



UNIVERSITY OF CALICUT

Abstract

General and Academic – Faculty of Science - Scheme and Syllabus of B.Voc Data Science & Analytics Programme, in tune with the CUFYVP Regulations 2025, with effect from 2025 Admission onwards - Approved - Subject to ratification by the Academic Council - Implemented - Orders Issued

G & A - I - F

U.O.No. 17680/2025/Admn

Dated, Calicut University.P.O, 20.12.2025

*Read:-*1. U.O.No. 14335/2025/Admn dated 14.10.2025.

2. Minutes of the meeting of the Board of Studies in Computer Science & Application (UG) held on 18.11.2025.
3. Remarks of the Dean, Faculty of Science dated 17.12.2025.
4. Orders of the Vice Chancellor in the file of even No and dated 20.12.2025.

ORDER

1. The Regulations of the B.Voc Programmes (CUFYVP Regulations 2025), was implemented with effect from 2025 admission onwards, vide paper read as (1) above.
2. The meeting of the Board of Studies in Computer Science & Application (UG) held on 18.11.2025, vide paper read as (2) above, approved the scheme and syllabus of the B.Voc Data Science & Analytics programme in tune with CUFYVP Regulations 2025 with effect from 2025 Admission onwards.
3. The Dean, Faculty of Science vide paper read as (3) above, approved the minutes of the meeting of the Board of Studies in Computer Science & Application (UG) held on 18.11.2025.
4. Considering the urgency, the Vice Chancellor has approved the minutes of the meeting of the Board of Studies in Computer Science & Application (UG) and accorded sanction to implement the scheme and syllabus of the B.Voc Data Science & Analytics programme in tune with CUFYVP Regulations 2025 with effect from 2025 Admission onwards, subject to ratification by the Academic Council.
5. The scheme and syllabus of the B.Voc Data Science & Analytics programme in tune with CUFYVP Regulations 2025 is therefore implemented with effect from 2025 Admission onwards.
6. Orders are issued accordingly. (Syllabus appended)

Ajayakumar T.K

Assistant Registrar

To

The Colleges concerned.

Copy to: PS to VC/PA to PVC/PA to Registrar/PA to CE/JCE I/JCE III /EX and EG
Sections/EPR VIII/SF/DF/FC.

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT



B. Voc. Data Science and Analytics

FOUR YEAR B. VOC. PROGRAMME STRUCTURE AND SYLLABUS

2025 - '26 ADMISSION ONWARDS

(CUFYVP Regulations 2025)

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1. REGULATIONS

The existing regulations of Choice-Based Credit Semester System (UO No. 8018/ 2025/ Admn. Dated 29-05-2025) which are applicable for CUFYVP Regulations 2025 are applicable for this programme with the following exceptions.

1.1 Objectives

- I. Build foundational knowledge in data science, statistics, computer science, and analytics through a balanced mix of theory and application.
- II. Develop data literacy and critical thinking skills required to collect, clean, analyze, interpret, and communicate insights from structured and unstructured data.
- III. Equip students with hands-on experience using modern data tools, software, and platforms such as Excel, Python, R, SQL, Power BI, Tableau, and SPSS.
- IV. Enable students to apply data science principles to solve real-world problems across domains such as business, health, agriculture, education, and public services.
- V. Foster interdisciplinary skills by integrating computing, mathematics, communication, and domain-specific knowledge.
- VI. Promote ethical and responsible data usage, including awareness of data privacy, bias, fairness, and societal implications of analytics and AI.
- VII. Prepare students for diverse career pathways, such as data analyst, business analyst, data engineer, and for further academic pursuits in data science and related fields.
- VIII. Encourage lifelong learning and innovation through internships, capstone projects, value-added courses, and industry exposure.

1.2 Rules and regulations applicable only to the B. Voc. Data Science and Analytics

- I. Mandatory internships and Industrial Visit shall be part of the curriculum in each academic year to ensure industry exposure and employability.
- II. Course teacher can select the Rubrics activities, open ended activities from the options given in the detailed syllabus and must be related to the course.
- III. Course teacher can select the any one practical activity from the options given in the detailed syllabus and must be related to the course.

2. PROGRAMME OUTCOMES (PO)

At the end of the graduate Programme at Calicut University, a student would:

PO No.	Graduate Attributes	PO Statement
PO 1	Knowledge Acquisition	Demonstrate a profound understanding of knowledge trends and their impact on the chosen discipline of study
PO 2	Communication, Collaboration, Inclusiveness, and Leadership	Become a team player who drives positive change through effective communication, collaborative acumen, transformative leadership, and a dedication to inclusivity
PO 3	Professional Skills	Demonstrate professional skills to navigate diverse career paths with confidence and adaptability.
PO 4	Digital Intelligence	Demonstrate proficiency in varied digital and technological tools to understand and interact with the digital world, thus effectively processing complex information
PO 5	Scientific Awareness and Critical Thinking	Emerge as an innovative problem-solver and impactful mediator, applying scientific understanding and critical thinking to address challenges and advance sustainable solutions.
PO 6	Human Values, Professional Ethics, and Societal and Environmental Responsibility	Become a responsible leader, characterized by an unwavering commitment to human values, ethical conduct, and a fervent dedication to the wellbeing of society and the environment.
PO7	Research, Innovation, and Entrepreneurship	Emerge as a researcher and entrepreneurial leader, forging collaborative partnerships with industry, academia, and communities to contribute enduring solutions for local, regional, and global development.

3. PROGRAMME SPECIFIC OUTCOMES

PSO No.	PSO Statement
PSO1	Data Handling and Analysis Collect, clean, process, and analyze structured and unstructured data using data science methodologies.
PSO2	Model Building and Interpretation Design and implement machine learning and AI models to predict and interpret patterns in data effectively.

PSO3	Business Intelligence Application Utilize business analytics tools and techniques to derive actionable insights and support strategic decision-making in business environments.
PSO4	Real-world Problem Solving and Internship Readiness Demonstrate industry-readiness through applied projects, internships, and case-based learning in sectors like finance, healthcare, marketing, and e-commerce.
PSO5	Data Communication and Visualization Effectively communicate data-driven insights through visualizations and storytelling using modern tools, enabling informed decision-making by both technical and non-technical stakeholders.

4. ELIGIBILITY FOR ADMISSION

Candidates who have passed (Eligible for Higher Studies) the HSE of the Kerala State Board of Higher Secondary Examination or any other examination recognised as equivalent thereto, with not less than 50% is eligible for admissions. A concession of 5% will be given to OBC/OEC candidates. The SC/ST candidates need get only a pass. Preferred subjects & index mark calculations for admission will be decided by the university. The eligibility for admission and reservation of seats shall be in accordance with the norms/rules made by Government/University from time to time.

5. QUALIFICATION PACKS (QPs)

Sl. No.	Semester	Sector Skill Council (SSC)	QP Code	Job Role
Under graduate Certificate (NSQF level 4.5)				
QP1	1	IT-ITeS Sector Skill Council	SSC/Q8101	Data Entry Operator
	2	IT-ITeS Sector Skill Council	SSC/Q0508	Junior Data Analyst
Under Graduate Diploma (NSQF level 5.0)				
	3	IT-ITeS Sector Skill Council	SSC/Q0509	Associate Data Analyst
	4	BFSI/IT-ITeS Sector Skill Council	BSC/Q8401 or SSC/Q2102	Business/Data Visualization Associate
B. Voc. Degree (NSQF level 5.5)				

	5	IT-ITeS Sector Skill Council	SSC/Q0511	Data Analyst
	6	IT-ITeS Sector Skill Council	SSC/Q4201	AI/ML Developer (Entry Level)
PG Diploma (NSQF level 6.0)				
	7 & 8	IT-ITeS Sector Skill Council	SSC/Q0502 or SSC/Q8402	Senior Data Analyst / BI Developer

6. PROGRAMME STRUCTURE

The B.Voc. curriculum comprises two key components: General Education Components (GEC) and Skill Development Components (SDC). Each academic year integrates both to ensure a well-rounded learning experience. SDC constitutes a minimum of 60% of the total credits, while GEC makes up the remaining portion. Students shall earn a minimum of 140 credits over three years to graduate with a B.Voc. degree. Additionally, they can complete a one-year apprenticeship or internship or project work along with three (3) online courses of four (4) credit each to earn 40 more credits, leading to a Post Graduate Diploma.

6.1. General Education Components

Students must earn 42-54 credits, in a span of 4 years, from the General Education Components (GEC). The GEC consists of:

- Foundation Courses
- Minor Pathway Courses

Table 3: Credit Distribution of General Education Components

Title	Course Type	Credit	No. of Courses	Total Credits
Foundation Courses	Ability Enhancement Course (AEC)	3	3	9
	Multi-Disciplinary Course (MDC)	3	3	9
Discipline Specific Courses	Minor Pathway Courses (DSC)	4	6 + 3*	24 + 12*
Total Credit for GEC				42 + 12*

6.2. Skill Development Components

Title	Course Type	Credit	No. of Courses	Total Credits
Foundation Courses	Value Added Course (VAC)	3	3	9
	Skill Enhancement Paper (SEC)	3	3	9
Discipline Specific Courses	Major pathway Courses (DSE)	4	17 + 3*	68 + 12*
	Internship / Apprenticeship / Project Work	-	-	40
	On Job Training (OJT)	60 Hours Mandatory		
Total Credit for SDC				126+ 12*

*Three online Discipline-Specific Courses (DSC), approved by the Board of Studies, may be studied in either the major or minor discipline.

Students may choose a minor pathway from the discipline-specific options listed below. The degree awarded will correspond to the selected minor pathway.

- Major with Minor – All six (6) minor courses from same discipline
E.g. B. Voc. Data Science and Analytics with minor in Commerce
- Major with Vocational Minor – All six (6) minor course from same vocational discipline
E.g. B. Voc. Data Science and Analytics with Vocation Minor in Multimedia
- Major with Multiple discipline – Out of Six (6) minor courses, two groups of three (3) courses from two (2) different disciplines
E.g. B. Voc. Data Science and Analytics with Mathematics and Statistics
- Single Major – Any six (6) minor courses from different disciplines
E.g. B. Voc. Data Science and Analytics

7. MINIMUM CREDIT REQUIREMENTS

Duration	General Education Components (GEC)				Skill Development Component (SDC)				Total Credits
	AEC	MDC	Minor	Total GEC	SEC	VAC	Major	Total SDC	
Undergraduate Certificate (1 Years)	9	6	8	23	3	-	24	27	50
Exit with Undergraduate Certificate (requires two additional 4-credit SDC online courses and 30 hours of mandatory on-the-job training (OJT)).									

Duration	General Education Components (GEC)				Skill Development Component (SDC)				Total Credits
	AEC	MDC	Minor	Total GEC	SEC	VAC	Major	Total SDC	
Undergraduate Diploma (2 Years)	9	9	20	38	6	6	52	64	102
Exit with Undergraduate Diploma (requires two additional 4-credit SDC online courses and 60 hours of mandatory on-the-job training (OJT))									
B. Voc. Degree (3 Years)	MDC	AEC	Minor	Total GEC	SEC	VAC	Major	Total SDC	Total GEC + SDC
	9	9	24	42	9	9	68 +12*	98	140
Exit with a B. Voc. Degree with 140 credits or proceed to the PG Diploma. 60 hours on-the-job training (OJT) is mandatory.									

* Internship/ Apprenticeship/ Project Work

Duration	Major (SDC) / Minor (GEC) Components	Internship/ Apprenticeship/ Project (SDC)	Total
PG Diploma (4th Year)	3 Online Courses of 4 Credits each (12 Credits)	28	40
Exit with B. Voc. Degree + PG Diploma (180 credits) 60 hours on-the-job training (OJT) is mandatory			

8. SEMESTER WISE COURSE DISTRIBUTION

Semester	Course Type	Credits	Theory Hours	Practical Hours	Internal	External	Total Marks	Total Credits	Total Hours / Week or Semester	Total Marks
1	Major 1	4	3	2	40	60	100	25	27/29	625
	Major 2	4	3	2	40	60	100			
	Major 3	4	4	0	40	60	100			
	Minor 1	4	3 / 4	2/0	30	70	100			
	AEC 1	3	2	2	25	50	75			
	SEC 1	3	3	0	25	50	75			
	MDC 1	3	3	0	25	50	75			
2	Major 4	4	3	2	40	60	100	25	27/29	625
	Major 5	4	3	2	40	60	100			
	Major 6	4	4	0	40	60	100			
	Minor 2	4	3 / 4	2/0	30	70	100			
	AEC 2	3	3	0	25	50	75			
	AEC 3	3	2	2	25	50	75			
	MDC 2	3	3	0	25	50	75			
	OJT	-	-	30*	-	-	-			
3	Major 7	4	3	2	40	60	100	26	26/28/30	650
	Major 8	4	3	2	40	60	100			
	Major 9	4	4	0	40	60	100			
	Minor 3	4	3 / 4	2/0	30	70	100			
	Minor 4	4	3 / 4	2/0	30	70	100			
	VAC 1	3	3	0	25	50	75			
	MDC 3	3	3	0	25	50	75			
4	Major 10	4	3	2	40	60	100	26	28/30	650
	Major 11	4	3	2	40	60	100			
	Major 12	4	4	0	40	60	100			
	Elective 1	4	4	0	40	60	100			
	Minor 5	4	3 / 4	2/0	30	70	100			
	VAC 2	3	3	0	25	50	75			
	SEC 2	3	2	2	25	50	75			
	OJT	-	-	30*	-					
5	Major 13	4	3	2	40	60	100	26	27/29	650
	Major 14	4	3	2	40	60	100			
	Major 15	4	4	0	40	60	100			
	Elective 2	4	4	0	40	60	100			
	Minor 6	4	3 / 4	2/0	30	70	100			
	VAC 3	3	3	0	25	50	75			
	SEC 3	3	3	0	25	50	75			

6	I/A/P	12			120	180	300	12	500	300
7&8	Online 1	4					100	40	1000	1000
	Online 2	4					100			
	Online 3	4					100			
	I/A/P	28			100	600	700			

* Number of learning hours per semester

9. LIST OF MAJOR COURSES OFFERED

Semester	Course Type	Course Code	Course Title	Credits	Hours		Internal	External	Total Marks
					Theory	Practical			
1	Major 1	DSA1CJ101	Introduction to Data Science	4	3	2	40	60	100
	Major 2	DSA 1CJ102	Programming in C	4	3	2	40	60	100
	Major 3	DSA 1CJ103	Mathematics and Statistics for Data Science	4	4	0	40	60	100
2	Major 4	DSA 2CJ101	Introduction to RDBMS and SQL	4	3	2	40	60	100
	Major 5	DSA 2CJ102	Data Visualization Techniques and Tools	4	3	2	40	60	100
	Major 6	DSA 2CJ103	Data Mining Techniques	4	4	0	40	60	100
	Audit	DSA 2CJ149	OJT	-	-	30#	-	-	-
3	Major 7	DSA 3CJ201	Python Programming	4	3	2	40	60	100
	Major 8	DSA 3CJ202	Data Structures and Algorithms	4	3	2	40	60	100
	Major 9	DSA 3CJ203	Artificial Intelligence	4	4	0	40	60	100
4	Major 10	DSA 4CJ201	Introduction to Machine Learning	4	3	2	40	60	100
	Major 11	DSA 4CJ202	Object Oriented Programming with Java	4	3	2	40	60	100

	Major 12	DSA 4CJ203	Big Data Technologies	4	4	0	40	60	100
	Elective 1	XXXXXXXXX	Elective Course 1	4	4		40	60	100
	Audit	DSA 4CJ249	OJT	-	-	30#	-	-	-
5	Major 13	DSA 5CJ301	Advanced Database Management Techniques with MongoDB	4	3	2	40	60	100
	Major 14	DSA 5CJ302	Advanced Python for Data Science	4	3	2	40	60	100
	Major 15	DSA 5CJ303	Software Project Management	4	4		40	60	100
	Elective 2	XXXXXXXXX	Elective Course 2	4	4		40	60	100
6	I/A/P	DSA 6CJ349	Internship/ Apprenticeship/ Project Work	12			120	180	300
7 & 8	Online 1	DSA 8CJ401		4*					100*
	Online 2	DSA 8CJ402		4*					100*
	Online 3	DSA 8CJ403		4*					100*
	I/A/P	DSA 8CJ449	Internship/ Apprenticeship/ Project Work	28			280	420	700
TOTAL				108 / 120*			2700 / 3000*		
* Credits and Total Marks depend on the course chosen from the major or minor pathway in the fourth year. # Number of learning hours per semester									

10.LIST OF ELECTIVE COURSES OFFERED

Semester	Course Type	Course Code	Course Title	Credits	Theory	Internal	External	Total Marks
4	Elective 1 (Any one)	DSA4EJ211	Cloud Computing	4	4	40	60	100

		DSA4EJ212	Computer Vision	4	4	40	60	100
		DSA4EJ213	Information Retrieval Techniques	4	4	40	60	100
5	Elective 2 (Any one)	DSA5EJ311	Deep Learning	4	4	40	60	100
		DSA5EJ312	R programming	4	4	40	60	100
		DSA5EJ313	Social Network Analysis	4	4	40	60	100

11. LIST OF ONLINE COURSES OFFERED

Semester	Course Title	Platform	Course details	Mark
7 & 8	Data Science for Engineers	Swayam	Course Provider: IIT Madras Duration: 8 weeks	100
	Business Analytics & Text Mining Using Python	Swayam	Course Provider: IIM Bangalore Duration: 8 weeks	100
	Next Generation Sequencing Technologies: Data Analysis and Applications	Swayam	Course Provider: IIT Kharagpur Duration: 12 weeks	100
	Finance Analytics for Decision Making using Excel	Swayam	Course Provider: IIM Bangalore Duration: 12 weeks	100
	Mathematical Foundations for Machine Learning	Swayam	Course Provider: IISc Bangalore Duration: 8 weeks	100
	Prescriptive Analytics: Strategies and Applications	Swayam	Course Provider: IIM Bangalore Duration: 6 weeks	100

12. LIST OF FOUNDATION COURSES OFFERED

Semester	Course Type	Course Code	Course Title	Credits	Theory	Internal	External	Total Marks
1	SEC 1 – SDC	DSA1FS111	Data Analysis using Spread Sheet	3	3	25	50	75

	MDC 1-GEC (Other Dept)	DSA1FM105	Introduction to computers and office Automation	3	3	25	50	75
2	MDC 2 -GEC (Other Dept)	DSA2FM106	Digital Marketing	3	3	25	50	75
3	VAC 1-SDC	DSA3FV108	Business Intelligence and Strategy	3	3	25	50	75
4	SEC 2- SDC	DSA4FS112	Computer Networks for Data Science	3	3	25	50	75
	VAC 2-SDC	DSA4FV109	Introduction to Cyber Law	3	3	25	50	75
5	VAC 3- SDC	DSA5FV110	Introduction To Content Management System	3	3	25	50	75
	SEC 3- SDC	DSA5FS113	Introduction to Digital Marketing	3	3	25	50	75

13.FOUNDATION COURSES FROM OTHER DEPARTMENTS

Sem.	Course Code	Code	Department
1	AEC1	ENG1FA101(4)	English
	MDC1	XXX1FM105	Other than Major department
2	AEC2	ENG2FA103(4)	English
	AEC3	XXX2FA104(4)	Language
	MDC2	XXX2FM106	Other than Major department
3	MDC3(KS)	XXX3FM107(4)	Language

14.GROUPING OF VOCATIONAL MINOR COURSES

Minor Title: Data Science and Analytics

Groups 1 and 2 may be offered to students from any discipline other than their major.

Group 3 is available exclusively to B. Voc. students from other disciplines.

Group 1 Title - Fundamental Techniques in Data Science and Analytics										
Semester	Course Type	Course Code	Course Title	Credits	Theory	Practical	Internal	External	Total	Marks

1	Minor 1	DSA1MN101	Introduction to Data Science and analytics	4	3	2	30	70	100
2	Minor 2	DSA2MN101	Data analysis using Spreadsheet	4	3	2	30	70	100
3	Minor 3	DSA3MN201	Foundations of Data Science with Python	4	3	2	30	70	100
Group 2 Title - Foundations of Intelligent Data Analysis									
Semester	Course Type	Course Code	Course Title	Credits	Theory	Practical	Internal	External	Total Marks
3	Minor 4	DSA3MN202	Introduction to Machine Learning and Artificial Intelligence	4	3	2	30	70	100
4	Minor 5	DSA4MN201	Data Visualization Using Power BI	4	3	2	30	70	100
5	Minor 6	DSA5MN301	Programming for Data Science with Python and R	4	3	2	30	70	100

15. SCHEME OF EVALUATION

General Educational Components (GEC)

The General Education Components (GEC) in the B.Voc. programme consist of Foundation Courses (18 credits) and Minor Pathway Courses (24 + 12* credits), totalling 42 - 54 credits. The distribution of these courses and credits is detailed in Table 1. The evaluation of these components is aligned with the existing FYUGP structure of the University of Calicut to ensure greater flexibility. The corresponding mark distribution for these components is provided in Table 2.

Table 1: Course Distribution

	AEC	MDC	Minor
No. of Courses	3	3	6 + 3*
Credits	9	9	24 + 12*

* Three online courses may be studied either the major or minor discipline (VII or VIII semester).

