss

6. Discuss the marginal productivity theory of factor pricing

B3.E8 R5 WIRELESS & MOBILE COMMUNICATION

TIME: 3 Hours TOTAL MARKS: 100

Part A

Answer all questions and carries equal marks

Module 1		
1.	Briefly discuss the basic concepts and terminologies used in RF measurement	5 Marks
Module2		
2.	Write a short note on channel allocation strategies used in cellular communication	5 Marks
Module 3		
3.	Compare the different IEEE 802.11 WiFi standards	5 Marks
Module4		
4.	Write a short note on WSN	5 Marks

Part B

Answer all questions and carries equal marks

Module 1		
5a.	Discuss the OFDM technology in detail.	10 Marks
5b.	What is MIMO ?Discuss the application areas of MIIMO	10 Marks
OR		

6a.	Briefly discuss various Digital Modulation techniques used in Mobile communication	10 Marks
6b.	Write a short note on various Multiple Access techniques	10 Marks
	Module2	
7a.	With neat block diagram explain the GSM architecture in detail	10 Marks
7b.	Write a short note on GSM Channel types	10 Marks
	OR	
8a.	Write a short note on handoff management schemes in 1G 2G and 3G cellular networks.	10 Marks
8b.	With neat block diagram explain the IS-95 architecture in detail	10 Marks
	Module 3	
9a.	What are the requirements of Wireless LAN? Discuss various types of Wireless LAN.	10 Marks
9 b.	Discuss the 802.11 MAC protocols in detail.	10 Marks
10.a.	Briefly discuss the 802.11 Physical and data link layer in details	10 Marks
10.b.	Compare the hidden node and exposed node problems in Wireless LAN.	10 Marks
	Module4	
11a.	Explain the Bluetooth protocol stack in detail.	10 Marks

11b.	Discuss the routing protocols used in Wireless Sensor Networks.	10 Marks
12a.	Compare the Zigbee, Zwave and LoRa technologies in detail.	10 Marks
12b.	Compare LoraWAN, sigfox and other long range low power WAN solutions used in Wireless communication with suitable examples.	10 Marks

B3.E9-R5 Blockchain Technology

Note:

5. Answer question 1 and any **FOUR** questions from 2 to 7.
6. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 100**

1. Short notes **[7x4=28]**

o) List some application of Blockchain Technology.
p) What is Blockchain? Explain.
q) What is use of Encryption and Decryption in Blockchain technology?
r) What is a Cryptocurrency. Name two popular cryptocurrency.
s) What is difference between Ethereum and Bitcoin Network?
t) What is Metamask?
u) What is dApp?

2. Brief answer for following questions
[3+3+6+6= 18]

e) What is Hashing? What should be property of A Hash Function? Give two examples of widely used Hash Function.
f) What is need of Digital Signature? What is Message Digest? What a digital signature consists of?
g) What is need of Blockchain Technology? What are relevant use cases of Blockchain Technology? What are different types of Blockchain?
h) What are needs of Consensus Mechanism? Explain Proof of work, Proof of Stake, Proof of authority and also list their advantages and disadvantages.

3. Notes on following questions **[6x3=18]**

c) What is need of Encryption and Decryption? Explain RSA Algorithm.
d) What is a Wallet? What are its types? Which kind of wallets are more secure and why?
e) What is Ethereum Virtual Machine? What is concept of Gas and Gas Limit?

4. Answer the following questions **[6x3=18]**

d) What is Hyperledger Fabric? What are the installation steps for HyperLedger Fabric on A Linux Machine?
e) What are peer nodes and What is a channel in Hyperledger Fabric? How will you test Hyperledger Fabric network?
f) What is a Smart Contract? What it contains?

5. Answer the following questions **[4+6+8=18]**

d) What are mappings in Solidity. Explain the significance with an appropriate example.
e) Write a solidity program having student structure with StudID, name and marks. Create a function to add a new student. Increment the studentcount variable by one when a student is added.
f) Write a contract Sendether with the following
   a. Constructor
   b. Function receivemoney
   c. Function getbalance to display the balance
   d. Function withdraw (address, uint) where only owner can withdraw and the amount should be less than the balance.

6. Make a dApp with the given interface **[10+8=18]**

Take the initial balance as zero. On clicking deposit the solidity function deposit_amt should run and amount to be added in balance. On clicking display, the solidity function display_balance should run and balance to be displayed in textbox balance.

d) Suppose you have to write a Blockchain Application for Land Records? What will be your approach to develop a network and writing application?

7. Write short notes on the following **[6x3=18]**

h) Public Key Infrastructure (PKI)
i) Bitcoin
j) Applications of Ethereum beyond cryptocurrency