Table 2: Mark Distribution

General Foundation Courses						
3 Credit Course with Open Ended Module (50 ESE + 25 CCA)						
External (50)		Theory Internal (20)		Open Module Internal (5)		
End Semester Examination	Mid Semester Examination	Rubrics 1	Rubrics 2	Test	Rubrics 1	Rubrics 2

50	10	6	4	2	2	1
3 Credit Course with Practical / Practicum (50 ESE + 25 CCA)						
External (50)	Theory Internal 1 (10)			Practical / Practicum Internal (15)		
End Semester Examination	Mid Semester Examination	Rubrics 1	Rubrics 2	Practical / Exercise	Exam / Viva	Record
50	5	3	2	8	5	2

Minor Pathway Courses

4 Credit Courses with Open Ended Module (70 ESE + 30 CCA)						
External (70)	Theory - Internal (20)			Open Ended Module - Internal (10)		
End Semester Examination	Mid Semester Examination	Rubrics 1	Rubrics 2	Test	Rubrics 1	Rubrics 2
70	10	6	4	4	4	2
4 Credit paper with Practical / Practicum (70 ESE + 30 CCA)						
External (70)	Theory Internal (10)			Practical / Practicum Internal (20)		
End Semester Examination	Mid Semester Examination	Rubrics 1	Rubrics 2	Practical / Exercise	Exam / Viva	Record
70	5	3	2	10	7	3

Suggested Rubrics of Formative Assessment include:

Practical assignments, observation of practical skills, viva voce, quizzes, interviews, oral presentations, computerised adaptive testing, in-class discussions, instructor-created exams, seminar presentations, clicker questions, low-stakes group work, group tutorial work, one-minute reflection writing assignments, home assignments, self and peer assessment, or any other method deemed appropriate by the BOS / Expert Committee based on the specific course context.

Suggested Rubrics of Summative Assessment include:

written tests, open book tests, laboratory reports, problem-based assignments, individual project reports, case study reports, team project reports, literature surveys, standardised tests, or any other pedagogic approach specifically designed for the course by the BOS / Expert Committee.

Note: Any pedagogical approach specifically designed for course evaluation as proposed by the Board of Studies (BOS) or Expert Committee.

Skill Development Components (SDC)

Skill Development refers to domain-specific, demand-driven training aimed at enhancing employability or leading to employment. Skill-based course (Major course) have the following components of learning: Lecture / Theory / Assignment, Practical / Hands-on Skill Training, Internship / Project work / On the Job Training or Apprenticeship. The distribution

of these courses and credits is detailed in Table 1 and the corresponding mark distribution for these components is provided in Table 2.

Table 1: **Course Distribution**

Sl.	Pathway Courses	Semester	Required Credits
1	Skill Enhancement Courses (SEC)	I, IV, V	9
2	Value Added Courses (VAC)	III, IV, V	9
3	Major Pathway: Skill Development Components	I - VI	98
4	Major Pathway: Skill Development Components	VII - VIII	28 + 12*

* Student can opt Minor Courses instead

Table 2: Mark Distribution (General Foundation Courses)

General Foundation Courses						
3 Credit Course with Open Ended Module (50 ESE + 25 CCA)						
External (50)	Theory Internal (20)			Open Module Internal (5)		
End Semester Examination	Mid Semester Examination	Rubric s 1	Rubric s 2	Test	Rubric s 1	Rubrics 2
50	10	6	4	2	2	1
3 Credit Course with Practical / Practicum (50 ESE + 25 CCA)						
External (50)	Theory Internal I (10)			Practical / Practicum Internal (15)		
End Semester Examination	Mid Semester Examination	Rubric s 1	Rubric s 2	Practical / Exercise	Exam / Viva	Record
50	5	3	2	8	5	2

Major Pathway Courses (Vocational)						
4 Credit paper with Open Ended Module (60 ESE + 40 CCA)						
External (60)	Theory Internal (30)			Open Ended Module Internal (10)		
End Semester Examination	Mid Semester Examination	Rubrics 1	Rubrics 2	Test	Rubrics 1	Rubrics 2
60	20	5	5	5	3	2

4 Credit paper with Practical / Practicum (60 ESE + 40 CCA)						
External (60)	Theory Internal (10)			Practical / Practicum Internal (30)		
End Semester Examination	Mid Semester Examination	Rubrics 1	Rubrics 2	Practical / Exercise	Exam/Viva	Record
60	5	3	2	15	10	5

Table 3: Mark Distribution (Major Pathway Courses)

Suggested Rubrics of Formative Assessment include:

Practical assignments, observation of practical skills, viva voce, quizzes, interviews, oral presentations, computerised adaptive testing, in-class discussions, instructor-created exams, seminar presentations, clicker questions, low-stakes group work, group tutorial work, one-minute reflection writing assignments, home assignments, self and peer assessment, or any other method deemed appropriate by the BOS / Expert Committee based on the specific course context.

Suggested Rubrics of Summative Assessment include:

Written tests, open book tests, laboratory reports, problem-based assignments, individual project reports, case study reports, team project reports, literature surveys, standardised tests, or any other pedagogic approach specifically designed for the course by the BOS / Expert Committee.

Note: Any pedagogical approach specifically designed for course evaluation as proposed by the Board of Studies (BOS) or Expert Committee.

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16. GUIDELINES FOR OJT / INTERNSHIP / APPRENTICESHIP / PROJECT WORK/ON JOB TRAINING(OJT)

Students shall undertake mandatory zero credit On-the-Job Training (OJT) for a minimum duration of thirty (30) hours in both Semester II and Semester IV. These skill development components shall be designated as audit courses.

To be eligible for a 'Pass' in an audit course, students are required to achieve a minimum of seventy-five percent (75%) attendance. Students who fulfil this attendance requirement are exempt from participation in continuous assessment for the audit course. Notwithstanding the foregoing, a student who does not meet the attendance requirement must undergo a prescribed evaluation to satisfy the course requirements.

Successful completion of an audit course, evidenced by meeting the attendance requirement or, where applicable, by successfully passing the prescribed evaluation, shall result in a 'Pass' grade with zero (0) academic credits.

Internship / Apprenticeship / Project Work (I / A / P)

Internship, Apprenticeship, or Project work constitute a critical capstone component of the B.Voc. programme. This component provides students with structured opportunities to apply theoretical knowledge in real-world settings, develop domain-specific competencies, promote workplace readiness, and align learning outcomes with industry standards and expectations.

I / A / P may be completed in any recognised industry, organisation, startup, research laboratory, or field site. Each student shall be assigned a faculty supervisor by the parent department and, where applicable, shall be supported by an industrial mentor. A learning agreement shall be signed by the student, faculty supervisor, and the host institution / industry prior to the commencement of the I / A / P.

I / A / P Report

Upon successful completion of the I / A / P, each student shall prepare a comprehensive report detailing the observations made and knowledge gained during the training period. Students are advised to consult their industrial mentor or faculty supervisor for the assignment of specific topics or problems upon which the final report shall be based. Maintaining a daily diary throughout the I / A / P is mandatory, as it shall serve as a valuable resource for compiling the final report by systematically incorporating daily learning and experiences. The final report must be duly signed by both the industrial mentor and faculty supervisor to be considered valid.

Table 1: Report Evaluation Criteria

The evaluation of the report shall be based on the following criteria:

Sl.	Criteria	Explanation
1	Originality	Uniqueness and independent thought demonstrated in the report.
2	Content Adequacy and Relevance	Thoroughness, coherence, and purposefulness of the writeup
3	Presentation Quality	Organization, adherence to specified format, clarity of visual aids (drawings, sketches), writing style, and language
4	Learning Experience	Breadth, depth, and relevance of the practical learning acquired during the I / A / P
5	Application and Theory Linkage	Demonstration of practical applications and the clear connection to basic theoretical concepts taught in the academic curriculum

Evaluation Process

A minimum of three (3) internal reviews shall be conducted to evaluate progress during the I / A / P. Internal evaluation shall be conducted jointly by the faculty supervisor and the industrial mentor, while the final evaluation shall be carried out by an evaluation panel comprising: one (1) external examiner from the University- approved panel, one (1) internal faculty member from the college, and one (1) industry representative.

Students shall be required to submit the following documents at the time of the evaluation: an internship completion certificate, an attendance statement and an I / A / P report. Each student shall present their work and participate in a viva voce before the evaluation panel. To be eligible for a 'Pass', students must obtain a minimum of fifty percent (50%) marks in the I / A / P.

Table 2: Internship - Evaluation Components

Sl. No.	Components of Evaluation of Internship/Apprentice	Type	Marks of Evaluation (300)	Marks of Evaluation (700)
1.	Attendance	Internal	20	50
2.	Team work evaluation from internship provider	Internal	60	140
3.	Log book	Internal	40	90
4.	Internship Report	External	40	80
5.	Presentation	External	100	200
6.	Viva Voce	External	40	140
	Total		300	700

Table 3: Apprenticeship - Evaluation Components

Sl. No.	Components of Evaluation of Apprenticeship	Type	Marks of Evaluation (300)	Marks of Evaluation (700)
1.	Attendance	Internal	20	50
2.	Skill proficiency evaluation from Apprenticeship provider	Internal	60	140
3.	Log book	Internal	40	90
4.	Work Report	External	40	80
5.	Presentation	External	100	200
6.	Viva Voce	External	40	140
	Total		300	700

Table 4: Project Work - Evaluation Components

Sl. No.	Components of Evaluation of Project Work	Type	Marks of Evaluation (300)	Marks of Evaluation (700)
1	Project Proposal and Planning (internal)	Internal	20	50
2	Project Progress and Implementation (internal)	Internal	60	140
3	Interim Presentations(internal)	Internal	40	90
4	Project Report (External)	External	40	80
5	Project Demonstration (External)	External	100	200
6	Viva Voce (External)	External	40	140
Total Marks			300	700

17. LETTER GRADES AND GRADE POINTS

Letter Grade	Grade Point	Percentage of Marks (Internal & External Put Together)	Class
O (Outstanding)	10	95 % and above	First Class with Distinction
A+ (Excellent)	9	Above 85% and below 95%	
A (Very Good)	8	75 % to below 85%	
B+ (Good)	7	65 % to below 75%	First
B (Above Average)	6	55 % to below 65%	
C (Average)	5	45 % to below 55%	Second
P (Pass)	4	35 % to below 45% aggregate (Internal + External) with a minimum of 30 % in the external valuation	Third
F (Fail)	0	Below an aggregate of 35% or below 30% in external evaluation	Fail
Ab (Absent)	0	-	Fail

$$SGPA = \frac{\sum \text{of the credit points of all the courses } \in \text{ a semester}}{\text{Total credits } \in \text{ that semester}}$$

$$CGPA = \frac{\sum \text{of the credit points of all the courses } \in \text{ all the semesters}}{\text{Total credits } \in \text{ all semesters}}$$

18. DETAILED SYLLABUS OF MAJOR COURSES

SEMESTER I

Course Code & Title	DSA1CJ101: Introduction to Data Science				
Type of Course	Major	Semester	1	Academic Level	100-199
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	Basic programming, Statistics Awareness				
Course Summary	This course introduces students to the interdisciplinary field of data science. It covers fundamental concepts including statistical inference, machine learning basics, data wrangling, and data visualization. Students will learn the data science process through practical examples and industry-relevant case studies. The course also emphasizes the ethical implications and responsibilities involved in handling and analyzing data.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Explain the foundational concepts and lifecycle of Data Science projects	U	C	Written Exam / MCQs
CO2	Apply basic machine learning algorithms and perform feature engineering	Ap	P	Practical Assignments / Quiz
CO3	Describe and differentiate recommendation system techniques	U	C	Case Study / Quiz
CO4	Demonstrate use of basic data visualization tools and principles	Ap	P	Practical Assignment / Viva
CO5	Analyze ethical issues in Data Science and describe emerging trends	A	M	Essay / Group Presentation / Seminar
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Foundations of Data Science		10	15
	1	What is Data Science?	1	
	2	Differences between Data Science and Data Analytics	1	
	2	Big Data and Data Science hype	1	
	3	The rise of Datafication	1	
	4	Roles in the Data Science Ecosystem: Data Scientist, Data Engineering, Data Analyst	1	
	5.	Essential skill sets in Data Science	1	
	6.	Data Science Project Lifecycle Problem Definition-> Data collection->Preprocessing->EDA->Modelling->Evaluation->Deployment	2	
	7.	Exploratory Data Analysis (EDA)-Concepts and Tools	2	
II	Machine Learning & Feature Engineering		15	15
	8	Three basic ML algorithms: Linear Regression, k-NN, k-means	3	
	9	Decision Tree & Naive Bayes Application: Filtering Spam	3	
	10	Data wrangling: Cleaning, transforming and preparing data sets	3	
	11	Introduction to Web Scrapping tools & APIs	3	
	12	Feature generation (Domain knowledge, Brain storming) and Feature selection (filters, wrappers, trees, forests)	3	
III	Recommendation Systems		15	15
	13.	Introduction to Recommendation Systems (Definitions, objectives, industry use, comparison with search system)	2	
	14	Components of recommendation system	3	
	15	Types of recommendation Systems (Content –Based Filtering, Collaborative filtering,	2	

		Hybrid Approaches)		
	16	Types of Collaborative Filtering	2	
	17.	Dimensionality reduction(SVD and PCA)	4	
	18.	Building a recommendation engine	2	
IV	Data Visualization & Ethics		10	15
	19	Data visualization, Data visualization in Data Science	2	
	20	Basic Plots & Common Tools	2	
	21	Principles of Effective Communications	2	
	22	Ethical Issues in Data Science: Data privacy, Bias& Fairness, security, Algorithmic transparency (Explainability of AI decisions)	2	
	23	Future of data science: Trends in DS, Next –Generation Data Scientists: Expectations, Responsibilities, Career paths	2	
V	24	The Data Science Workflow Revisited	25	
	25	Integrating all stages: data collection → cleaning → modeling → visualization → communication	10	
	26	Case Study – Walk through a complete example using a real-world dataset (e.g., COVID-19 statistics, student performance data, or e-commerce sales) to demonstrate data analysis steps and interpretation of results.	15	

References:

Text Books:

1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline.O’Reilly. 2014.
2. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
3. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition.

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	-	-	-	-	3	2	-	-	2	-	-
CO 2	3	3	-	3	-	3	-	3	3	3	-	2
CO 3	2	3	3	-	-	3	2	2	2	3	-	2
CO 4	2	2	2	3	3	3	2	3	3	2	-	-
CO 5	2	-	-	2	2	3	3	2	-	3	3	3

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	

Course Code & Title	DSA1CJ102: Programming in C				
Type of Course	Major	Semester	1	Academic Level	100-199
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	Basic computer literacy				
Course Summary	The objectives of this course are to make the student understand programming language, programming, concepts of Loops, reading a set of Data, stepwise refinement, Functions, Control structure, Arrays, Structures, Unions, and Pointers. After completion of this course the student is expected to analyze the real-life problem and write a program in 'C' language to solve the problem. The main emphasis of the course will be on problem solving aspect i.e. developing proper algorithms.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Remember the program structure of C with its syntax and semantics	U	C	Instructor- created exams / Quiz
CO2	Use the various constructs of a programming language viz. conditional, iteration and recursion	Ap	P	Practical Assignment / Instructor- created exams / Quiz
CO3	Implement the algorithms in C language.	Ap	P	Practical Assignment / Instructor- created exams / Quiz
CO4	Use simple data structure like array in solving problems.	Ap	C	Practical Assignment / Observation of Practical Skills
CO5	Handling pointers and memory management functions in C.	Ap	P	Practical Assignment / Observation of Practical Skills

CO6	Develop efficient programs for solving a problem	Ap	P	Viva Voce/ Practical Assignment
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to C Language		10	15
	1	History of C, Importance of C, and sample programs	2	
	2	Character set, Tokens, Constants, Variables, and Data types	2	
	3	Operators - Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special operators. Arithmetic expressions, operator precedence, type conversions, mathematical functions	3	
	4	Managing Input and Output Operators: Reading and writing a character, formatted input, formatted output.	3	
II	Decision Making Branching and Looping		10	15
	5	Decision making with If - simple If, If else, nested If else, else If ladder	3	
	6	Switch statement, conditional operator, Goto statement	3	
	7	Loops: while, do while, for statements and nested loops	2	
	8	Jumps in loops – break, continue	2	
III	Arrays and Functions		15	15
	9	One-dimensional array – declaration, initialization and accessing	1	

	10	Two-dimensional array – declaration, initialization and accessing	1	
	11	Multi-dimensional array, dynamic array	1	
	12	Strings – Reading, Writing. Arithmetic operations on characters, Comparisons and string handling functions	2	
	13	Functions – Need, Elements of user defined functions and definition	2	
	14	Return values and their types, function call and declaration, call by value and call by reference	2	
	15	Categories of functions, Nesting of functions	2	
	16	Recursion and command line arguments	2	
	17	Passing arrays to functions and passing strings to functions	2	
IV	Storage Classes, Structure and Union, Pointers		15	15
	18	Storage classes – The scope, visibility and lifetime of variables. Auto, Extern, Static and Register storage classes. Storage classes in a single source file and multiple source files	3	
	19	Structure and Union - Defining, giving values to members, initialization and comparison of structure variables, arrays of structure, arrays within structures, structures within structures, structures and functions, unions	3	
	20	Pointers definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor	3	
	21	Pointers and arrays, pointers and functions, pointers and structure	3	
	22	Dynamic memory allocation and memory management functions	3	
V	Practice-Based Problem Solving		25	

1	Write a C program to find the largest of three numbers		
2	Find the sum of digits and reverse of a number		
3	Create a simple calculator using switch statement		
4	Print prime numbers between 1 and 100 using loops		
5	Print N Fibonacci series		
6	Print Armstrong numbers up to N		
7	Implement factorial calculation using recursion		
8	Write a program to perform matrix addition		
9	Find the transpose of a matrix		
10	Read a string and check whether it is a palindrome		
11	Create a structure for student details and display records using arrays of structures		
12	Swapping of two numbers using pointers		
13	Find the number of vowels in a string		
14	Read and write data from/to a text file (e.g., student marks)		
15	Copy the contents of one file into another		

References:

1. Programming in ANSI C by E. Balaguruswami.
2. Title: *Let Us C* Author: Yashavant Kanetkar Publisher: BPB Publications
3. The C Programming Language by Brian W. Kernighan & Dennis M. Ritchie.
4. Byran Gotfried, Schaums Outline series- Programming with C

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	3	-	2	-	-	-	-
CO2	3	2	-	3	-	3	2	3	3	2	-	-
CO3	3	3	-	3	-	3	2	3	3	3	-	-
CO4	3	3	-	3	-	3	2	3	3	3	-	-
CO5	3	3	-	2	-	3	-	3	3	-	-	-
CO6	3	3	2	3	-	3	2	3	3	3	-	2

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6	✓	✓	✓	

Course Code & Title	DSA1CJ103: Mathematics and Statistics for Data Science				
Type of Course	Major	Semester	1	Academic Level	100-199
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	0	0	60
Pre-requisites	1. Basic Mathematics and Statistics				
Course Summary	This undergraduate course provides the fundamental mathematical and statistical tools necessary for understanding and analysing data in the context of data science. The course covers topics ranging from basic algebraic operations to advanced statistical techniques.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply Vector and Matrix operations to solve computational problems.	Ap	P	Instructor-created exams / Quiz
CO2	Students will evaluate eigenvalues and eigenvectors to decompose matrices, enabling them to analyze and interpret data transformations effectively.	A	P	Seminar Presentation / Group Tutorial Work
CO3	Students will apply fundamental probability concepts to solve real-world problems.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Students will apply sampling techniques and hypothesis tests to make inferences about populations from sample data, using one-tailed, two-tailed tests, and ANOVA for analysis	Ap	P	Practical Assignment / Observation of Practical Skills
CO5	Apply statistical techniques to solve real-world data analysis problems through practical exercises	Ap	P	Practical Assignment / Observation of Practical Skills
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Linear Algebra		10	15
	1	Vector in space	1	
	2	Vector algebra operations	1	
	3	Unit Vector, Inner Product, Vector Product	2	
	4	Vector scalar multiplication	1	
	5	Matrix: Special Matrices, Matrix Operations	2	
	6	Trace of a square matrix, Determinant of a square matrix	2	
	7	Diagonal and Triangular matrices.	1	
II	Linear Algebra for Data Transformation		6	15
	8	Eigen Values and Eigen Vectors	1	
	9	Eigen Decomposition	1	
	10	Singular Value Decomposition	2	
	11	Principal Component Analysis	2	
III	Descriptive Statistics – Numerical Methods and Tabular and Graphical Methods		10	15
	12	Measures of central tendency: mean, median, mode, percentiles, quartiles	2	
	13	Measures of variability: range, interquartile range, mean deviation, variance, standard deviation	2	
	14	Skewness, Kurtosis	2	
	15	Coefficient of variation	1	
	16	Graphs: bar chart, pie chart, dot plot, histogram, box plot, stem-and-leaf plot, ogive, Scatter diagrams	3	
IV	Bivariate Analysis and Regression		9	15

	17	Covariance and correlation	2	
	18	Rank correlation	1	
	19	Curve fitting: least squares method	2	
	20	Linear and non-linear trend fitting	2	
	21	Simple linear regression and its properties	2	
V	Applications and Case-Based Problem Solving		25	
	1- Real-World Data Set Analysis – Choose a dataset (e.g., student scores, COVID-19, retail sales) – Apply descriptive statistics and create summary tables & charts			
	2- Linear Algebra in Action – Apply matrix operations or PCA on multi-variable data – Visualize dimensionality reduction with simple 2D examples			
	3- Regression and Trend Analysis – Use spreadsheet or Python to fit linear and non-linear trends			

References:

1. **Anderson, Sweeney, Williams (2012)** – *Statistics for Business and Economics*, Cengage Learning
2. **S.C. Gupta & V.K. Kapoor (2002)** – *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	–	–	–	–	3	2	–	–	–	2	–
CO 2	3	–	2	–	–	2	3	2	–	–	–	3
CO 3	3	3	–	–	–	2	3	3	–	–	–	3
CO 4	3	3	–	3	–	2	3	3	2	–	2	3
CO5	3	3	3	3	3	3	3	3	3	2	3	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	

SEMESTER II

Course Code & Title	DSA2CJ101: Introduction to RDBMS and SQL				
Type of Course	Major	Semester	2	Academic Level	100-199
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	Basic knowledge of programming or data structures				
Course Summary	<p>This course introduces students to the foundational principles of relational database management systems (RDBMS) and equips them with practical SQL programming skills. It covers database design using the Entity–Relationship (ER) model, implementation of databases through Data Definition Language (DDL), and manipulation using Data Manipulation Language (DML). The course also explores advanced SQL constructs including views, joins, functions, stored procedures, triggers, and concurrency control. Through a hands-on practical module and mini project, students develop competence in creating and managing real-world relational databases and applying best practices for secure and efficient data handling.</p>				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Explain the fundamentals of database systems and ER modeling	U	C	Instructor- created exams / Quiz
CO2	Create and modify database schemas and constraints using SQL	Ap	P	Seminar Presentation / Group Tutorial Work
CO3	Perform data manipulation and use queries with joins and group operations	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Implement advanced database programming using stored procedures, functions, and triggers	Ap/E	P	Practical Assignment / Seminar
CO5	Apply SQL concepts to solve real-world data problems and develop a complete mini project	C	M, P	Viva Voce/ Observation of Practical Skills
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Database System- Concept		9	15
	1	Introduction, Characteristics of the Database Approach	2	
	2	Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach, File system vs Database	2	
	3	View of Data – Physical, Logical, and View levels Data Models: Relational, Hierarchical, Network, Object-oriented Instances and Schemas Three-schema architecture and Data Independence	2	
	4	Database Languages-- DDL, DML, DCL, and TCL and Interfaces (command-line, GUI, embedded)	3	
II	Data Definition in SQL		12	15
	5	SQL Data types, Creating and Dropping tables, modifying table structure (ALTER TABLE), Truncate Inserting, Updating, Deleting Data	4	
	6	Table Operations: Viewing table structure and content, Renaming tables and columns	4	
	7	Constraints in SQL:Input/Output constraints, PRIMARY KEY, FOREIGN KEY,UNIQUE and NOT NULL Using ALTER TABLE to add constraints	4	
III	SQL - Data Manipulation and Access Control		12	15
	8	Basic SQL Queries: SELECT command with WHERE, ORDER BY Logical Operators (AND, OR, NOT),Range Searching (BETWEEN),Pattern Matching (LIKE, %),Membership Operator(IN),Set Operations	3	

	9	Grouping and Aggregation :GROUP BY and HAVING Aggregate Functions: COUNT, AVG, SUM, MIN, MAX	3	
	10	Joins and Views: Types of Joins: INNER, LEFT, RIGHT, FULL, Joining a table to itself (Self Join) <ul style="list-style-type: none"> • Creating and Modifying Views • Dropping Views • Renaming columns in views 	4	
	11	Access Control GRANT and REVOKE commands Object privileges	4	
IV	Programming with SQL		12	15
	12	Procedural Constructs: <ul style="list-style-type: none"> • IF, ELSE, WHILE, GOTO • Variables, SET and SELECT 	2	
	13	Locks: Types and Levels of Locking	1	
	14	Cursors: Working with Cursors	2	
	15	Stored Procedures: Create, Alter, Drop, Passing Parameters	2	
	16	User defined functions, Scalar functions	2	
	17	Triggers: Creation, Multiple Trigger Interaction	2	
	18	Error Handling and Security	1	
V	RDBMS LAB		30	
	1	Case Study & Problem Statement Formulation Task: Students choose a real-world scenario (e.g., Library Management, Online Shopping, Student Portal etc) and define a problem statement. Note: Submission: Written problem statement (1 page)		

2	Based on Identified problem Statement, Design ER Diagram (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.) Note: Students are required to submit a document by drawing an ER Diagram to the Lab teacher.		
3	Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys) Note: Students are required to submit a document showing the database tables created from ER Model.		
4	Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables		
5	Practice Constraints using table creation: NOT NULL, UNIQUE, CHECK		
6	Practicing DML commands-Insert, Select, Update, Delete.		
7	Practicing Queries using : ORDER BY Logical Operators (AND, OR, NOT), Range Searching (BETWEEN), Pattern Matching (LIKE, %) ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, etc.		
8	Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi).		
9	Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, DISTINCT,		
10	VIEWS Creation, Renaming Columns and Dropping.		

References:

- Fundamentals of Database Systems, Elmasri & Navathe, Pearson Education.
- Database System Concepts Abraham Silberschatz, Henry F Korth, S.
- Introduction to Database Systems, CJ Date, Addison Wesley

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	-	-	-	-	3	-	2	2	2	-	-
CO 2	3	2	2	2	-	3	2	3	3	-	-	-
CO 3	3	2	3	2	-	3	2	3	3	2	-	-
CO 4	3	3	3	3	2	3	3	3	3	3	-	2
CO 5	3	3	3	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓		✓	

Course Code & Title	DSA2CJ102: Data Visualization Techniques and Tools				
Type of Course	Major	Semester	2	Academic Level	100-199
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	Basic knowledge of statistics and spreadsheets				
Course Summary	This course introduces the principles, techniques, and tools used to visualize data effectively. Students learn how to select appropriate visual formats, apply design best practices, and use tools like Power BI, Tableau to create meaningful insights from data. The course emphasizes both analytical thinking and design skills, guiding students through the development of interactive dashboards and domain-specific visualizations for real-world datasets.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamental principles of effective data visualization	U	C	Instructor-created exams / Quiz
CO2	Use Power BI to connect, transform, and visualize data interactively	Ap	P	Seminar Presentation / Group Tutorial Work
CO3	Develop dashboards and data stories using Tableau	Ap/C	P	Practical Assignment / Observation of Practical Skills
CO4	Design domain-specific dashboards using best practices and case studies	Ap	P	Practical Assignment / Seminar
CO5	Evaluate and present ethical and effective data visualization projects	C	M, P	Viva Voce/ Observation of Practical Skills
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Principles of Data Visualization		10	15
	1	Importance of data visualization in analytics and communication	2	
	2	Types of data: categorical, numerical, temporal, geospatial	2	
	3	Choosing the right chart: bar, line, pie, histogram, box plot, scatter plot	2	
	4	Design best practices: clarity, simplicity, color, labeling, storytelling	2	
	5	Common mistakes in visualization	2	
II	Data Visualization with Power BI		15	15
	6	Overview of BI tools	3	
	7	Connecting to data sources	3	
	8	Creating charts and visuals	3	
	9	Designing dashboards and reports	3	
	10	Filters, slicers, interactivity, sharing reports	3	
III	Data Visualization with Tableau		15	15
	11	Introduction to Tableau and its workspace	3	
	12	Connecting to datasets and creating basic visualizations	3	
	13	Working with calculated fields and parameters	3	
	14	Dashboard design and storyboards	3	
	15	Interactivity, filters, and publishing dashboards	3	
IV	Advanced Topics and Real-World Applications		10	15
	16	Interactive visualizations	2	
	17	Geographic visualizations	2	

	18	Visual storytelling and presentation techniques	2	
	19	Domain-specific visualizations	2	
	20	Final project with dashboard creation	2	
V	Lab Exercises in Data Visualization Tools		25	
	1	Load & Clean Data in Power BI Import an Excel/CSV dataset (e.g., sales, student scores) into Power BI, clean missing/null values, and apply basic transformations using Power Query.		
	2	Create Basic Charts Using Power BI, generate bar, pie, line, and column charts to display different types of categorical and numerical data.		
	3	Build an Interactive Dashboard (Power BI) Create a dashboard with slicers, filters, and multiple visuals (charts, maps). Enable drill-down interactivity.		
	4	Data Modeling with Relationships Create relationships between tables (e.g., orders and customers) and demonstrate how relational joins work in Power BI visualizations.		
	5	Geo Visualization in Power BI Use geographic data to build map visualizations (e.g., sales by state or country). Explore tooltips and custom map visuals.		
	6	Connect & Visualize Data in Tableau Connect to a dataset in Tableau, perform data interpretation using filters and sorting, and build basic charts.		
	7	Create Storyboard in Tableau Design a storyboard to present a step-by-step narrative of visual insights, using at least 3 different visuals.		
	8	Calculated Fields in Tableau Use calculated fields (e.g., profit margin, average marks) and demonstrate the impact in visual outputs.		
	9	Create Domain-Specific Dashboard Design a dashboard based on a specific theme (e.g., E-commerce sales, COVID trends, tourism data) in either		

		Power BI or Tableau.		
	10	Final Project – Data Storytelling Choose a real-world dataset and build a complete data story with visuals, interactive filters, and summary insights. Present using Power BI or Tableau.		

References:

Text Books:

1. Storytelling with Data: A Data Visualization Guide for Business Professionals

- **Author:** Cole Nussbaumer Knaflic
- **Publisher:** Wiley
- **ISBN:** 978-1119002253

2. Microsoft Power BI Data Analysis and Visualization

- **Author:** Roger F. Silva
- **Publisher:** Independently published
- **ISBN:** 979-8634465649

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	-	-	-	2	3	2	-	2	2	-	-
CO 2	3	2	3	2	3	3	2	3	3	2	-	-
CO 3	3	2	3	2	3	3	2	3	3	3	-	-
CO 4	3	3	3	3	3	3	3	3	3	3	-	2
CO 5	3	3	3	3	3	3	3	3	3	3	3	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6		✓	✓	

Course Code & Title	DSA2CJ103: Data Mining Techniques				
Type of Course	Major	Semester	2	Academic Level	100-199
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	0		60
Pre-requisites	Basic understanding of data structures and statistics				
Course Summary	<p>This course provides students with a comprehensive foundation in data mining, covering essential concepts, methods, and tools. It begins with the structure of data warehouses and OLAP operations, and progresses into core data mining functionalities like association rule mining, classification, prediction, and clustering. It also addresses preprocessing techniques and the mining of various complex data types, such as text, spatial, and web data. By the end of the course, students will be able to analyze large datasets to discover hidden patterns and trends, and apply appropriate mining techniques for real-world decision-making.</p>				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the structure and functionalities of data warehouses and OLAP operations	U	C	Instructor-created exams / Quiz
CO2	Apply preprocessing techniques and mining algorithms for association rules	Ap	P	Seminar Presentation / Group Tutorial Work
CO3	Implement and evaluate classification and prediction models	Ap / E	P	Practical Assignment / Observation of Practical Skills
CO4	Apply clustering and outlier detection methods for data segmentation	Ap	P	Practical Assignment / Seminar
CO5	Analyze advanced data types like text, spatial, and web data using mining methods	A / E	M, P	Viva Voce/ Observation of Practical Skills
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Data Warehousing and OLAP		9	15
	1	Overview of data mining and knowledge discovery in databases	1	
	2	Data warehousing architecture	1	
	3	Differences between OLTP and OLAP	1	
	4	Data warehouse schema: star, snowflake, fact constellation	2	
	5	OLAP operations: roll-up, drill-down, slicing, dicing, pivoting	2	

	6	Data cube computation and aggregation techniques	2	
II	Data Preprocessing and Association Rule Mining		14	15
	7	Data cleaning, integration, transformation, and reduction	2	
	8	Data discretization and concept hierarchy generation	2	
	9	Introduction to frequent pattern mining	2	
	10	Market basket analysis	2	
	11	Apriori algorithm and its optimizations	2	
	12	FP-Growth algorithm	2	
	13	Evaluation metrics: support, confidence, lift	2	
III	Classification and Prediction		12	15
	14	Basic concepts: supervised learning, classification vs. prediction	2	
	15	Decision tree induction (e.g., ID3, C4.5)	2	
	16	Rule-based classification	2	
	17	Naïve Bayes classifier	2	
	18	k-Nearest Neighbors (k-NN)	2	
	19	Logistic regression	2	
IV	Clustering, Outlier Detection, and Advanced Topics		15	15
	20	Clustering overview and applications	2	
	21	Partitioning methods: k-means, k-medoids	2	
	22	Hierarchical clustering: agglomerative, divisive	2	
	23	Density-based methods: DBSCAN	2	
	24	Cluster evaluation metrics	2	
	25	Outlier detection techniques	2	
	26	Introduction to graph mining and mining advanced data types: Text mining, Spatial data mining, Web mining	3	
V	Practical Applications and Mini Project		10	
	27	Analyze a public dataset (e.g., UCI, Kaggle) using		

	selected mining techniques		
28	Perform classification or clustering and interpret the results		
29	Apply association rule mining on transactional data		
30	Document and present a mini project using one or more techniques learned		

References:

1- Data Mining: Concepts and Techniques

- **Authors:** Jiawei Han, Micheline Kamber, Jian Pei
- **Publisher:** Morgan Kaufmann
- **Edition:** 3rd Edition

2. Introduction to Data Mining

- **Authors:** Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar
- **Publisher:** Pearson
- **Edition:** 2nd Edition

Mapping of CO's with Pos and PSO s :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	-	-	-	3	-	2	2	2	-	-
CO 2	3	2	3	2	2	3	2	3	3	2	-	-
CO 3	3	3	3	3	3	3	2	3	3	3	-	2
CO 4	3	3	3	3	3	3	2	3	3	3	-	2
CO 5	3	3	3	3	3	3	2	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓	✓	

SEMESTER III

Course Code & Title	DSA 3CJ201: Python Programming				
Type of Course	Major	Semester	3	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge of computers and logical reasoning				
Course Summary	This course introduces the fundamentals of Python programming with emphasis on practical applications in data science. It covers data types, control structures, functions, modules, file handling, and introduces libraries such as NumPy, Pandas, and Matplotlib. The course blends theoretical concepts with real-world practice through labs and mini-projects.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand Python basics, variables, and data types	U	C	Quiz / Written Exam
CO2	Implement decision-making and loop structures in Python	Ap	P	Lab Assignment / Observation
CO3	Design and apply user-defined functions and modules	Ap	P	Practical Assignment / Viva
CO4	Use file handling and exception handling techniques	An	P	Practical / Mini Project
CO5	Work with data using NumPy, Pandas, and visualize using Matplotlib	Ap/C	P	Practical Assignment / Project Presentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Basics of python programming		15	15
	1	History and Features of Python	2	
	2	Python Installation and IDEs	3	
	3	Variables, Keywords, Comments	2	
	4	Data Types: Numbers, Strings, Lists, Tuples, Dictionaries, Sets	4	
	5	Type Conversion and Operators	4	
II	Control Structures		12	15
	6	Decision Making: if, if-else, if-elif-else	4	
	7	Loops: while, for, break, continue, pass	4	

	8	Looping with range(), enumerate(), and nested loops	4	
III	Functions and Modules		14	15
	9	Defining and Calling Functions	4	
	10	Arguments and Return Values	4	
	11	Lambda Functions	3	
	12	Modules and import Statement	2	
	13	Python Standard Library	1	
IV	File and Exception Handling		12	15
	14	File Operations: Open, Read, Write, Append	4	
	15	Working with CSV Files	4	
	16	Exception Handling: try, except, finally, raise	4	
V	PRACTICUM		22	
	1	Write programs using different data types and basic operations		
	2	Create Python scripts with conditional statements		
	3	Write loop-based programs including nested loops		
	4	Implement functions with and without parameters		
	5	Handle exceptions and read/write text and CSV files		
	6	Use NumPy for vectorized computation and basic statistics		
	7	Manipulate and filter data using Pandas		
	8	Plot graphs using Matplotlib		
	9	Mini project: Analyze and visualize a real dataset		

References:

1. “Python Programming” by Reema Thareja, Oxford University Press
2. “Learning Python” by Mark Lutz, O’Reilly Media
3. “Python for Data Analysis” by Wes McKinney, O’Reilly

4. Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO 5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	1	1	2	3	1	2	3	2	1	1
CO 2	3	3	2	2	2	3	2	3	3	2	1	1
CO 3	3	3	2	2	2	3	2	3	3	2	1	2
CO 4	3	3	3	2	2	3	2	3	3	3	2	2
CO5	3	3	3	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6	✓	✓	✓	✓

Course Code & Title	DSA3CJ202: Data Structures and Algorithm				
Type of Course	Major	Semester	3	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	1. Fundamental Mathematics Concepts: Set, Functions, Logic 2. Fundamentals of Programming				
Course Summary	This course explores implementations of linked list and array-based data structures, delving into the inner workings of basic data structures including lists, stacks, queues, trees, and graphs.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Differentiate basic data structures (arrays, linked lists, stacks, queues) based on their characteristics, operations, and real-world applications.	U	C	Instructor-created exams / Quiz
CO2	Perform basic operations (e.g., insertion, deletion, search) on fundamental data structures using a chosen programming language.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Identify the properties and applications of advanced data structures (trees, graphs).	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Investigate the properties of various searching and sorting Techniques	U	C	Practical Assignment / Observation of Practical Skills
CO5	Demonstrate critical thinking and problem-solving skills by applying data structures and algorithms to address complex computational challenges.	Ap	P	Practical Assignment / Observation of Practical Skills
CO6	Implement and analyse different data	Ap	P	Viva Voce

structure algorithms (to solve practical problems).			
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)			

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Data Structures and Basic Algorithms		9	15
	1	Overview of Data Structures: Data type Vs. Data structure, ADT, Definition of Data structure, Data structure Classification – Linear, Non- Linear (Array, Linked List, Stack, Queue, Tree, Graph)	1	
	2	Introduction to Arrays: Definition, Types (1 Dimensional, 2 Dimensional, Multi-Dimensional, Sparse matrix), Different Array Operations with Algorithm (insertion, deletion, traversal)	3	
	3	Structures and Self-referential structures	1	
	4	Introduction to Linked list: Definition, Types (Single linked list, Doublelinked list, Circular linked list- concept only).	2	
	5	Singly Linked List Operations with Algorithm (insertion, deletion, traversal)	2	
II	Stack and Queue		10	15
	6	Introduction to Stack: Definition, stack operations with Algorithm, Applications: recursion, infix to postfix - example and Algorithm	3	
	7	Implementation of Stack: using array (overflow & underflow) and Linkedlist (with algorithm)	2	
	8	Introduction to Queue: Definition, queue operations with Algorithm, Types: Double ended queue (Input Restricted and Output restricted), Circular queue, Applications	2	

	9	Implementation of Queue: using array and Linked list (with algorithm)	3	
III	Non- Linear Data Structures		16	15
	10	Introduction to Trees: Basic terminology, Types (Binary tree- complete,full, skewed etc., Expression Tree)	2	
	11	Properties of Binary tree, Applications.	2	
	12	Binary tree representations- using array and linked list	2	
	13	Operations on Binary tree- Insertion, Deletion, Traversal- inorder, preorder, postorder - (concepts with examples)	3	
	14	Functions – Need, Elements of user defined functions and definition	3	
	15	Introduction to Graph: Definition, Basic terminology, Types (Directed, Undirected, Weighted).	2	
	16	Graph representation –Adjacency list and Adjacency Matrix, Applications.	2	
IV	Sorting and Searching		10	15
	17	Introduction to Sorting: Definition, Classification (Internal, External)	1	
	18	Internal Sorting Algorithms: Selection sort- Selection sort algorithm, Exchange sort- Bubble sort algorithm	2	
	19	External Sorting Algorithms: Merge sort- Demonstrate with example.(NoAlgorithm needed)	1	
	20	Advanced sorting Algorithm-: Quick sort- Demonstrate with example. (NoAlgorithm needed)	1	
	21	Introduction to Searching: Linear search and Binary search(Algorithm needed) with example.	2	
	22	Hashing: Hash Tables, Hash Functions, Different Hash Functions – Division method, Multiplication method, Mid square method, Folding Method, Collision and Collision resolution Techniques: Open hashing- Chaining, Closed hashing- Probing	2	
V	Hands-on Programming in Data		30	

Structures: Practical Applications, Case Study and Course Project			
1	Basic Operations in a single linked list (Menu driven)		
2	Sort the elements in given singly linked list		
3	Stack using array.		
4	Stack using Linked list		
5	Queue using Array		
6	Queue using Linked list		
7	Sorting algorithms- Selection, Bubble Sort		
8	Searching Algorithms- Linear and Binary search		
9	Project/ Case study	5	

References :

1. Seymour Lipschutz, “Data Structures with C”, McGraw Hill Education (Schaum's Outline Series)
3. Reema Thareja, “ Data Structures Using C”, Oxford University Press

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	1	1	-	-	3	-	2	-	-	-	-
CO 2	2	1	2	3	-	3	2	3	3	2	-	-
CO 3	2	1	2	3	-	3	2	3	3	3	-	-
CO 4	2	-	2	3	1	3	2	3	3	3	-	-

CO 5	1	1	2	3	1	3	-	3	3	-	-	-
CO 6	1	1	3	3	-	3	2	3	3	3	-	2

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6	✓	✓	✓	✓

Course Code & Title	DSA 3CJ203: Artificial Intelligence				
Type of Course	Major	Semester	3	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	0	0	60
Pre-requisites	Basic knowledge of programming and logic.				
Course Summary	This course introduces students to fundamental concepts of Artificial Intelligence. Topics include intelligent agents, search algorithms, knowledge representation, reasoning, and machine				

	learning basics. Emphasis is placed on developing problem-solving techniques and hands-on experience with AI tools and algorithms.
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Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the concept and evolution of Artificial Intelligence	U	C	Quiz / Written Exams
CO2	Design and apply search strategies for solving real-world problems	Ap	P	Assignments / Problem-solving Labs
CO3	Apply knowledge representation and reasoning techniques	Ap	P	Seminars / Mini Projects
CO4	Analyze and apply machine learning algorithms to datasets	A / E	P	Practical Assignments / Case Studies
CO5	Develop simple AI models using Python or AI libraries	C	P	Viva / Projects / Instructor-created Exams
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to AI		10	15
	1	Definition and history of AI, Applications of AI in various fields	2	
	2	Foundations of AI: Logic, reasoning, and machine learning	2	
	3	Intelligent agents and environments, Rationality	3	
	4	Structure of Agents: Agent Programs, Simple Reflex	3	

		Agent, Model Based Reflex Agent, Goal Based Agent, Utility Based Agent, Learning Agent		
II	Problem Solving and Search		15	15
	5	Problem formulation	3	
	6	Uninformed search strategies: BFS, DFS	4	
	7	Informed search: A*, greedy algorithms, Heuristic search	4	
	8	Constraint satisfaction problems	4	
III	Knowledge Representation & Reasoning		15	15
	9	Propositional logic and predicate logic	4	
	10	Inference rules and resolution, forward and backward chaining, matching algorithms,	4	
	11	Semantic networks and frames	4	
	12	Reasoning under uncertainty – Bayesian networks	3	
IV	Machine Learning and AI Programming		10	15
	13	Introduction to machine learning: Supervised, unsupervised, reinforcement learning	2	
	14	Decision trees, KNN, Naive Bayes	3	
	15	Neural networks basics	2	
	16	Clustering - basic agglomerative, divisive algorithms similarity/dissimilarity measures. Expert Systems, Applications to NLP	3	
V	PRACTICUM		10	
	1	Building a chatbot using rule-based logic		
	2	Implementing search algorithms in Python		
	3	Developing a classification model on a dataset		
	4	Creating a simple recommendation engine		

	5	Case Study: AI in Healthcare/Finance/Smart Assistants		
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References:

1. Stuart Russell, Peter Norvig (2010), *Artificial Intelligence: A Modern Approach*, 3rd Ed., Pearson
2. Elaine Rich and Kevin Knight (2017), *Artificial Intelligence*, McGraw-Hill
3. Tom M. Mitchell (1997), *Machine Learning*, McGraw-Hill
4. Sebastian Raschka, *Python Machine Learning*, Packt Publishing

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	--	--	2	3	2	--	2	3	--	--
CO 2	3	3	2	3	2	3	3	3	2	3	--	2
CO 3	2	3	2	2	2	3	3	2	3	3	2	2
CO 4	2	3	3	3	2	3	3	3	3	3	2	3
CO5	3	3	2	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓	✓	

SEMESTER IV

Course Code & Title	DSA 4CJ201: Introduction to Machine Learning				
Type of Course	Major	Semester	4	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	Basic knowledge of programming, statistics, and linear algebra				
Course Summary	This course provides foundational knowledge and hands-on experience in machine learning. Students will learn the theory and application of supervised, unsupervised, and reinforcement learning algorithms. Emphasis is placed on data preprocessing, model evaluation, and using libraries like scikit-learn.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the basic concepts and types of machine learning	U	C	Quizzes, Exams
CO2	Apply supervised learning algorithms to classification and regression tasks	Ap	P	Assignments, Labs
CO3	Implement unsupervised learning techniques	Ap	P	Labs, Mini Projects
CO4	Analyze model performance and apply evaluation metrics	A/E	P	Case Studies
CO5	Develop ML models using Python libraries	C	P	Projects, Viva
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Machine Learning		11	15
	1	Definition and Importance of Machine Learning - Types: Supervised, Unsupervised, Reinforcement Learning	3	
	2	Applications of ML in various domains	1	
	3	Steps in ML workflow – Problem formulation, data collection, preprocessing, model training, evaluation	2	
	4	Data preprocessing techniques: normalization, missing data handling, data splitting	3	
	5	Understanding data:- numeric variables – mean, median, mode, Measuring spread.	2	
II	Supervised Learning Techniques		15	15
	6	Introduction to Supervised Learning: Classification vs Regression	3	
	7	Linear Regression, Logistic Regression	3	

	8	k-Nearest Neighbors (k-NN), Decision Trees	3	
	9	Support Vector Machines (SVM)	3	
	10	Evaluation Metrics: Confusion Matrix, Accuracy, Precision, Recall, F1-score	3	
III	Unsupervised Learning Techniques		13	15
	11	Introduction to Unsupervised Learning	2	
	12	Clustering: k-Means, Hierarchical Clustering	4	
	13	Dimensionality Reduction: Principal Component Analysis (PCA), t-SNE	4	
	14	Applications and limitations of unsupervised learning	3	
IV	Neural Networks and Model Evaluation		13	15
	15	Basics of Neural Networks: Perceptron, activation functions	3	
	16	Network Models – Cost function	3	
	17	Multilayer Perceptrons and backpropagation (overview), Algorithm	3	
	18	Model evaluation: Cross-validation, Overfitting and Underfitting, Introduction to deep learning	4	
V	PRACTICUM		23	
	1	Building a classification model using real-world data		
	2	Implementing clustering and visualizing clusters		
	3	Dimensionality reduction and plotting		
	4	Model tuning with cross-validation		
	5	Case Study: Machine Learning in Healthcare, Finance, or Social Media		

References:

1. Introduction to Machine Learning with Python" by Andreas C. Müller & Sarah Guido
2. Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili

3. Pattern Recognition and Machine Learning" by Christopher M. Bishop
4. Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy
5. **Tom M. Mitchell** *Machine Learning* McGraw-Hill, 1997
6. **Athem Alpaydin** *Introduction to Machine Learning* (4th Edition) MIT Press, 2020
7. **Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani** *An Introduction to Statistical Learning* (2nd Edition) Springer, 2021

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	1	1	2	3	2	2	3	2	1	1
CO 2	2	3	2	2	2	3	2	3	3	3	2	2
CO 3	2	3	2	2	2	3	2	3	3	3	2	2
CO 4	2	3	3	3	2	3	2	3	3	3	2	3
CO5	2	3	2	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓

CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6	✓	✓	✓	✓

Course Code & Title	DSA4CJ202: Object Oriented Programming with Java				
Type of Course	Major	Semester	4	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	Knowledge in basic programming				
Course Summary	The aim of this course is to provide students with an understanding of the basic concepts in Java programming. This course will help students create GUI applications in Java and establish database connectivity.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the concepts and features of Object-Oriented Programming (OOPs)	U	C	Practical Assignment / Instructor-created exams / Quiz
CO2	To practice programming in Java	Ap	P	Seminar Presentation / Group Tutorial Work
CO3	To learn java's exception handling mechanism, I/O operations and multithreading.	Ap	P	Practical Assignment / Observation

				of Practical Skills
CO4	To learn java's O operations and multithreading.	Ap	P	Practical Assignment / Seminar
CO5	Implement programs using Java Database Connectivity	Ap	P	Viva Voce/ Observation of Practical Skills
CO6	Students will be capable of developing Graphical User Interface (GUI) applications using Swing, understanding layout management, and implementing basic event handling.	Ap	P	Assignment / Instructor created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I		Review of OOPs and Introduction to Java	17	10
	1	Overview of OOPs Concept	1	
	2	History of Java and Java Virtual Machine	1	
	3	Basic Structure of Java Programming : Data Types, Operators, Expression and Control Statement	2	
	4	Arrays and String: One Dimensional Array, Multidimensional Array, String Operation	2	
	5	Scanner, Type Conversion and Casting	2	
	6	Introduction to Class and Objects: Definition of Class and Objects, Access Modifier	2	
	7	Constructor and Inheritance: Types of Constructors, Types of	3	

		Inheritance, use of extends, super, final, this keyword		
	8	Method Overriding, Method Overloading and Dynamic Method Dispatch : Programming implementation of Method Overriding and Overloading	2	
	9	Interface, Abstract Class and Packages ; Programming implementation of Interface, Abstract class and Package	2	
II	Exception and I/O Operations		8	15
	10	Exception: Baic Concept of exception and Exception Hierarchy	2	
	11	Managing Exception: Use of try.....catch.....fanally finally blocks, throw and throws keyword	2	
	12	Managing Input/Output files in Java : Importance of I/O Operations, BufferedInputStream, BufferedOutputStream	2	
	13	File Operations : Programming implementation of FileInputStream, FileOutputStream, FileReader, FileWrite	2	
III	Multithreading and Database Connectivity		9	20
	14	Thread : Concept of Thread and Thread state	2	
	15	Programming Implementation of Thread : Using extending thread class and Runnable interface, Thread Priorities	2	
	16	Database Programming : Basic Concept of Database and JDBC Driver, Connecting with Database	2	
	17	Querying Database: Programming implementation of creating table, insert and update values to the table using preparedStatement, Statement object and querying the values	3	

		using ResultSet and ResultSetMetadata		
IV	GUI Programming		11	15
	18	Introduction to GUI Application : AWT Basics, Introduction to IDE	2	
	19	Swing Programming : Introduction of Model-View-Controller Patter	2	
	20	Introduction to layout Management : Fundamental controls used in SWING	4	
	21	Event Handling : Basic Knowledge of Event Handling(Event Class and Event Listener	3	
V	Hands-on Programming in Java(Using IDE NetBeans, Eclipse, VSCode):		30	
	Practical Applications, Case Study and Course Project			
	1	Implement the following:		
		1. String and Arrays:	20	
		Write a program to perform various String operations in Java(Hint: charAt, substring, concat, equals,, isEmpty..)		
		Write a program to implement Multi-Dimensional Array (Hint :Matrix multiplication)		
		2. Object Oriented Programming Concept:		
		Write a program to implement the concept of class and object.(Hint: Complex Number addition)		
		Write a program to demonstrate the order in which constructors are invoked in multilevel inheritance		
		Write a program to implement method overloading		
	Write a program to implement method overriding.			
	3. Exception Handling and Multithreading			

	Write a program to implement try ...catch..... finally block (Hint: Arithmetic and ArrayOutOfBoundException)		
	Write a multi thread java program for displaying odd numbers and even numbers up to a limit (Hint :Create thread by inheriting Thread class).		
	Write a multi thread java program for displaying odd numbers and even numbers up to a limit (Hint : Implement thread using Runnable interface)		
	4. GUI Application with Database		
	Write a swing program to track mouse & key events		
	Write a swing program to fetch data from TextFiled and display it in Label		
	Write a swing program to perform form validation		
	Write a swing program to display data in tabular form		
	Write a simple login program without database connectivit		
	Write a swing program to create a registration form (Hint : Create table student in any database and link the registration form with database using JDBC		
2	Case Study	2	
3	Project: Build a application for shop management system (Eg: Admin Login, Product registration, stock management, product selling, employee salary	8	

Text Books:

1. Herbert Scheldt, Java: The Complete Reference, 12th Edition, Tata McGraw-Hill Edition, ISBN: 9781260463415.
- 2.

References :

1. C. Thomas Wu, An introduction to Object-oriented programming with Java, 5e, McGraw- Hill, 2009.
2. Y. Daniel Liang, Introduction to Java programming, Comprehensive Version, 10e,Prentice Hall India, 2013.

3. K. Arnold, J. Gosling, David Holmes, The JAVA programming language, 4e, Addison- Wesley, 2005

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO 4	PSO 5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	-	-		2	3	-	2	2	2	-	-
CO 2	3	3	-	2	-	-	2	3	3	-	-	-
CO 3	3	2	-	2	-	-	-	3	3	2	-	-
CO 4	3	2	-	2	-	2	-	3	3	2	-	-
CO 5	3	3	2	3	2	-	2	3	3	2	2	-
CO6	-	3	2	3	3	-	2	3	3	-	-	2

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓		✓	

Course Code & Title	DSA4CJ203: Big Data Technologies				
Type of Course	Major	Semester	4	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	0	0	60
Pre-requisites	Knowledge of Databases, Basic Programming (Python/Java), and Data Analysis				
Course Summary	This course introduces the principles and practices of big data storage and processing. Emphasis is placed on Hadoop ecosystem tools, NoSQL databases, distributed systems, and real-time data processing using Apache Spark. Students will gain hands-on experience building scalable data solutions aligned with industry practices.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand big data fundamentals, including its evolution, characteristics, and enabling technologies.	U	C	Quiz / Written Test / Class Discussion
CO2	Explain distributed storage and NoSQL concepts like CAP theorem, BASE, replication, and sharding.	U	C	Assignment / Oral Test / Group Work
CO3	Analyze the architecture and functions of Hadoop ecosystem components like HDFS, YARN, Hive, and HBase.	An	C	Quiz / Seminar / Instructor-Created Exams
CO4	Develop and optimize MapReduce jobs for distributed data processing.	Ap	P	Practical Lab / Observation of Practical Skills
CO5	Apply big data processing using Apache Spark including SQL, Streaming, and MLlib libraries.	Ap	P	Practical Assignment / Group Project / Viva Voce
CO6	Build a big data pipeline project using ingestion, processing, and visualization tools on real-world datasets.	C	M	Case Study / Project

				Demonstration / Report Presentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Fundamentals of Big Data		5	15
	1	Definition, Features (5 V's), and Applications	1	
	2	Evolution from Traditional to Big Data Systems	1	
	3	Big Data Stack and Ecosystem Overview	1	
	4	Distributed and Parallel Computing	1	
	5	Cloud Infrastructure for Big Data	1	
II	Data Storage and NoSQL		15	15
	6	Clusters and Distributed File Systems	3	
	7	NoSQL Concepts: Sharding, Replication, CAP Theorem	3	
	8	ACID vs BASE; RDBMS vs NoSQL vs NewSQL	4	
	9	Tools: MongoDB, Cassandra, HBase (Hands-on)	5	
III	Hadoop Ecosystem		12	15
	10	HDFS Architecture & Features	2	
	11	YARN Resource Management	3	
	12	Hive, Pig, Sqoop, Flume, Oozie Overview	3	
	13	HBase: Design and Access Patterns	4	
IV	MapReduce & Spark		13	15
	14	MapReduce Architecture, Working & Optimization	3	
	15	Real-time vs Batch Processing	2	

	16	Spark Introduction: RDD, DataFrames, SparkSQL	4	
	17	Spark MLlib and Streaming Basics	4	
V	Hands-on Project and Case Studies		15	
	1	Setup of Hadoop/Spark locally or on cloud		
	2	Case studies: Healthcare, Retail, Social Media Data		
	3	Build a pipeline: Ingest → Store → Process → Visualize		
	4	Mini-project		

Text Books:

- Chandrakant Naikodi, *Managing Big Data*, Vikas Publishing, 2015
- DreamTech Editorial Services, *Big Data*, Dreamtech Press, 2015
- Michael Frampton, *Big Data Made Easy*, Apress, 2014
- Michael Manoochehri, *Data Just Right*, Pearson Education, 2015
- Thomas Erl, *Big Data Fundamentals: Concepts, Drivers and Techniques*, Pearson, 2016

Mapping of CO's with POs and PSO s :

	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	2	1	-	1	3	1	2	2	2	1	-
CO 2	2	2	2	1	1	3	1	2	2	3	1	-
CO 3	3	3	2	2	2	3	2	3	3	3	1	1
CO 4	3	3	2	2	2	2	2	3	3	3	1	1
CO 5	3	3	3	3	3	3	2	3	3	3	1	2

CO6	3	3	3	3	3	2	3	3	3	3	2	3
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Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	✓
CO 6	✓		✓	

SEMESTER V

Course Code & Title	DSA5CJ301: Advanced Database Management Techniques with MongoDB				
Type of Course	Major	Semester	5	Academic Level	300-399
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	<ol style="list-style-type: none"> 1. Basic knowledge of RDBMS and SQL 2. Familiarity with data structures and basic programming logic 3. Introductory understanding of data modeling and entity–relationship concepts 				
Course Summary	<p>This course provides a comprehensive understanding of modern database systems, focusing on both relational databases and the emerging NoSQL paradigm. Beginning with relational database design and advanced SQL concepts, the course transitions into NoSQL databases, exploring document-based storage and key concepts like the CAP theorem, data distribution, and eventual consistency. A significant portion is dedicated to MongoDB, the most widely used NoSQL platform, where students will learn CRUD operations, indexing, aggregation, and advanced features such as replication, sharding, and MapReduce. The course concludes with a practical module involving hands-on lab exercises and a mini project to apply concepts to real-world datasets.</p>				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand relational database concepts, data models, and normalization techniques	U	C	Instructor- created exams / Quiz
CO2	Apply SQL and PL/SQL commands to define, manipulate, and control data in relational databases	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Differentiate NoSQL systems and explain their applications in modern data scenarios	A	C	Practical Assignment / Observation of Practical Skills

CO4	Perform data manipulation, queries, and aggregations using MongoDB	Ap	P	Practical Assignment / Observation of Practical Skills
CO5	Design scalable and efficient NoSQL-based systems with MongoDB features like indexing, sharding, and MapReduce	C	M,P	Project Report / Demo / Viva
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Relational Database Design and Structured Query Language (SQL)		10	15
	1	Introduction to database systems and DBMS components	1	
	2	Types of data models: Hierarchical, Network, XML, Relational	1	
	3	Relational design anomalies and normalization: – Functional Dependency, Lossless Join, Dependency Preservation – 3NF, BCNF, 4NF, PJNF, DKNF	3	
	4	Structured Query Language (SQL): – Data Definition Language (DDL), Data Manipulation Language (DML) – Integrity constraints, Views	2	
	5	Singly Linked List Operations with Algorithm (insertion, deletion, traversal)	3	
II	NoSQL Databases and Emerging Database Technologies		10	15
	6	Need for NoSQL, SQL vs NoSQL – Tradeoffs, CAP Theorem, Eventual Consistency	3	
	7	Types of NoSQL databases: – Document-Oriented, Columnar, Graph, Key-Value	2	
	8	NoSQL design principles: performance, schema flexibility,	2	

	scalability		
	9	Introduction to Indexing, Hashing, Query Processing, Transactions	3
	10	Overview of Distributed DBMS, Object-Oriented DB, Object-Relational DB, Data Warehousing, Data Mining, and Big Data concepts	
III	Fundamentals of MongoDB and Data Manipulation		15
	11	Introduction to MongoDB – Comparison with RDBMS, Setup, Configuration	3
	12	Data import/export, Server settings, Data extraction from CSV, XML, JSON	3
	13	CRUD operations: Create, Read, Update, Delete using Mongo shell & mongoimport	3
	14	MongoDB operators: \$gt, \$lt, \$regex, \$exists, \$in, \$all	3
	15	Aggregation framework: – Operators: \$match, \$project, \$unwind, \$group – Aggregation pipeline and examples	3
IV	Advanced MongoDB Concepts and Applications		10
	16	User Management, Data Replication, Sharding	2
	17	Indexing in MongoDB: create, drop, find, backup	2
	18	Relationships in MongoDB: embedding vs referencing	2
	19	MapReduce framework and text processing – Regular Expressions, Text Indexing	2
	20	Case Studies: – Text mining on large datasets – Implementing MapReduce jobs with MongoDB	2
V	Practical Applications and Case-Based Lab		30
	1	Import sample dataset (JSON or CSV) into MongoDB using mongoimport	
	2	Perform CRUD operations on collections with operators	

	like \$set, \$gt, \$regex
3	Design and execute queries using aggregation pipeline: \$match, \$group, \$project
4	Create indexes and analyze query performance using explain()
5	Simulate data sharding and replication (concept demo or command-based setup)
6	Implement a simple MapReduce task on large text dataset
7	Use regular expressions to perform text analysis queries
8	Design and demonstrate a mini NoSQL project (e.g., product catalog, blog system, student DB)
9	Prepare a technical report documenting schema, queries, and insights
10	Present project and explain decisions based on performance, structure, and efficiency

Text Books:

1. Abraham Silberchatz, Henry K.Forth, Sudharshan, “Database system Concepts”, 7 th edition, McGraw Hill, 2020.
2. Prabu C.S.R, “Object-Oriented Database Systems: Approaches and Architectures” 3 rd Edition, PHI, 2011.
- 3-Kristina Chodorow , “MongoDB: The Definitive Guide”, 3rd Edition , O'Reilly Media, ISBN: 9781491954461, 2019.
4. Guy Harrison, “Next Generation Databases: NoSQL, NewSQL, and Big Data”, Apress, 2016.

Reference Books:

1. ShamkantB.Navathe, RamezElamsri"Fundamentals of Database Systems", 7th Edition, Pearson Education Limited, 2017.
2. David Hows , Peter Membrey , EelcoPlugge , Timm Hawkins , “The Definitive Guide to MongoDB”, 3rd Edition, Apress, 2015.
3. GauravVaish ,“Getting Started with NoSQL”Packt Publishing, 2013

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	–	–	–	3	2	1	–	–	2	–
CO 2	3	3	2	–	–	3	2	3	–	–	2	–
CO 3	3	3	3	2	2	3	3	2	2	2	3	2
CO 4	3	3	3	3	3	3	3	3	3	2	3	3
CO 5	3	3	3	3	3	3	3	3	3	2	3	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5		✓	✓	

Course Code & Title	DSA5CJ302: Advanced Python for Data Science				
Type of Course	Major	Semester	5	Academic Level	300-399
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	Basic Python, Statistics, Data Handling				
Course Summary	This course deepens the learner's expertise in Python with a focus on data analysis, scientific computation, machine learning, and data engineering. Emphasis will be placed on using libraries such as NumPy, pandas, Scikit-learn, and TensorFlow for solving data science problems.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Perform array-based computation using NumPy and apply matrix operations	Ap	P	Instructor-created exams / Quiz/ Assignment
CO2	Conduct data analysis and transformation using pandas effectively	Ap	P	Practical Assignment, Viva
CO3	Explore and utilize additional data science packages like Scikit-learn, Seaborn, and BeautifulSoup	U	C	Practical Assignment / Observation of Practical Skills
CO4	Understand and implement Tensor operations using TensorFlow	AP	M, P	Practical Assignment / Seminar

CO5	Demonstrate real-world data processing and visualization using Python tools.	C	M, P	Viva Voce/ Observation of Practical Skills
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Arrays and Matrix Manipulation using NumPy		10	15
	1	Array creation, sorting, concatenating	2	
	2	Shape and size of an array, arithmetic operations, broadcasting	2	
	3	Aggregate functions, unique(), count()	2	
	4	Matrix creation and operations	2	
	5	Transpose, reverse, flatten, ravel	2	
II	Data Analysis and Manipulation using pandas		10	15
	6	Series creation (array, index, dictionary)	2	
	7	DataFrame creation (arrays, dicts, structured arrays, series), indexing	2	
	8	Arithmetic and binary operations on DataFrames	2	
	9	Broadcasting operations in pandas	2	
	10	Universal functions, melt(), pivot()	2	
III	Other Python Packages for Data Science		12	15

	11	Overview: Scipy, Scikit-learn, PyTorch, Seaborn, Scrapy, BeautifulSoup	3	
	12	Import/export data, data cleansing	3	
	13	Processing CSV, JSON, XLS data	3	
	14	Descriptive statistics: Central tendency, variance, correlation	3	
IV	TensorFlow Fundamentals		13	15
	15	Tensors, random tensors, distributions, set_seed()	2	
	16	Tensor attributes: size, rank, reshaping	1	
	17	Tensor arithmetic, relational/logical ops, shuffle()	2	
	18	Dimension-wise reduce operations	1	
	19	Ragged tensors, TensorArray	1	
	20	Operations: unique(), fill(), concat(), gather(), ones(), ones_like(), zeros()	2	
	21	Functions: eye(), range(), repeat(), reverse(), roll(), slice(), sort()	2	
	22	Advanced ops: split(), squeeze(), tile(), stack(), unstack(), tensordot()	2	
V	Integrated Lab and Project Module (Hands-on Implementation)		30	
	Tasks/Programs:			
	1	NumPy + pandas	4	
		Load CSV and Excel datasets, clean missing values, perform EDA		
		Calculate aggregates, correlations, and summary stats		
		Use slicing, broadcasting, and reshaping operations		
	2	Data Parsing	4	
		Parse JSON, HTML using BeautifulSoup		

	Scrape sample data from websites and clean it for analysis		
3	Data Visualization	4	
	Plot charts using matplotlib/seaborn/plotly		
	Create interactive dashboards and correlation heatmaps		
4	Statistical Analysis	5	
	Compute variance, standard deviation, z-scores		
	Analyze trends with rolling averages and visual plots		
5	ML Pipelines using Scikit-learn	5	
	Build and evaluate classification models (e.g., Logistic Regression, Decision Trees)		
	Perform train-test split, cross-validation, confusion matrix, etc.		
6	TensorFlow-Based Mini Models	8	
	Construct and reshape tensors		
	Perform matrix operations and reductions		
	Build a simple neural net using Keras API on a dataset (e.g., MNIST, Iris)		

References:

1. VanderPlas, Jake. Python Data Science Handbook: Essential Tools for Working with Data. United States, O'Reilly Media, 2016.
2. Rogel-Salazar, Jesus. Data Science and Analytics with Python. United Kingdom, CRC Press, 2018
3. Wes McKinney – Python for Data Analysis
4. Jake VanderPlas – Python Data Science Handbook
5. Aurélien Géron – Hands-On Machine Learning

Mapping of CO's with PO s and PSO s :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	-	-	-	-	3	-	2	2	-	-	-
CO 2	3	2	-	-	2	3	2	2	3	-	-	-
CO 3	2	2	2	-	2	2	3	2	2	2	-	-
CO 4	2	3	-	2	-	3	2	3	2	2	-	2
CO 5	3	3	2	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4		✓	✓	✓
CO 5		✓	✓	

Course Code & Title	DSA5CJ303 Software Project Management				
Type of Course	Major	Semester	5	Academic Level	300-399
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60

Pre-requisites	<p>1. Computer Science knowledge</p> <p>2. Understanding fundamental computer science concepts, data structures, and algorithms</p> <p>3. Basic knowledge of project planning and scheduling</p>
Course Summary	<p>Students are introduced to the concepts, procedures, and resources of software project management in this course. Project scheduling, budgeting, quality assurance, risk management, and teamwork are among the subjects covered. The goal of the course is to equip students with the skills necessary for efficient project management in software development settings.</p>

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Define and explain the fundamental concepts, principles, and terminologies related to software project management. Differentiate between various software engineering process models. Understand the agile principle and methodologies and appreciate the need for iterative approaches to software Development	U	C	Assignment / Instructor created exams / Quiz
CO2	Master various design concepts used during project development life cycle.	U	P	Assignments / Test papers/ Viva Voce
CO3	Master various SPM techniques	U	P	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Develop project plans, Create project schedules using tools like Gantt charts and network diagrams	Ap	C	Instructor-created exams / Home Assignments
CO5	Understand the importance of quality in software development by mastering quality assurance processes, methodologies, and testing strategies.	U	P	Writing assignments/ Exams

CO6	Prepare and deliver effective project presentations..	Ap	P	Case Study/ mini Project/ Seminar Presentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Software Engineering and Process Models		10	15
	1	Software and Software Engineering- nature of software, Software Engineering, Software Process	2	
	2	Software Development Life Cycle (SDLC)	2	
	3	Prescriptive Process Model- Water fall model, Incremental Model, Evolutionary Process Model	2	
	4	Agile Development- What is Agility, What is agile Process?	2	
	5	Extreme Programming	2	
II	Software requirements and Design Concepts		16	15
	6	Understanding requirements- requirement engineering process	3	
	7	Feasibility studies	1	
	8	Design Concepts- Design process, Design Concepts	2	
	9	Design Model Elements- Data design elements, Architectural design elements, Interface Design Elements, Component-Level Design Elements, Deployment-Level Design Elements	2	
	10	Architectural design using DFD	2	
	11	Component level design guidelines	2	

	12	Modelling with UML – Class diagram Use Case Diagram, State chart Diagram, Activity Diagram,	4	
III	Software Project Management		11	15
	13	Introduction to Software Project Management- Overview of software project management, Importance of project management in software engineering, Role of a project manager	2	
	14	Project Planning and Scope Management- Work breakdown structure (WBS) and project estimation techniques	2	
	15	Project Scheduling and Resource Allocation- Gantt charts and network diagrams,	2	
	16	Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT)	2	
	17	Risk Management-reactive vs proactive risk strategies, Risk identification, risk projection, RMMMM plan	3	
IV	Software Quality Assurance		11	15
	18	Quality Concepts- Software quality, Achieving Software quality,	2	
	19	Testing Strategies	2	
	20	Software testing- levels of software testing	1	
	21	Types of software test- Unit testing, Integration testing, Black box testing, white box testing, System testing	4	
	22	Art of debugging	2	
V	Open Ended Module- Trends in Software Engineering		12	
		<ul style="list-style-type: none"> • Case study of CASE tools • Prepare a project report • Analysis of real-world software project management case studies • Group project presentations 		

References:

- Roger S, “Software Engineering – A Practitioner’s Approach”, seventh edition, Pressman, 2010.
- Pearson Education, “Software Engineering by Ian Sommerville”, 9th edition, 2010.
- Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House.

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	2	2	2	3	2	2	2	3	1	1
CO 2	3	3	2	2	2	2	2	3	2	2	1	1
CO 3	2	3	2	2	2	2	3	3	2	3	2	2
CO 4	2	2	3	3	3	2	2	3	3	2	1	2
CO 5	2	3	2	2	3	3	2	3	3	3	2	2
CO 6	1	1	2	3	3	2	3	2	2	2	2	2

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		

19. DETAILED SYLLABUS OF THE ELECTIVE COURSES (MAJOR)

SEMESTER IV

Course Code & Title	DSA4EJ211: Cloud Computing				
Type of Course	Major	Semester	4	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	0	0	60
Pre-requisites	Basic understanding of computer networks and operating systems.				
Course Summary	This course provides a comprehensive introduction to Cloud Computing technologies. It covers fundamental concepts, architectures, deployment models, services (IaaS, PaaS, SaaS), virtualization, security, and emerging trends. Practical sessions involve using popular cloud platforms like AWS, Azure, and Google Cloud.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand basic concepts, models, and architecture of Cloud Computing	U	C	Quiz / Exams
CO2	Demonstrate knowledge of virtualization and its role in cloud environments	Ap	P	Lab Sessions / Assignments
CO3	Analyze cloud service models (IaaS, PaaS, SaaS) and deployment models	A	C	Seminars / Presentations
CO4	Apply cloud tools to develop and deploy cloud-based applications	Ap/C	P	Mini Projects / Viva
CO5	Evaluate issues related to security, compliance, and governance in the cloud	E	M	Case Studies / End Semester Exam
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Cloud Computing		11	15
	1	Definition, history, and characteristics of Cloud Computing	3	
	2	Benefits and challenges of cloud adoption	1	
	3	Virtual machines and Virtualisation middleware, Data center virtualisation for cloud computing	2	
	4	Implementation levels of virtualisation, Virtualisation structures tools and mechanisms	3	
	5	Virtualisation of CPU-Memory-I/O Devices	2	
II	Virtualization and Cloud Infrastructure		15	15
	6	System Models: Basics of distributed and cloud systems.	3	
	7	Cloud Types: <ul style="list-style-type: none"> • Public Cloud • Private Cloud • Hybrid Cloud 	4	
	8	Cloud service models: IaaS, PaaS, SaaS	4	
	9	Cloud service providers: AWS, Azure, GCP overview	4	
	III	Cloud Architecture & Tools		13
10		Compute & Storage Cloud Design: How cloud systems are built for processing and saving data.	2	
11		Popular Public Cloud Platforms: <ul style="list-style-type: none"> • GAE (Google App Engine) • AWS (Amazon Web Services) • Azure (Microsoft Cloud) 	4	
12		Emerging Cloud Platforms:	4	

	<ul style="list-style-type: none"> Eucalyptus, Nimbus, OpenStack – Open-source cloud platforms. 		
13	Cloud Services: <ul style="list-style-type: none"> Resource Provisioning Virtual Machine Management 	3	
IV	Parallel Computing & Big Data Tools	9	15
14	Parallel Computing	1	
15	Programming Models: <ul style="list-style-type: none"> MapReduce Twister & Iterative MapReduce 	3	
16	Hadoop Ecosystem: <ul style="list-style-type: none"> Hadoop Library Pig Latin 	3	
17	Google Tools: <ul style="list-style-type: none"> Google App Engine Google File System (GFS) BigTable 	2	
V	PRACTICUM	12	
1	Launching and configuring a virtual server using AWS/Azure		
2	Deploying a simple web app using PaaS (e.g., Heroku, GCP App Engine)		
3	Creating scalable cloud storage solutions (S3, Blob storage)		
4	Implementing IAM and monitoring dashboards		
5	Case Study: Cloud adoption in industry (education, healthcare, or e-commerce)		

References:

1. Alex Amies, Harm Sluiman, Qiang Guo Tong and Guo Ning Liu: Developing and Hosting Applications on the cloud, IBM Press, 2012.
2. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice)”, O’Reilly Publications, 2009.
3. Haley Beard, “Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing – applications and Data Centers in the Cloud with SLAs”, Emereo Pty Limited, July 2008
4. James E. Smith and Ravi Nair: Virtual Machines: Versatile Platforms for Systems and Processes, Morgan Kaufmann, ELSEVIER Publication, 2006.
5. John W Rittinghouse and James F Ransome, “Cloud Computing: Implementation – Management – and Security”, CRC Press, 2010.

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	2	1	2	3	2	2	3	3	2	1
CO 2	3	3	2	2	2	3	3	3	3	2	2	2
CO 3	2	3	3	2	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3	3	3	3	3	2	3
CO5	2	2	3	3	3	3	3	3	3	3	3	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	--	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	--	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6	✓	--	✓	✓

Course Code & Title	DSA4EJ212: Computer Vision				
Type of Course	Elective	Semester	4	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Basic knowledge of Linear Algebra, Digital Image Processing, and Python Programming.				
Course Summary	This course introduces the concepts and techniques in computer vision, including image formation, spatial and frequency domain processing, image restoration, morphological operations and segmentation. The course also introduces medical image processing and related case studies.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand image formation, pixel-based processing, and spatial domain filtering.	U	C	Quiz / Written Test / Class Discussion
CO2	Apply frequency domain transforms and image restoration techniques.	Ap	P	Assignment / Oral Test / Group Work

CO3	Analyze and apply morphological and segmentation techniques.	An	C	Quiz / Seminar / Instructor-Created Exams
CO4	Use OpenCV and Python libraries to process and analyze image and video data.	Ap	P	Practical Lab / Observation of Practical Skills
CO5	Understand medical imaging concepts and demonstrate processing techniques.	U, Ap	C,P	Practical Assignment / Group Project / Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Image Formation and Spatial Domain Filtering		12	15
	1	Image Formation: Light, Pixels, Brightness, Imaging Geometry, Perspective Projection	3	
	2	Spatial Domain Filtering: Intensity transformations, contrast, histogram equalization	4	
	3	Correlation, convolution, smoothing and sharpening filters, gradient & Laplacian	3	
	4	Sampling and Quantization	2	
II	Frequency Domain Filtering and Image Restoration		12	15
	6	Frequency Domain: Hotelling Transform, Fourier Transform, FFT (DIF, DIT), DCT	3	
	7	Frequency Filtering: Convolution, Correlation, 2D Sampling	3	
	8	Image Restoration: Degradation models, Noise filters, adaptive filtering	3	
	9	Geometric transforms, morphing, projection-based restoration	3	

III	Morphological Processing and Image Segmentation		11	15
	10	Morphological Operations: Dilation, Erosion, SE, Opening, Closing, Skeletons	2	
	11	Connected Components, Hole Filling, Convex Hull, Pruning, Reconstruction	3	
	12	Image Segmentation: Edge, Line, Point Detection, Thresholding, Hough Transform	3	
	13	Region-based Segmentation, Watershed, Motion-based segmentation	3	
IV	Tools and Applications in Computer Vision		12	15
	14	OpenCV Setup & Core Modules: imgproc, highgui, video, ml	4	
	15	Python Modules: PIL, Pillow, scikit-image	3	
	16	Introduction to Medical Image Processing, File Formats, Techniques	3	
	17	Applications of Medical Image Processing	2	
V	Open ended module: Case study		13	
	<ul style="list-style-type: none"> Case studies in healthcare and biomedical domains. 			

References

Textbooks:

1. Richard Szeliski, *Computer Vision: Algorithms and Applications*, Springer.
2. Hartley & Zisserman, *Multiple View Geometry in Computer Vision*, 2nd Edition.
3. Ma, Soatto, Kosecka & Sastry, *An Invitation to 3D Vision*, Springer.
4. Adrian Rosebrock, *Practical Python and OpenCV*, PyImageSearch.
5. Gonzalez & Woods, *Digital Image Processing*, Pearson.

Mapping of CO's with POs and PSO s :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	2	1	-	1	3	1	2	2	2	1	-
CO 2	2	2	2	1	1	3	2	2	3	2	1	-
CO 3	3	3	2	2	2	3	2	3	3	3	1	1
CO 4	3	3	3	2	2	3	3	3	3	3	1	1
CO5	3	3	3	3	3	3	2	3	3	3	2	2

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓	✓	✓
CO 5		✓	✓	✓

Course Code & Title	DSA4EJ213: Information Retrieval Techniques				
Type of Course	Major	Semester	4	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours

	4	3	0	2	75
Pre-requisites	Basic knowledge of data structures, algorithms, and probability.				
Course Summary	This course introduces the core concepts, models, and algorithms of Information Retrieval (IR). Students will explore indexing, querying, ranking, and evaluation techniques along with recent advances in web and multimedia IR. Emphasis will be placed on practical implementation using Python and IR libraries.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand fundamentals and terminology of IR	U	C	Quiz / Exams
CO2	Apply IR models and techniques to retrieve relevant data	Ap	P	Lab Sessions / Assignments
CO3	Analyze retrieval effectiveness and perform evaluation	A	P	Case Studies
CO4	Develop a basic IR system with indexing and ranking	C	P	Mini Projects / Viva
CO5	Explore modern IR techniques including web and multimedia retrieval	U/A	C/P	Projects
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Information Retrieval		11	15
	1	Introduction to IR, IR vs Information Extraction	3	
	2	Architecture of IR Systems	1	
	3	The IR Process: Document and Query Representation	2	

	4	Boolean Retrieval Model	3	
	5	Tokenization, Stop Word Removal, Stemming	2	
II	Indexing and Retrieval Models		13	15
	6	Inverted Index Construction	3	
	7	Positional Indexes, Compression	4	
	8	Vector Space Model and TF-IDF	4	
	9	Probabilistic Models: Binary Independence Model	4	
	10	Language Models for IR		
III	Web and Multimedia IR		12	15
	11	Web Crawling and Indexing	2	
	12	Link Analysis: PageRank, HITS	4	
	13	Search Engines: Architecture and Features	4	
	14	Multimedia IR: Audio, Image, and Video Retrieval	3	
IV	Retrieval Evaluation and Ranking		11	15
	15	Evaluation Measures: Precision, Recall, MAP, NDCG	3	
	16	Relevance Feedback and Query Expansion	3	
	17	Ranking Algorithms and Learning to Rank	4	
	18	Personalization and Contextual IR	3	
V	PRACTICUM		13	
	1	Implementing an inverted index		
	2	Ranking documents using TF-IDF		
	3	Building a mini search engine		
	4	Evaluation of search results using IR metrics		
	5	Case Study: IR in e-commerce, healthcare, or legal domain		

References:

1. Ricardo Baeza-Yate, Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Pearson Education, 2011.
2. G.G. Chowdhury, "Introduction to Modern Information Retrieval", NealSchuman Publishers; 2nd edition, 2003.
3. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Pearson Education, 2000
4. David A. Grossman, Ophir Frieder, "Information Retrieval: Algorithms, and Heuristics", Academic Press, 2000
5. C. Manning, P. Raghavan, and H. Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.
6. AnandRajaraman and Jeffery D.ullman,"Mining the Massive",Cambridge

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	2	1	2	3	2	2	3	2	1	1
CO 2	2	3	2	2	2	3	2	3	3	3	2	2
CO 3	2	3	3	2	3	3	2	3	3	3	2	2
CO 4	2	3	3	3	3	3	2	3	3	3	2	3
CO5	2	3	3	2	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	--	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6	✓	✓	✓	✓

SEMESTER V

Course Code & Title	DSA5EJ311: Deep Learning				
Type of Course	Elective	Semester	5	Academic Level	300-399
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	0	0	60
Pre-requisites	<ol style="list-style-type: none"> Basic programming knowledge (preferably in Python) Familiarity with fundamental statistics and linear algebra concepts (e.g., vectors, matrices) Introductory understanding of machine learning concepts (e.g., supervised/unsupervised learning, classification) Awareness of basic data handling tools like NumPy, Pandas, or Jupyter Notebook is helpful 				
Course Summary	<p>This course introduces students to the core principles and advanced applications of Deep Learning, a subset of artificial intelligence focused on learning from large-scale data using neural networks. Students will begin with fundamental concepts of artificial neural networks and progress through advanced architectures such as Convolutional Neural Networks (CNNs) for image data and Recurrent Neural Networks (RNNs) for sequential data. The course also covers foundational unsupervised models like</p>				

	Restricted Boltzmann Machines and clustering via Deep Belief Networks .
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Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the architecture and functioning of artificial neural networks and apply backpropagation to simple problems	U, Ap	C	Quiz / Written Exam
CO2	Analyze and implement convolutional neural networks for image classification tasks	Ap, A	P	Quiz / Written Exam
CO3	Design and train recurrent neural networks using LSTM to handle sequential data	Ap,C	C	Practical / Case Study / Report
CO4	Explain and experiment with Boltzmann machines and deep belief networks for generative modeling	U,Ap	P	Viva / Assignment
CO5	Analyze the societal impact, ethical concerns, and emerging applications of Deep Learning, and identify potential career paths in the field	A	M	Case-based Essay / Group Discussion / Seminar Presentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Artificial Neural Networks		10	15
	1	Biological vs Artificial Neuron	2	
	2	Activation Functions: Sigmoid, ReLU, Tanh	2	
	3	Gradient Descent and Stochastic Gradient Descent	2	
	4	Backpropagation Algorithm	2	

	5	Simple business problem solved using ANN	2	
II	Convolutional Neural Networks (CNN)		10	15
	8	Convolution operation and filters	2	
	9	ReLU layer and Pooling (max, average)	2	
	10	Flattening and Fully Connected Layers	2	
	11	Softmax activation and Cross-Entropy loss	2	
	12	Application context: image classification	2	
III	Recurrent Neural Networks (RNN)		15	15
	13	Introduction to RNN: idea and architecture	3	
	14	Vanishing gradient problem	3	
	15	Long Short-Term Memory (LSTM) networks	3	
	16	Building, evaluating, and improving RNN models	3	
	17	RNN tuning and training workflow	3	
IV	Boltzmann Machines and Deep Belief Networks		10	15
	18	Introduction to Boltzmann Machines	2	
	19	Energy-based models and structure	2	
	20	Restricted Boltzmann Machines (RBM)	2	
	21	Contrastive Divergence	2	
	22	Deep Belief Networks and Deep Boltzmann Machines	2	
V	Trends, Applications, and Ethical Aspects of Deep Learning		15	
	1	Real-world Applications of Deep Learning <ul style="list-style-type: none"> – Healthcare: disease diagnosis, medical imaging – Finance: fraud detection, risk analysis – Agriculture: crop monitoring, pest detection – Retail: recommendation systems, inventory forecasting 		
	2	Deep Learning in Emerging Technologies <ul style="list-style-type: none"> – Deep Learning for IoT, Edge AI, Autonomous vehicles – Integration with NLP, computer vision, and 		

		reinforcement learning		
	3	Challenges in Deep Learning – Data scarcity and quality issues – Model interpretability and explainability – Computational and energy demands		
	4	Ethical and Social Considerations – Algorithmic bias and fairness – Privacy, surveillance, and data security – Responsible AI and model governance		
	5	Career Pathways and Future Trends – Roles: Deep Learning Engineer, AI Researcher, Data Scientist – Learning path and certifications – Latest research and industry outlook		

References:

1. Francois Chollet, “Deep learning with Python”, Manning, 2017.
2. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence, By Jon Krohn, Grant Beylerveld and Aglaé Bassens, September 2019
3. Ian Goodfellow, “Deep Learning”, MIT Press, 2017.
4. Josh Patterson, “Deep Learning: A Practitioner’s Approach”, PACKT, 2017.
5. Dipayan Dev, “Deep Learning with Hadoop”, PACKT, 2017.
6. Hugo Larochelle’s Video Lectures on Deep Learning

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	–	2	–	3	2	1	–	–	2	–
CO 2	3	3	2	2	3	3	3	3	2	–	3	2
CO 3	3	3	2	3	3	3	3	3	3	2	3	2

CO 4	2	2	–	2	2	2	2	2	–	–	2	–
CO 5	2	2	3	2	3	2	3	3	2	3	3	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5		✓	✓	

Course Code & Title	DSA5EJ312: R programming				
Type of Course	Major	Semester	5	Academic Level	300-399
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	0	0	60
Pre-requisites	1. Basic knowledge about data, basic mathematical knowledge				
Course Summary	This course covers data types, distributions, graphs, and statistical measures using R programming. Students learn to analyze data effectively for informed decision-making across diverse domains.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the R environment, its interface, and perform basic data input, indexing, programming structures, and graphics	U	C	Instructor-created exams / Quiz
CO2	Apply R to represent and summarize univariate and bivariate data using appropriate statistical techniques and visualizations	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Perform hypothesis testing and analyze data using classical and non-parametric inferential statistics in R	Ap	C	Practical Assignment / Observation of Practical Skills
CO4	Apply multivariate techniques such as PCA, clustering, and basic discriminant analysis using R to summarize and interpret complex datasets	Ap	P	Practical Assignment / Observation of Practical Skills
CO5	Implement and document complete data analysis workflows in R using real-world datasets through scripting and reporting	C	M,P	Project Report / Demo / Viva
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to R Programming		10	15
	1	R as a calculator, statistical software, and programming language	1	

	2	R preliminaries: workspace, getting help, installing packages	1	
	3	Data input methods: direct input, importing from Excel/CSV	3	
	4	Data accessing, indexing, and manipulation	2	
	5	Graphics in R – base plotting system	3	
	6	Built-in functions: saving, storing, retrieving work		
	7	Looping and decision-making structures: – for, while, if, if-else commands		
II	Exploratory Data Analysis in R		10	15
	8	Diagrammatic representation of univariate and bivariate data: – Box plots, stem-and-leaf, bar plots, pie charts, scatter plots	3	
	9	Probability plots: P–P and Q–Q plots	2	
	10	Descriptive statistics: – Measures of dispersion (range, SD, MAD, IQR) – Measures of dispersion (range, SD, MAD, IQR)	2	
	11	Summary statistics, skewness, and kurtosis	3	
	12	Correlation analysis (Pearson and Spearman)		
III	Probability, Inference & Non-Parametric Tests in R		13	15
	13	Random sampling with and without replacement	3	
	14	Random number generation for probability distributions	3	
	15	Classical tests: – One- and two-sample z-test, t-test, F-test – Chi-square tests: independence, goodness-of-fit	3	

	16	Confidence intervals: mean, difference of means, variance	3	
	17	One-way and two-way ANOVA	3	
	18	Non-parametric tests: Shapiro-Wilk test, one-sample KS test – Mann-Whitney U test, Wilcoxon signed-rank test		
IV	Advanced MongoDB Concepts and Applications		13	15
	18	One-way MANOVA	2	
	19	Principal Component Analysis (PCA)	2	
	20	Factor Analysis	2	
	21	Discriminant Analysis	2	
	22	Cluster Analysis (hierarchical and k-means)	2	
V	Practical R Exercises		14	
	1	Import a CSV file, explore structure, and summarize with summary() and str()		
	2	Compute mean, median, mode, variance, SD for a numeric variable		
	3	Generate box plot, histogram, and bar chart for a dataset		
	4	Perform correlation analysis and visualize using scatter plot		
	5	Conduct a one-sample and two-sample t-test on sample data		
	6	Perform Chi-square test of independence on a categorical dataset		
	7	Run one-way ANOVA and interpret the F-value		

	8	Apply Principal Component Analysis (PCA) and interpret scree plot		
	9	Perform k-means clustering and visualize the clusters		
	10	Use a real dataset (e.g., iris, mtcars) to create a summary dashboard using plots, tables, and PCA		

References:

1. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, “A Beginner’s Guide to R” Springer, 2009
2. Roger D. Peng, “R Programming for Data Science” Lean Publishing, 2014 Phil Spector, Data Manipulation with R, Springer.
<http://www.springer.com/statistics/computational+statistics/book/978-0-387-74730-9>

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	–	2	–	3	2	1	–	–	2	–
CO 2	3	3	2	2	2	3	3	2	–	–	2	–
CO 3	3	3	3	3	2	3	3	2	2	2	3	2
CO 4	3	3	2	3	3	3	3	3	3	2	2	2
CO 5	3	3	3	3	3	3	3	3	3	2	3	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5		✓	✓	

Course Code & Title	DSA5EJ313: Social Network Analysis				
Type of Course	Major	Semester	5	Academic Level	300-399
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	0	0	60
Pre-requisites	Basic knowledge of graph theory, statistics, and programming				
Course Summary	This course introduces the theory, methods, and applications of Social Network Analysis (SNA). Students will learn how to model, analyze, and visualize complex social structures using network science concepts and tools. Emphasis is placed on graph-theoretic measures.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamental concepts of social networks and graph theory	U	C	Quiz / Exams

CO2	Model social systems using graph structures	Ap	P	Lab Sessions / Assignments
CO3	Analyze networks using centrality and structural metrics	A	P	Case Studies/Practical 1
CO4	Discover communities and roles in networks	A/E	P	Mini Projects /Labs
CO5	Apply SNA tools and techniques on real-world social network datasets	C	P	Projects
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge (F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Social Networks		12	16
	1	Introduction to Social Network Analysis - Network Analysis - Key Concepts	3	
	2	Graphs and network representation: nodes, edges, types	1	
	3	Measures in Network Analysis	2	
	4	Global Structure of Networks	3	
	5	Macro Structure of Social Networks, Personal Networks	2	
II	Network Measures and Models		12	14
	6	Degree, centrality measures , clustering coefficient	3	
	7	Social Media Examples: Asynchronous Threaded Conversation – Synchronous Conversation	3	
	8	World Wide Web - Collaborative Authoring - Blogs and Podcast – Social Sharing	3	
	9	Electronic sources for network analysis - Electronic discussion networks	3	
	10	Blogs and online communities - Web based networks	3	

III	Mathematical Representations and Notations		13	15
	11	Mathematical Representations of Social Networks - Notations for Social data	2	
	12	Graph Theoretic Notation, Sociometric Notation	4	
	13	Algebraic Notation - Sets of Actors	4	
IV	Modeling and Reasoning with Social Network		13	15
	14	Modelling and Aggregating Social Network Data : Ontological representation of social individuals	3	
	15	Ontological representation of social relationships Aggregating	3	
	16	Reasoning with social network data - Representing identity Determining equality	3	
	17	Reasoning with instance equality- Evaluating Smushing	4	
V	PRACTICUM		10	
	1	Building and analyzing small social networks		
	2	Network visualization using Gephi		
	3	Centrality and influence analysis using Python		
	4	Community detection and interpretation		
	5	Case study: Social media network (Twitter/Facebook/LinkedIn)		

References:

1. Peter Mika, Social Networks and the Semantic Web , Springer, 2007
2. Hansen, Derek, Ben Shneiderman, Marc Smith, Analyzing Social Media Networks with NodeXL: Insights from a Connected World , Morgan Kaufmann, 2011
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications.", Cambridge University Press, 1994
4. Christina Prell, Social Network Analysis: History, Theory and Methodology , SAGE Publications Ltd, 2012

Mapping of COs with POs and PSOs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	1	1	2	3	2	2	3	2	1	1
CO 2	2	3	2	2	2	3	2	2	3	3	2	2
CO 3	2	3	2	2	2	3	2	3	2	3	3	2
CO 4	2	3	3	3	2	3	2	3	3	2	2	3
CO5	2	3	2	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6	✓	✓	✓	

20. DETAILED SYLLABUS OF FOUNDATION COURSES

SEMESTER I

Course Code & Title	DSA1FS111: Data analysis using Spreadsheet				
Type of Course	SEC	Semester	1	Academic Level	100-199
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	1. Basic mathematics knowledge 2. Basic computer knowledge				
Course Summary	This syllabus aims to cover a broad spectrum of Excel skills, catering to participants with varying levels of expertise.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate the ability to enter data accurately and efficiently into Excel worksheets.	Ap	P	Instructor-created exams / Quiz
CO2	Use of Excel formulas, including basic arithmetic operations, application of common functions calculations in spreadsheets.	Ap	C	Problem-solving assessments
CO3	Use Excel for data analysis, including sorting, filtering, and the creation of Tables.	Ap	P	Instructor-created exams / Quiz
CO4	Demonstrate proficiency in utilizing advanced Excel functions	Ap	P	Instructor-created exams / Quiz

CO5	Demonstrate collaboration skills and the ability represent real world data and create reports.	Ap	P	Modelling Assignment s/ / Case studies
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Spreadsheets		6	10
	1	Overview - Overview of spreadsheet software (Microsoft Excel, Google Sheets) and their application	1	
	2	Excel Interface and Navigation-Ribbon, Row, Column, Cell Worksheet, Workbook, Cell Address, Data range, Formula, Chart)	1	
	3	Basic navigation techniques within the workbook	1	
	4	Creating and Saving Workbooks - Creating a new workbook and saving it, Different file formats and when to use them	1	
	5	Inserting or deleting rows or columns	1	
	6	Basic Cell Formatting - Formatting text, numbers, and dates	1	
II	Data Management		9	10
	7	Find and select -Find,Replace,Go To,Go To Special	2	
	8	Cell Referencing-Relative, Absolute and Mixed	2	
	9	Sorting data-Quick Sorting,Sorting by Multiple Criteria	1	
	10	Filtering data-Quick Filtering, Filtering by Multiple Criteria , Performing Calculations on Filtered Data	1	
	11	AutoFill and Flash Fill, Remove Duplicates	1	
	12	Get External Data - From web,from text and from other sources	2	

III	Excel Functions and formulas		8	15
	12	Mathematical and Statistical functions(-SUM, AVERAGE, MAX, MIN, ROUND, ABS, SQRT, MOD.,COUNT, COUNTIF, SUMIF, AVERAGEIF, MEDIAN, STDEV, VAR)	2	
	13	Logical Functions(IF, AND, OR, NOT, XOR, IFERROR, IFNA, SWITCH.)	2	
	14	Text Functions (CONCATENATE, LEFT, RIGHT, MID, LEN, SUBSTITUTE, FIND, SEARCH.)	2	
	15	Date & Time Functions-(TODAY, DATE, DAY, MONTH, YEAR, HOUR, MINUTE, SECOND.)	1	
		Using formula: Writing a formula, Cell reference	1	
	IV	Data Analysis and Manipulation		8
16		Introduction to Tables and Data Organization - Creating and formatting tables for effective data management, Sorting and filtering data within tables	2	
17		Data Analysis Techniques - Advanced functions (VLOOKUP, HLOOKUP, INDEX, MATCH)	2	
18		PivotTables and PivotCharts - Understanding PivotTables for data analysis, Creating PivotCharts for visual representation	2	
19		Data Visualization: Creating and customizing various chart types, Effective use of charts for data presentations	2	
V		Project and Practical Applications		14
	1	Practical session on real-world applications (Eg: Use advanced functions relevant to field of study, Tabulation of Lab experiments data for better analysis and visualisation)		
		Course Project: Creating a comprehensive project using Excel features.		

References:

1. "Microsoft Excel 2019 Step by Step" by Curtis Frye
2. "Excel 2019 Bible" by Michael Alexander and Richard Kusleika
3. "Microsoft Excel 2019 Data Analysis and Business Modeling" by Wayne Winston

Mapping of CO's with PSO s and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	-	-	-	-	3	2	2	3	-	-	-
CO 2	3	2	-	-	-	3	2	3	3	2	-	-
CO 3	3	2	2	2	3	3	3	3	3	2	-	-
CO 4	3	3	3	2	3	3	3	3	3	2	-	-
CO 5	3	3	3	3	3	3	3	3	3	3	2	2

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	✓

Course Code & Title	DSA1FM105: Introduction to Computers and Office Automation				
Type of Course	MDC	Semester	1	Academic Level	100-199
Course Details	Credit	Lecture Per Week	Tutorial Per Week	Practical Per Week	Total Hours
	3	3	-	-	45
Pre-requisites	Basic knowledge of computers & Internet.				
Course Summary	This course focuses on the use of computer technology and software applications to automate routine office tasks and streamline business processes. Students will be able to use computer technology to enhance communication and data management.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamentals of computer Hardware and Software and Computer Networks.	U	C	Instructor-created exams / Quiz/ Assignment/ Seminar
CO2	Understand the fundamentals of word processing and its importance in office automation. Demonstrate proficiency in creating, editing, and formatting documents using word processing software. Explore advanced formatting options and features	Ap	P	Practical Assignment / Instructor-created exams/ Quiz
CO3	Understand the fundamentals of electronic spreadsheets and their role in data analysis, manipulation, and presentation. Demonstrate proficiency in creating, saving, and editing workbooks and worksheets within electronic spreadsheet software. Utilize various data entry	Ap	P	Practical Assignment / Instructor-created exams/ Quiz

	techniques. Handle operators in formulas and utilize a wide range of functions.			
CO4	Demonstrate proficiency in creating, manipulating, and enhancing slides within presentation software, including adding text, images, shapes, and multimedia elements. Expertise in utilizing organizational charts and various chart types to represent hierarchical structures and data trends effectively. Explore drawing tools to create custom shapes, diagrams, and illustrations.	Ap	P	Practical Assignment / Instructor-created exams/ Quiz
CO5	To empower students to design and implement automation solutions in real- world scenarios.	Ap	P	Case study/ Project
CO6	Gaining a deep understanding of emerging trends and technologies in the field of automation.	U,Ap	P	Assignment/ Seminar
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs. (36+9)	Marks
I	Introduction To Computers		8	14
	1	Types of Computers	1	
	2	Hardware: CPU, Input / Output Devices. Storage Devices, Memory hierarchy, RAM ROM, Secondary Memory, and Registers.	3	
	3	Software: Types of Software, Computer languages, Language translators, and Operating Systems.	2	
	4	Computer Networks: LAN, WAN, MAN, Client	2	

II		-Server		12
	Documentation Using a Word Processor (Open Office Writer / MS Word)		8	
	5	Introduction to Office Automation, Word Processing Concepts - creating and editing documents, Formatting documents.	3	
	6	Finding and Replacing Text, Printing documents, Auto-text, Autocorrect, Spelling and Grammar Tools.	2	
	7	Document Dictionary, Graphics, Tables, Charts, Columns, Page Borders, Bookmark.	1	
	8	Advanced Features- Mail Merge, Macros, Tables, File Management, Printing, Styles, linking and embedding objects, Template	2	
III	Electronic Spread Sheet (Open Office Calc / MS-Excel)		10	12
	9	Introduction to Spread Sheet, Spread sheet Concepts, Creating, Saving, and Editing a Workbook.	2	
	10	Inserting, deleting worksheets, entering data in a Cell/Formula, Copying and moving data from selected Cells.	1	
	11	Handling Operators in Formula. Functions: Mathematical, Logical, Statistical, Text, Financial, Date and Time, Function Wizard.	1	
	12	Formatting a Worksheet, Formatting Cells, and Changing Data alignments. Changing date, Character, Number, Currency format, Changing font.	2	
	13	Adding borders and colors, Printing Worksheets, Charts and graphs, creating previewing and	3	

		modifying charts, Conditional Formatting, and Filters.		
	14	Advanced features – Pivot table & Pivot Chart, Linking and Consolidation	1	
IV	Presentation using (OpenOffice Impress/MS-Power Point)		10	12
	15	Presentations, Creating, Manipulating & Enhancing Slides	2	
	16	Organizational Charts, Charts, Drawing objects, clip arts, Word Art, Layering art Objects	4	
	17	Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect.	4	
V	Open Ended Module		9	
	1	· Design and Implement Automation Solutions in real-world scenarios · Understand Future Trends in Automation	9	

References:

1. P.K. Sinha and P.Sinha, “Foundations of Computing”, BPB Publication
2. Russell A. Stultz, Learn Microsoft Office, BPB Publication.
3. S. Sagman. “Microsoft Office 2000 for Windows”. Pearson Education.
4. Turban, Mclean and Wetherbe. “Information Technology and Management John Weily and Sons.

Mapping of Cos with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	2	3	2	-	3	2	2	3	2	-	-
CO 2	3	3	3	3	2	-	3	3	3	3	2	-	-
CO 3	3	3	3	3	2	-	3	3	3	3	2	-	-
CO 4	3	3	3	3	2	-	3	3	3	3	2	-	-

CO 5	3	3	3	3	3	2	3	3	3	3	3	2	2
CO 6	3	2	2	3	3	2	3	2	2	3	3	2	2

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

SEMESTER II

Course Code & Title	DSA2FM106: Digital Marketing				
Type of Course	MDC	Semester	2	Academic Level	100-199
Course Details	Credit	Lecture Per Week	Tutorial Per Week	Practical Per Week	Total Hours
	3	3	-	-	45
Pre-requisites	<ol style="list-style-type: none"> 1. Basic Computer Literacy 2. Familiarity with Online Platforms 				
Course Summary	<p>This course provides students with a foundational understanding of key concepts and techniques in the rapidly evolving field of digital marketing. Through engaging lectures. Students will explore various digital marketing channels, including search engine optimization (SEO), social media marketing, email marketing, and content marketing.</p>				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the concept of digital marketing and its integration with traditional marketing	U	C	Instructor-Create Exams or Quiz
CO2	To understand customer value journey in digital context and behaviour of online consumers	A	P	Discussions and Quizzes
CO3	To examine various tactics for enhancing a website's position and ranking with search engines	U	F	Instructor created exams or Home assignments
CO4	To Identify and differentiate between various digital marketing channels, including SEO, social media, email, and content marketing.	A,E	P	Discussions, Quizzes
CO5	To get overall idea in implementing basic digital marketing strategies to enhance online visibility and engagement.	Ap	P	Viva Voce Observation of practical skills
CO6	To get to know about ethical considerations and best practices in digital marketing, including privacy, data protection, and consumer trust.	U	M	Instructor Created - Exams, Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs. (36+9)	Marks
		Digital Marketing Basics	9	
	1	Overview of digital marketing	2	
	2	Importance of digital marketing for businesses	2	

I	3	Introduction to key digital marketing channels (SEO, social media, email marketing)	3	12
	4	Basics of creating a digital marketing strategy	2	
	Content Marketing & Social Media		9	
II	5	Content Marketing Fundamentals	2	12
	6	Content Strategy Development	2	
	7	Content Creation for Different Platforms	2	
	8	Introduction to Social Media Marketing & keyword Optimization	2	
	9	Social Media Strategy & Community Management	1	
III	Search Engine Optimization (SEO) & Paid Advertising		9	14
	10	Introduction to Search Engine Optimization	2	
	11	On-page and Off-page SEO Techniques	2	
	12	Search Engine Marketing (SEM) Fundamentals	2	
	13	Pay-Per-Click (PPC) Advertising with Google Ads	2	
	14	Social Media Advertising Platforms	1	
IV	Web Analytics & Emerging Trends		9	12
	15	Introduction to Web Analytics & Key Metrics	2	
	16	Using Analytics Tools for Data-Driven Decision Making	2	
	17	Conversion Tracking & Optimization	2	
	18	Emerging Trends in Digital Marketing	2	
V	19	Emerging Trends in Digital Marketing	1	9
	Open Ended Module Hands-on: Practical Applications, Case Study and Course Project			

1	<ul style="list-style-type: none"> · Social Media Marketing-Social media Channels · Leveraging social media for brand conversions and buzz · Recent trends in digital marketing · Demonstrate how to use google web masters Indexing Using API 	2	
		2	
		3	
		2	

References:

1. DeWald, R. (2021). Digital Marketing for Dummies.
2. Kotler, P., Kartajaya, H., & Setiawan, I. (2017). Marketing 4.0: Moving from Traditional to Digital.
3. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation. Kogan Page Limited.
4. Kumar, S., & Kaur, S. (2020). Digital Marketing. Taxmanns.
5. Hill, R. (2024). Social Media Marketing 2024: Mastering New Trends & Strategies for Online Success.

Mapping of Cos with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	-	2	1	2	3	2	2	3	1	2	-
CO 2	2	1	3	2	2	2	3	3	2	3	2	-
CO 3	3	1	3	2	3	3	1	3	3	2	-	-
CO 4	3	2	3	3	3	2	3	3	3	3	2	-
CO 5	3	2	3	3	3	2	2	3	3	2	-	2
CO 6	1	-	2	2	2	1	2	2	2	2	3	2

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓			✓
CO 5		✓		✓
CO 6				✓

SEMESTER III

Course Code & Title	DSA3FV108: Business Intelligence and Strategy				
Type of Course	Major	Semester	3	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	0	0	45
Pre-requisites	Basic knowledge of databases, statistics, data visualization tools and organizational strategy.				
Course Summary	This course explores the integration of business intelligence (BI) tools and strategies to support effective decision-making. It covers BI architecture, data-driven decision models, dashboards, analytics, and performance measurement frameworks. Emphasis is placed on aligning BI initiatives with organizational goals and competitive strategy.				

Course Outcomes (CO):

CO	CO Statement	Cognitive	Knowledge	Evaluation
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		Level*	Category#	Tools used
CO1	Understand core concepts of business intelligence and strategic management.	U	C	Instructor-created exams / Quiz
CO2	Explain BI architecture, tools, and data lifecycle in enterprise systems.	U	C	Problem-solving assessments
CO3	Analyze organizational strategy using frameworks like SWOT, BCG, and Porter.	An	C	Instructor-created exams / Quiz
CO4	Develop BI reports and dashboards for decision support.	Ap	P	Instructor-created exams / Quiz
CO5	Apply predictive and descriptive analytics to solve business problems.	Ap	P	Written Exam / Group Discussion / Seminar
CO6	Create a strategic BI roadmap and performance measurement plan.	C	M	Presentation/ Viva
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Business Intelligence		10	12
	1	Concepts and components of BI	2	
	2	Evolution from traditional reporting to BI systems	2	
	3	Types of BI: Strategic, Tactical, Operational	2	

	4	Comparison: BI vs Business Analytics vs Data Science	2	
	5	Importance of BI in strategic decision-making	2	
II	BI Architecture and Tools		9	12
	6	Overview of BI architecture and data warehousing	2	
	7	ETL (Extract, Transform, Load) process	2	
	8	Introduction to BI tools: Power BI, Tableau, QlikView	3	
	9	Sector-wise BI applications (Retail, Healthcare, etc.)	2	
III	Strategic Analysis Frameworks		9	13
	10	SWOT, PESTEL, and BCG Matrix	3	
	11	Porter's Five Forces & Value Chain Analysis	2	
	12	Balanced Scorecard and Strategy Maps	2	
	13	Aligning BI with strategic goals	2	
IV	Analytics for Strategy		10	13
	14	Types of analytics: Descriptive, Predictive, Prescriptive	3	
	15	Basic data mining: Clustering, Classification, Regression	3	
	16	Key Performance Indicators (KPIs) and metrics	2	
	17	Creating dashboards for decision-making	2	
V	Strategy Implementation & Case Studies		7	
	18	BI case studies from various industries		
	19	BI strategy planning: Roadmaps and Governance		
	20	Creating a BI strategy for a sample company		
	21	Capstone project: From raw data to business insights		

References:

- Ramesh Sharda, Dursun Delen, Efraim Turban, *Business Intelligence and Analytics*, Pearson, 2014.
- Larissa T. Moss, *Business Intelligence Roadmap*, Addison Wesley, 2003.
- David Loshin, *Business Intelligence: The Savvy Manager's Guide*, Morgan Kaufmann, 2012.
- Cindi Howson, *Successful Business Intelligence*, McGraw-Hill, 2013.

Mapping of CO’s with PSO s and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	1	3	2	2	3	2	2	2	3	1	1
CO 2	3	2	3	2	2	3	2	2	3	2	1	2
CO 3	2	1	3	2	2	3	3	2	2	3	2	2
CO 4	3	2	3	3	3	2	2	3	3	2	1	2
CO 5	3	3	3	3	3	2	2	3	3	3	1	2
CO 6	3	2	3	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓

CO 2	✓	✓		✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓		✓	

SEMESTER IV

Course Code & Title	DSA4FS112: Computer Network for Data Science				
Type of Course	Major	Semester	4	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	0	0	45
Pre-requisites	1. Basic mathematics knowledge 2. Basic computer knowledge				
Course Summary	This course introduces the fundamentals of computer networking with a focus on concepts and protocols relevant to data science, cloud platforms, and IoT. Students will gain knowledge about data transmission, APIs, and network security essential for handling and sharing data across distributed systems. The course emphasizes real-world applications like accessing remote data sources, working with APIs, and understanding network-based data transfer.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Explain the basic concepts, architecture, and models of computer networks.	U	C	Instructor-created exams / Quiz
CO2	Describe protocols like TCP/IP, HTTP, DNS, and their role in data communication.	U	C	Problem-solving assessments
CO3	Apply networking tools to analyze data traffic and understand packet flow.	Ap	P	Instructor-created exams / Quiz
CO4	Demonstrate API-based data access using HTTP requests and JSON data.	Ap	P	Instructor-created exams / Quiz
CO5	Explain emerging trends, technologies, and applications of computer networks in data science, such as cloud networking, and AI-driven networks.	U	C	Written Exam / Group Discussion / Seminar

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Networking Basics		10	10
	1	Introduction to Networks – LAN, WAN, MAN, Internet.	2	
	2	Network topologies and components (switches, routers).	2	
	3	OSI & TCP/IP models – Layers and their functions.	3	
	4	Data transmission concepts: packets, bandwidth, latency.	3	
II	Protocols and Data Communication		8	10
	5	TCP/IP architecture – IP addressing (IPv4 vs IPv6).	2	
	6	HTTP, HTTPS, FTP protocols – Request/response cycle.	2	
	7	DNS, DHCP, and routing basics.	2	
	8	Hands-on with ping, tracert, netstat, and Wireshark.	2	
III	Cloud & APIs		10	10
	9	API fundamentals – REST, JSON, and XML data formats.	2	
	10	Accessing data from public APIs (e.g., weather or stock APIs).	2	
	11	Use of Python requests library for data fetching.	3	
	12	Introduction to cloud data services (AWS, Azure basics).	3	
IV	Network Security		10	10
	13	Cybersecurity fundamentals – Threats, attacks, and prevention.	3	
	14	Firewalls, VPNs, and encryption (HTTPS and SSL).	3	
	15	Secure data transfer – Importance of authentication and tokens.	4	
V	Emerging Trends and Applications in Networking		7	10
	16	Cloud Networking for Data Science	2	
	17	Big Data and Networking	2	
	18	Future of Networking in Data Science	3	

Mapping of CO's with PSO s and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	-	2	-	2	1	3	2	-	-	2
CO 2	3	2	-	2	-	2	1	3	2	-	-	2
CO 3	3	3	2	2	2	2	2	3	3	-	-	3
CO 4	3	3	3	3	2	2	2	3	3	2	-	3
CO 5	3	2	-	3	2	3	2	3	3	2	-	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓

References:

- "Computer Networking: Principles, Protocols and Practice" by Olivier Bonaventure.
- "Computer Networks" by Andrew S. Tanenbaum & David Wetherall.
- "Foundations of Data Science and Networking" by J. Leskovec et al. (relevant chapters).
- Online API documentation (e.g., OpenWeatherMap API) for practical work.

Course Code & Title	DSA4FV109: Introduction to Cyber Law				
Type of Course	VAC	Semester	4	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	Basic understanding of computers, internet, and general law principles.				
Course Summary	This course introduces students to the legal aspects of cyberspace. It covers key legislation, regulatory frameworks, and legal principles governing cybercrimes, data protection, digital signatures, and e-commerce. It also explores international perspectives and current issues in cyber law.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand fundamental concepts of cy frameworks	U	C	Quiz / Exams
CO2	Analyze cybercrime types and laws associated with them	A	C	Assignments, Case Studies
CO3	Apply legal reasoning in issues related to e-contracts, data privacy, and IP rights	Ap	P	Projects, Presentations
CO4	Evaluate global cyber law practices and frameworks	E	M	Mini Projects, Viva
CO5	Discuss ethical challenges and recent developments in cyber law	U	C	Group Discussions, Assignments

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge (F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Cyber Law		9	14
	1	Evolution and importance of cyber law	2	
	2	Cyber jurisprudence and jurisdictional challenges	2	
	3	Cyber ethics and netiquette	2	
	4	Classification of Cyber Crimes: Hacking, Cyber Stalking, Phishing, Cyber Terrorism	3	
	5	Cyber Crime Investigation & Reporting	2	
II	Legal Framework in India		9	11
	6	Information Technology Act, 2000 – objectives, definitions	2	
	7	Electronic records, digital signatures, certifying authorities	3	
	8	Cyber regulations and adjudication	3	
	9	Cyber Offenses under the IT Act	2	
III	Cybercrimes and Offenses		10	15
	10	Types of cybercrimes: hacking, phishing, cyberstalking, identity theft	3	
	11	Legal provisions and penalties under IT Act & IPC	3	
	12	Case studies on cybercrime investigations	3	
	13	Intellectual Property in Cyberspace – Copyright, Trademarks	4	
IV	Data Protection, Privacy, and		8	10

		International Frameworks			
	14	Personal Data Protection Bill, GDPR overview		3	
	15	Cross-border data flow and cyber law trends		3	
	16	International organizations: UNCITRAL, ITU, WIPO		4	
V	PRACTICUM			9	
	1	Drafting of cybercrime reports			
	2	Simulation of e-contracts			
	3	Case law analysis and mock trials			
	4	Case Studies: Indian & International Cyber Crime Judgments			

References:

1. **Cyber Law** by Pavan Duggal
2. **Information Technology Law and Practice** by Vakul Sharma
3. **Cyber Law in India** by Farooq Ahmad
4. **Computer Forensics & Cyber Crime** by Marjie T. Britz
5. Relevant sections from **The Information Technology Act, 2000** and **Indian Penal Code**

Mapping of COs with POs and PSOs:

	PSO 1	PSO2	PSO3	PSO 4	PSO 5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	2	1	1	3	2	1	2	2	1	2
CO 2	2	3	2	2	2	3	3	2	3	2	2	2
CO 3	2	3	3	2	2	3	3	3	3	2	2	2
CO 4	2	2	3	3	2	3	2	2	3	3	2	3
CO5	3	2	3	2	3	3	3	3	3	2	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	--	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6	✓	✓	✓	✓

SEMESTER V

Course Code & Title	DSA5FV110: Introduction to Content Management System				
Type of Course	VAC	Semester	5	Academic Level	300-399
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	Familiarity with web content management systems (CMS). Basic knowledge of internet technologies provides a foundation for learning web design.				
Course Summary	The course covers fundamental web design concepts including HTML and CMS principles, focusing on Drupal as a robust Content Management System. Students will learn to create and customize websites using Drupal, exploring its features such as content types, themes, and modules to build dynamic and interactive web pages.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Cultivate a robust understanding of web design fundamentals, laying a strong foundation for their journey into the dynamic world of digital design and development.	U	C	Assignment / Instructor created exams / Quiz
CO2	Attain comprehensive knowledge and practical proficiency in Content Management Systems (CMS), empowering to navigate and excel in the ever-evolving landscape of digital content creation and management.	U	C	Assignment / Instructor created exams / Quiz
CO3	Develop expertise in Drupal, a widely used CMS platform, gaining comprehensive understanding of its features, configuration, and installation processes, thus preparing them for proficient and innovative web development endeavors.	Ap	P	Practical Assignment / Instructor created exams / Quiz
CO4	Impart a comprehensive understanding of website development using Drupal and facilitate the acquisition of expertise across various options within the Drupal ecosystem.	Ap	P	Practical Assignment / Instructor created exams / Quiz
CO5	Gain an understanding of how to apply web design concepts to real-world scenarios, effectively designing and developing functional and aesthetically pleasing websites utilizing the Drupal CMS.	C	P	Practical Assignment / Instructor created exams / Quiz
CO6	Develop proficiency in advanced website management skills, including installing and configuring modules, managing menus, and more, to effectively navigate and optimize the functionality of websites built on the	C	P	Practical Assignment / Instructor created exams / Quiz

Drupal platform.			
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)			

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Web Designing		8	10
	1	Basics of Web Designing -World Wide Web (WWW), W3C, Web Browser	1	
	2	Web Server, Web Hosting, Web Pages	1	
	3	DNS, URL	2	
	4	Overview of HTML (Concept only) and its role in Web Development	2	
	5	Open-Source S/W, Open-Source vs Closed Source Software, Open-Source Licenses (Concept only)	2	
II	Introduction to CMS		6	10
	6	Introduction to Content Management Systems (CMS) - Features of CMS	2	
	7	Web Content Management System	2	
	8	Components of Content Management System	2	
III	Introduction to Drupal		10	15
	9	Drupal - Features, Advantages and Disadvantages	1	
	10	Installation and Configuration	1	
	11	Content types and Field	2	
	12	Drupal Architecture	1	
	13	User Management, Managing Comments	2	
	14	Creating and Customizing Themes	3	

IV	Building Website		12	15
	15	Website Development - Working with Templates and Template files	2	
	16	Articles, Creating Web Forms	2	
	17	Managing blocks, Add Links to Blocks, Moving Elements within Block	2	
	18	Blocks and Regions	2	
	19	Creating and Customizing Views	1	
	20	Installing and Configuring Modules	1	
	21	Static Pages, Creating Pages, Menu Management.	2	
V	Open Ended Module – Website Development		9	
		Develop a simple Website using Drupal.		

References:

1. Jennifer Campbell, Jennifer T Campbell, Web Design: Introductory, Course Technology.
2. Jason Beaird and Alex Walker, The Principles of Beautiful Web Design, SitePoint.
3. Bob Boiko, Content Management Bible, Wiley.
4. Daniel Sipos, Drupal 9 Module Development, Packt Publishing Limited.

Mapping of COs with POs and PSOs:

	PSO 1	PSO2	PSO3	PSO 4	PSO 5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	1	2	1	2	3	2	2	3	2	1	1
CO 2	2	2	2	2	2	3	2	3	3	2	1	1
CO 3	3	2	3	3	3	3	3	3	3	3	2	2
CO 4	3	3	3	3	3	3	3	3	3	3	2	3
	3	3	3	3	3	3	3	3	3	3	2	3

CO5												
CO6	3	3	3	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

Quiz / Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		

Course Code & Title	DSA5FS113: Introduction to Digital Marketing				
Type of Course	SEC	Semester	5	Academic Level	300-399
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	Basic computer skills and familiarity with internet usage.				
Course Summary	This course offers an introduction to digital marketing fundamentals including organic and paid marketing, web development basics, SEO, SEM, content marketing, social media strategies, and analytical tools. Emphasis is placed on both strategic thinking and hands-on application using modern digital platforms and tools.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand digital marketing concepts, platforms, and traditional comparison	U	C	Quiz / Written Exam
CO2	Apply knowledge of website creation and search engine basics	Ap	P	Assignment / Written Exam
CO3	Utilize lead generation techniques and inbuilt marketing tools	Ap	P	Assignment / Viva
CO4	Explore and apply trending digital marketing skills and tools	Ap/ C	P	Quiz / Written Exam
CO5	Analyze digital marketing campaigns using web analytics and performance tools. Develop a basic end-to-end digital marketing plan based on a case scenario	An	M	Case Study / Practical Assignment
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Digital Marketing		8	15
	1	What is Digital Marketing?	1	
	2	Why Digital Marketing?	1	
	3	Organic vs. Paid Digital Marketing	1	
	4	Digital vs. Traditional Marketing	1	
	5	Digital Marketing Platforms & Channels	1	

	6	Role, Functions & Significance of a Digital Marketing Manager	2	
	7	Workplace Safety & Ethical Aspects in Digital Practice	1	
II	Website and Search Engine Basics		9	15
	8	Website Planning and Development	2	
	9	Hosting & Domain – Concepts and Setup	1	
	10	Platforms for Website Creation: WordPress, Wix, etc.	2	
	11	Introduction to Search Engines: Google, Bing, Yahoo	1	
	12	Website Tools:	3	
		● Google Search Console		
		● Sitemap Creators		
		● Page Rank & Indexing Tools		
		● Dead Link & WHOIS Tools		
III	Lead Management & social media Tools		9	15
	13	What is a Lead? Web-to-Lead / Web-to-Case Forms	2	
	14	Lead Generation Techniques	1	
	15	Introduction to Social Media Platforms	1	
	16	Group Posting, Scheduling, and Automation	2	
	17	Inbuilt Digital Tools:	3	
		● IP Trackers		
		● CPC Reduction Techniques		
		● Quick Sprout and Similar Analyzers		
IV	Digital Marketing Skills and Trends		10	15
	18	Search Engine Optimization (SEO)	1	

	19	Search Engine Marketing (SEM) & Google Ads	1	
	20	Social Media Marketing & Optimization	1	
	21	Email Marketing Tools & Techniques	1	
	22	Content Creation: Blogging, Copywriting	2	
	23	Affiliate, Mobile, and SMS Marketing	2	
	24	Marketing Automation & Analytics	1	
	25	Growth Hacking Concepts	1	
V	Case Studies / Hands-On Implementation		9	
	1	Hands-on:		
		<ul style="list-style-type: none"> ● Creating a Basic Website 		
		<ul style="list-style-type: none"> ● SEO Audit of a Website 		
		<ul style="list-style-type: none"> ● Google Ads Campaign Simulation 		
		<ul style="list-style-type: none"> ● Design and Deploy an Email Campaign 		
		<ul style="list-style-type: none"> ● Social Media Post Planning using a Scheduler 		
	2	Case Study:		
		<ul style="list-style-type: none"> ● Developing a Digital Marketing Plan for a Small Business 		
		<ul style="list-style-type: none"> ● Analyze an Existing Campaign Using Web Analytics Tools 		

References:

1. Chaffey, D. (2019). *Digital Marketing*. Pearson UK.
2. Chaffey, D., & Smith, P. R. (2017). *Digital Marketing Excellence*. Taylor & Francis.
3. Dodson, I. (2016). *The Art of Digital Marketing*. Wiley.
4. Kaufman, I., & Horton, C. (2014). *Digital Marketing: Integrating Strategy and Tactics*. Routledge.
5. Royle, J., & Laing, A. (2014). *The Digital Marketing Skills Gap*. Int. Journal of Information Management.
6. Stokes, R. (2011). *E-Marketing: The Essential Guide to Digital Marketing*. Quirk eMarketing.

Mapping of CO's with PSO s and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	1	1	2	3	2	2	3	2	1	1
CO 2	3	3	2	2	3	3	2	3	3	2	1	1
CO 3	3	3	3	2	3	3	3	3	3	3	2	2
CO 4	3	3	3	3	3	3	3	3	3	3	2	3
CO5	3	3	3	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓

21. DETAILED SYLLABUS OF THE VOCATION MINOR COURSES

GROUP 1

Course Code & Title	DSA1MN101: Introduction to Data Science and analytics				
Type of Course	Minor	Semester	1	Academic Level	100-199
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic understanding of computer science concepts. 2. Familiarity with data handling.				
Course Summary	This course provides a foundational overview of data science and analytics, aimed at equipping students with essential knowledge and practical skills in the data analysis lifecycle. It introduces the core concepts of data science, data types, and roles within the data ecosystem. Students will explore methods for data collection, preprocessing, and integration, followed by analytical techniques using descriptive statistics and correlation measures. The course also covers the basics of business analytics including time series analysis, forecasting, and an introduction to supervised and unsupervised learning. A case study-based module allows students to apply theoretical knowledge to real-world data, enhancing their ability to derive insights and make data-informed decisions in a business context..				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamental concepts and real-world applications of data science and analytics	U	C	Assignment / Instructor created exams / Quiz
CO2	Collect and preprocess data using structured techniques for cleaning, integration, and transformation	Ap	P	Assignment / Instructor

				created exams / Quiz
CO3	Apply descriptive statistical techniques to summarize and visualize datasets	Ap	P	Instructor created exams/ Home Assignments
CO4	Analyze basic business patterns and relationships using trend analysis, correlation, and regression	Ap	P	Instructor created exams/ Home Assignments
CO5	Execute an end-to-end business data analysis project and present findings and recommendations	C	P, M	Project work / Presentation / Viva
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Data Science and Analytics		10	15
	1	What is data science?	2	
	2	Differences between data science, data analytics, and business intelligence	2	
	3	Data types: structured, unstructured, semi-structured	2	
	4	Application of data science and analytics	2	
	5	Roles in the data ecosystem: analyst, data engineer, data-driven manager	2	
II	Data Collection and Data Pre-Processing		10	15
	6	Data Collection Strategies	2	
	7	Data Pre-Processing Overview	2	
	8	Data Cleaning	2	
	9	Data Integration and Transformation	2	

	10	Data Reduction and Discretization	2	
III	Data Analytics		15	20
	12	Descriptive Statistics	3	
	13	Mean, Standard Deviation	3	
	14	Skewness and Kurtosis	3	
	15	Box Plots	3	
	16	Correlation Statistics	3	
IV	Basic Business Analytics		15	20
	16	Trend analysis using time series plots	3	
	17	Forecasting basics with moving averages	3	
	18	Correlation and relationships between business variables	3	
	19	Introduction to regression: concept of prediction	3	
	20	Supervised learning techniques and unsupervised learning techniques	3	
V	Case Study: Sales Analysis for a Retail Business		25	
		To apply the concepts of data collection, cleaning, analysis, and visualization in a business context by exploring and presenting insights from a real-world sales dataset.		

Mapping of CO's with POs and PSO s :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	2	2	2	3	2	2	2	2	-	-
CO 2	3	2	3	3	2	3	2	3	3	2	-	-
CO 3	3	2	3	3	3	3	2	3	3	3	-	-

CO 4	3	2	3	3	3	3	2	3	3	3	-	2
CO 5	3	3	3	3	3	3	3	3	3	3	2	3

References:

Text Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.
2. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
3. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition.

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	

Course Code & Title	DSA2MN101: Data analysis using Spreadsheet				
Type of Course	Minor	Semester	2	Academic Level	100-199
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic mathematics knowledge 2. Basic computer knowledge				
Course Summary	This syllabus aims to cover a broad spectrum of Excel skills, catering to participants with varying levels of expertise.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate understanding of spreadsheet environments and perform basic workbook operations	U	C	Instructor-created quizzes / Assignments
CO2	Manage and manipulate data effectively using referencing, sorting, filtering, and formatting	Ap	P	Practical Exercises / Lab Observation
CO3	Apply mathematical, logical, text, and date functions in formulas to solve practical problems	Ap	P	Function-based Practical Assignment
CO4	Analyze and organize data using advanced tools like tables, lookup functions, and pivot tables	Ap	P	Use-case-based exercises / Viva / Test
CO5	Create charts and dashboards to present data insights clearly and effectively	C	P, M	Project / Hands-on Tasks / Visual Presentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Spreadsheets		12	15
	1	Overview - Overview of spreadsheet software (Microsoft Excel, Google Sheets) and their application	2	
	2	Excel Interface and Navigation-Ribbon, Row, Column, Cell Worksheet, Workbook, Cell Address, Data range, Formula, Chart)	2	
	3	Basic navigation techniques within the workbook	2	
	4	Creating and Saving Workbooks - Creating a new workbook and saving it, Different file formats and when to use them	2	
	5	Inserting or deleting rows or columns	2	
	6	Basic Cell Formatting - Formatting text, numbers, and dates	2	
II	Data Management		12	15
	7	Find and select -Find,Replace,Go To,Go To Special	2	
	8	Cell Referencing-Relative, Absolute and Mixed	2	
	9	Sorting data-Quick Sorting,Sorting by Multiple Criteria	2	
	10	Filtering data-Quick Filtering, Filtering by Multiple Criteria , Performing Calculations on Filtered Data	2	
	11	AutoFill and Flash Fill, Remove Duplicates	2	
	12	Get External Data - From web,from text and from other sources	2	
III	Excel Functions and formulas		12	20
	13	Mathematical and Statistical functions(-SUM, AVERAGE, MAX, MIN, ROUND, ABS, SQRT, MOD.,COUNT, COUNTIF, SUMIF, AVERAGEIF, MEDIAN, STDEV, VAR)	2	
	14	Logical Functions(IF, AND, OR, NOT, XOR, IFERROR, IFNA, SWITCH.)	2	
	15	Text Functions (CONCATENATE, LEFT, RIGHT, MID, LEN,	2	

		SUBSTITUTE, FIND, SEARCH.)		
	16	Date & Time Functions-(TODAY, DATE, DAY, MONTH, YEAR, HOUR, MINUTE, SECOND.)	2	
	17	Using formula: Writing a formula, Cell reference	4	
IV	Data Analysis and Manipulation		14	20
	18	Introduction to Tables and Data Organization - Creating and formatting tables for effective data management, Sorting and filtering data within tables	2	
	19	Data Analysis Techniques - Advanced functions (VLOOKUP, HLOOKUP, INDEX, MATCH)	4	
	20	PivotTables and PivotCharts - Understanding PivotTables for data analysis, Creating PivotCharts for visual representation	4	
	21	Data Visualization: Creating and customizing various chart types, Effective use of charts for data presentations	4	
V	Hands-on Spreadsheets		25	
	1	Create and Format a Workbook		
	2	Insert, Delete and Format Rows/Columns		
	3	Data Sorting and Filtering		
	4	Apply Relative and Absolute Cell Referencing		
	5	Use Basic Functions and Formulas		
	6	Use Logical and Text Functions		
	7	Perform VLOOKUP or INDEX-MATCH		
	8	Create PivotTables and PivotCharts		
	9	Design a Dashboard		
	10	Import and Clean External Data		

References:

1. "Microsoft Excel 2019 Step by Step" by Curtis Frye
2. "Excel 2019 Bible" by Michael Alexander and Richard Kusleika
3. "Microsoft Excel 2019 Data Analysis and Business Modeling" by Wayne Winston

Mapping of CO's with PSO s and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	-	-	-	-	3	-	2	3	-	-	-
CO 2	3	2	-	2	2	3	2	3	3	2	-	-
CO 3	3	3	2	2	3	3	2	3	3	3	-	-
CO 4	3	3	3	3	3	3	2	3	3	3	-	2
CO 5	3	3	3	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	

Course Code & Title	DSA3MN201: Foundations of Data Science with Python				
Type of Course	Minor	Semester	3	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	Basic knowledge of programming logic and high school-level mathematics				
Course Summary	This course provides a comprehensive introduction to data science concepts using Python. Students will learn core Python programming, essential data structures, data wrangling, visualization, and exploratory data analysis. Emphasis is placed on practical implementation using libraries such as NumPy, Pandas, Matplotlib, and Seaborn.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply Python programming concepts relevant to data analysis	U	C	Instructor-created quizzes / Assignments
CO2	Demonstrate data handling and visualization using Python libraries	Ap	P	Practical Exercises / Lab Observation
CO3	Understand and explain core data science algorithms and their applications	Ap	P	Function-based Practical Assignment
CO4	Implement simple data science models using Python libraries like scikit-learn	Ap	P	Use-case-based exercises / Viva / Test
CO5	Perform end-to-end practical data analysis tasks through lab-based exercises and projects	C	P, M	Project / Hands-on Tasks / Visual Presentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Python Basics		12	10

	1	Introduction to Python and IDEs	2	
	2	Variables, Data Types, Type Conversion	2	
	3	Operators and Expressions	2	
	4	Conditional Statements (if, elif, else), Loops (for, while)	2	
	5	Functions and Modules	2	
	6	Basic I/O operations	2	
II	Data Handling and Visualization		12	10
	7	Lists, Tuples, Sets, Dictionaries	2	
	8	File Handling	2	
	9	NumPy: arrays and operations	2	
	10	Pandas: Series, DataFrames, importing/exporting data	2	
	11	Data Cleaning Basics	2	
	12	Matplotlib and Seaborn: bar chart, histogram, scatter plot	2	
III	Core Data Science Algorithms		12	15
	13	Linear Regression	2	
	14	K-Nearest Neighbors (KNN)	2	
	15	K-Means Clustering	2	
	16	Decision Tree Basics	2	
	17	Classification vs Regression	2	
IV	Implementing Algorithms in Python		14	15
	18	Linear Regression using scikit-learn	2	
	19	KNN classification (Iris dataset)	4	
	20	K-Means clustering (customer segmentation or similar)	4	
	21	Decision Tree (Titanic dataset or similar)	4	
V	Lab Exercises (Practical Module)		25	

1	Python program for basic arithmetic and string operations		
2	Using conditional statements and loops to solve simple problems		
3	Working with lists and dictionaries to manage student marks		
4	Load a CSV using Pandas and compute basic statistics		
5	Plotting bar chart, histogram, and boxplot with Matplotlib/Seaborn		
6	Calculate and visualize correlation between two features		
7	Implement Linear Regression on a real dataset (e.g., salary prediction)		
8	Apply KNN on Iris dataset and interpret output		
9	Use K-Means for clustering a customer segmentation dataset		
10	Train a Decision Tree and plot the tree diagram		

References:

Data Science from Scratch: First Principles with Python, Publisher: O'Reilly Media ,Edition: 2nd Edition (2020)

Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, Publisher: O'Reilly Media, Edition: 2nd Edition (2018)

Introduction to Machine Learning with Python: A Guide for Data Scientists, Publisher: O'Reilly Media, Edition: 1st Edition (2016)

Mapping of CO's with PSO s and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	2	2	2	2	2	3	2	2	–	–
CO 2	3	3	3	2	2	3	2	3	3	2	–	–
CO 3	2	3	2	3	2	2	2	3	3	3	2	2

CO 4	3	3	3	3	3	3	3	3	3	3	2	2
CO 5	3	3	3	3	3	3	3	3	3	3	3	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	

GROUP II

Course Code & Title	DSA3MN202: Introduction to Machine Learning and Artificial Intelligence				
Type of Course	Minor	Semester	3	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic understanding of computer concepts.				
Course Summary	This course offers a foundational understanding of Artificial Intelligence (AI) and Machine Learning (ML) in a simple, practical, and tool-based manner. Students will explore what AI and ML mean, how machines learn from data, and how these technologies are applied in real-world systems such as recommendations, voice assistants, and automation.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamentals of Artificial Intelligence and its applications in the real world	U	c	Instructor-created exams / Seminar
CO2	Explain the types of Machine Learning and their relevance in everyday life	U	c	Assignment / Instructor-created exams
CO3	Interpret the basic working of a machine learning model using examples and tools	Ap	P	Assignment / Instructor-created exams
CO4	Identify ethical concerns and challenges in AI and propose responsible use	A	M	Assignment / Instructor-created exams
CO5	Apply AI/ML concepts through case-based thinking by identifying patterns, simulating logical decisions, and explaining model-like behavior without using programming tools.	Ap	P, M	Presentation / Viva
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Basics of Artificial Intelligence (AI)		9	17
	1	What is Artificial Intelligence?	2	
	2	History and Applications of AI	2	
	3	Types of AI: Narrow, General, Super AI	2	

	4	Real-world examples of AI (Chatbots, Google Maps, YouTube recommendations)	3	
II	Introduction to Machine Learning (ML)		12	17
	5	What is Machine Learning?	2	
	6	Types of Machine Learning:	2	
	7	Supervised, Unsupervised	4	
	8	Reinforcement, Everyday ML applications (Face recognition, Spam filters)	4	
III	How Machines Learn – Intuition		12	18
	9	Basic idea of training data and models	3	
	10	Understanding features and labels (No maths)	3	
	11	Simple use cases like loan prediction or movie recommendation	3	
	12	Demonstration using online tools (Teachable Machine, Google's AI Experiments)	3	
IV	Ethics and Impact of AI		12	18
	13	Positive impact of AI (Healthcare, Education, Agriculture)	4	
	14	Challenges (Bias in AI, Privacy concerns, Job automation)	4	
	15	Responsible use of AI	4	
V	AI Thinking – Real-Life Problem Solving and Reflection		30	
	Case Study: To apply AI/ML concepts by observing real-life patterns, thinking logically, and exploring how machines can learn or make decisions — without requiring any coding or technical tools.			

References:

1. “Artificial Intelligence: A Guide for Thinking Humans”
Author: Melanie Mitchell
2. “Machine Learning for Absolute Beginners”
Author: Oliver Theobald

3. “AI & Machine Learning Made Simple”

Author: V Kishore Ayyadevara

Mapping of CO’s with POs and PSO s :

	PSO 1	PSO 2	PSO 3	PS O4	PS O5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	-	-	2	-	3	2	2	2	2	-	-
CO 2	2	1	-	2	-	3	2	2	2	2	-	-
CO 3	3	2	2	3	2	3	2	3	3	2	-	2
CO 4	2	-	1	2	-	3	2	2	2	3	3	-
CO 5	3	3	3	3	3	3	3	3	3	3	2	3

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	

Course Code & Title	DSA4MN201: Data Visualization Using Power BI				
Type of Course	Minor	Semester	3	Academic Level	200-299
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic mathematics knowledge 2. Basic computer knowledge				
Course Summary	This course provides a comprehensive introduction to the principles and practice of data visualization using Microsoft Power BI. Students will explore the fundamentals of data-driven communication, including chart selection, design best practices, and visual storytelling. The course emphasizes hands-on experience with Power BI for connecting to various data sources, transforming data using Power Query, building interactive dashboards, and creating dynamic reports with slicers, filters, and KPIs. By the end of the course, learners will be equipped to translate complex datasets into compelling visual insights to support strategic decision-making across domains.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the core components of Power BI and load data from various sources	U	C	Instructor-created quizzes / Assignments
CO2	Perform data cleaning and shaping tasks using Power Query Editor	Ap	P	Practical Exercises / Lab Observation
CO3	Build data models, relationships, and perform data analysis using DAX functions	Ap	P	Function-based Practical Assignment
CO4	Create interactive reports and dashboards using a variety of visuals, filters, and formatting options	Ap/A	P	Use-case-based exercises / Viva / Test
CO5	Apply end-to-end workflow to a real	C	P, M	Project /

	dataset—transform, model, visualize, and report insights through a dashboard project			Hands-on Tasks / Visual Presentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Introduction to Power BI and Data Loading		10	15
	1	What is Power BI? Components (Desktop, Service, Gateway, Mobile)	2	
	2	Installing Power BI Desktop – Exploring the User Interface	2	
	3	Connecting to Data Sources – Excel, CSV, Web, SQL Server	2	
	4	Overview of Power BI Workflow: Get Data → Transform → Visualize	2	
II	Data Preparation with Power Query		15	15
	5	Introduction to Power Query Editor	1	
	6	Data cleaning: Removing duplicates, handling nulls, renaming	2	
	7	Shaping data: Splitting columns, pivoting/unpivoting	3	
	8	Merging and appending queries	3	
	9	Data types, conditional columns, and error handling	3	
III	Data Modeling and Analysis using DAX		15	20
	10	Creating relationships and setting cardinality	1	
	11	Introduction to DAX – calculated columns vs. measures	2	
	12	Basic DAX functions – SUM, AVERAGE, COUNT, IF, SWITCH	3	
	13	Understanding row vs. filter context	3	
	14	Implementing KPIs, filters, and slicers in reports	3	

IV	Data Visualization and Dashboarding		15	20
	15	Overview of visual types – bar, column, line, pie, scatter, maps, etc.	1	
	16	Creating and formatting custom visuals	2	
	17	Using slicers, cards, and gauges	3	
	18	Conditional formatting, tooltips, and annotations	3	
	19	Designing and publishing interactive dashboards and reports	3	
V	Mini Project / Case Study		20	
	20	Choose a dataset		
	21	Apply end-to-end process: transform → model → visualize		
	22	Submit a report with key insights and dashboard screenshots		

References:

1-"Mastering Microsoft Power BI" ,Author: Brett Powell

Publisher: Packt Publishing

2- "The Definitive Guide to DAX", Authors: Alberto Ferrari & Marco Russo

Publisher: Microsoft Press

3-"Pro Power BI Desktop", Author: Adam Aspin

Publisher: Apress

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	–	2	–	2	3	2	–	–	3	2
CO 2	3	3	2	2	2	3	3	2	–	–	3	3
CO 3	3	3	3	2	3	3	3	2	–	–	3	3

CO 4	3	3	3	3	3	3	3	3	3	1	3	3
CO 5	3	3	3	3	3	3	3	3	3	2	2	2

Mapping of CO's with PSO s and POs :

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	

Course Code & Title	DSA5MN301: Programming for Data Science with Python and R				
Type of Course	Minor	Semester	5	Academic Level	300-399
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	0	2	75
Pre-requisites	1. Basic mathematics knowledge 2. Basic computer knowledge				
Course Summary	This course introduces students to data science programming using both Python and R in a balanced and integrated manner. Students will learn how to use Python and R for data manipulation, analysis, and visualization. Emphasis will be placed on using standard libraries and tools in both languages to perform real-world data science tasks. By the				

	end of the course, students will be able to choose and apply appropriate tools in either language based on the task at hand.
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Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand basic syntax, structures, and workflows of Python and R	U	C	Written Exam
CO2	Manipulate and process datasets using appropriate libraries in both Python and R	Ap	P	Assignments, Practical Exam
CO3	Perform basic statistical analysis and create visualizations using both languages	Ap	P	Practical Exam, Viva
CO4	Compare the advantages of using Python vs. R for specific data science tasks	A	M	Viva / Group Discussion
CO5	Apply the complete data science pipeline in Python or R via a real-world mini project	C	P, M	Lab work and Practical Exam
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours	Marks
I	Programming Fundamentals in Python and R		10	15
	1	Python: Syntax, variables, data types, control flow, functions	4	
	2	R: Syntax, variables, data types, conditional statements, loops, functions	3	
	3	Comparison of Python and R in scripting and development environments	3	
II	Data Structures and File Handling		10	15
	4	Python: Lists, tuples, dictionaries, sets, file handling (txt, CSV)	5	
	5	R: Vectors, lists, data frames, matrices, importing/exporting CSV and Excel	5	

III	Data Manipulation with Libraries		15	20
	6	Python: NumPy and Pandas – filtering, cleaning, merging, aggregating	10	
	7	R: dplyr and tidyr – select, filter, mutate, summarise, joins	5	
IV	Data Visualization and Basic Statistical Analysis		15	20
	8	Python: matplotlib, seaborn – line, bar, boxplot, scatter	5	
	9	R: ggplot2 – grammar of graphics, common plots	5	
	10	Basic statistics in both languages (mean, median, SD, correlation)	5	
V	Lab Exercises and Mini Project		25	
	1	Basic syntax and data types in Python and R		
	2	Control structures and functions		
	3	File input/output in both languages		
	4	Data manipulation using pandas (Python) and dplyr (R)		
	5	Exploratory Data Analysis on a sample dataset in both languages		
	6	Visualization using matplotlib and ggplot2		
	7	Summary statistics and correlation analysis		
	8	Handling missing data		
	9	Combining and reshaping datasets		
	10	Final mini-project: Sales or Education dataset analysis		

References:

- Python for Data Analysis by Wes McKinney
- R for Data Science by Hadley Wickham and Garrett Golemund
- Hands-On Programming with R by Garrett Golemund

- Data Science from Scratch by Joel Grus
- Think Python by Allen B. Downey

Mapping of CO's with PSO s and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	1	-	-	-	2	-	-	-	3	2
CO 2	3	3	2	2	2	-	3	2	-	-	3	3
CO 3	3	2	3	2	2	-	3	2	-	-	3	3
CO 4	2	3	2	3	-	1	3	3	-	1	3	3
CO 5	3	3	3	3	2	2	3	3	3	2	2	2

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	

22. MODEL QUESTION PAPERS

Format of the Question Papers – Type I (Foundation Courses)

I Semester B. Voc. Degree Examinations – October 2025

DSA1FS101: Data analysis using Spreadsheet

(Credits: 3)

Maximum Time: 1:30 Hours

Maximum Marks: 50

Course Outcomes (COs)

Co #	CO Statement
CO1	Demonstrate the ability to enter data accurately and efficiently into Excel worksheets.
CO2	Use of Excel formulas, including basic arithmetic operations, application of common functions calculations in spreadsheets.
CO3	Use Excel for data analysis, including sorting, filtering, and the creation of Tables.
CO4	Demonstrate proficiency in utilizing advanced Excel functions
CO5	Demonstrate collaboration skills and the ability represent real world data and create reports.

Section A

[Answer all questions. Each question carries 2 marks] (Ceiling: 16 Marks)

1. What is the difference between a worksheet and a workbook in Excel? [CO1]
2. Write any two basic cell formatting options in Excel. [CO1]
3. Define relative and absolute cell referencing with one example. [CO2]
4. List any four statistical functions in Excel. [CO2]
5. How does the Filter function differ from Sort in Excel? [CO3]
6. What are PivotTables used for? [CO4]
7. Write the syntax and use of the IF function in Excel. [CO4]
8. Mention any two types of charts suitable for data visualization. [CO5]
9. What do you mean by importing data from external sources in Excel? [CO3]
10. Write any two uses of VLOOKUP. [CO4]

Section B

[Answer all questions. Each question carries 6marks] (Ceiling:24 Marks)

11. Explain the steps to create a new workbook and save it with different file formats. [CO1]

12. Demonstrate with an example how SUMIF and COUNTIF functions work in Excel. [CO2]
13. Describe the process of sorting and filtering student data based on marks and gender. [CO3]
14. Explain the role and usage of INDEX and MATCH functions in Excel. [CO4]
15. Discuss the design of a dashboard to represent company sales data using tables and charts. [CO5]

Section C

[Answer any One. Each question carries 10 marks]

16. Describe the end-to-end process of cleaning, analyzing, and visualizing the data using Excel with given dataset. [CO3, CO4, CO5]
17. Explain how Excel can be used to create a report for monthly sales analysis. Include steps for data entry, formula use, charting, and summary table creation. [CO1, CO2, CO4, CO5]

Format of the Question Papers – Type II (Major Courses)

I Semester B. Voc. Degree Examinations – October 2025

DSA1CJ101: Introduction to Data Science

(Credits: 4)

Maximum Time: 2 Hours

Maximum Marks: 60

Course Outcomes (COs)

Co #	CO Statement
CO1	Explain the foundational concepts and lifecycle of Data Science projects
CO2	Apply basic machine learning algorithms and perform feature engineering
CO3	Describe and differentiate recommendation system techniques
CO4	Demonstrate use of basic data visualization tools and principles
CO5	Analyze ethical issues in Data Science and describe emerging trends

Section A

[Answer all questions. Each question carries 2 marks] (Ceiling: 20 Marks)

1. Define data science and list any two of its applications. [CO1]
2. Differentiate between Data Science and Data Analytics. [CO1]
3. Name two key roles in the Data Science ecosystem. [CO1]
4. What are the main steps in the data science lifecycle? [CO1]
5. Name any two machine learning algorithms used in classification. [CO2]
6. What is feature selection? List two techniques. [CO2]
7. Define recommendation system and give an example. [CO3]
8. State the difference between content-based and collaborative filtering. [CO3]
9. Mention two basic plots used in data visualization. [CO4]
10. What is the role of labeling and color in a good visualization? [CO4]
11. Mention two ethical concerns in Data Science. [CO5]
12. List any two career paths available for a data science graduate. [CO5]

Section B

[Answer all questions. Each question carries 6marks] (Ceiling: 30 Marks)

13. Explain the importance of Exploratory Data Analysis (EDA) and list its tools. [CO1]
14. Describe how decision trees and Naive Bayes are used for classification. [CO2]
15. Explain data wrangling and its role in model building. [CO2]
16. Describe the components and types of recommendation systems. [CO3]
17. Explain common tools used in data visualization with example plots. [CO4]
18. Discuss the ethical implications of data privacy and algorithmic bias. [CO5]

Section C

[Answer any One. Each question carries 10 marks]

19. Write a detailed essay on the entire Data Science Project Lifecycle with suitable examples. [CO1, CO2]
20. Analyze a real-world scenario where data visualization, ethics, and future trends in Data Science converge. [CO4, CO5]

Format of the Question Papers – Type III (Minor Courses)

I Semester B. Voc. Degree Examinations – October 2025
DSA3MN102: Introduction to Machine Learning and Artificial Intelligence
(Credits: 4)

Maximum Time: 2 Hours

Maximum Marks: 70

Course Outcomes (COs)

Co #	CO Statement
CO1	Understand the fundamentals of Artificial Intelligence and its applications in the real world
CO2	Explain the types of Machine Learning and their relevance in everyday life
CO3	Interpret the basic working of a machine learning model using examples and tools
CO4	Identify ethical concerns and challenges in AI and propose responsible use
CO5	Apply AI/ML concepts through case-based thinking by identifying patterns, simulating logical decisions, and explaining model-like behavior without using programming tools.
CO6	Understand the fundamentals of Artificial Intelligence and its applications in the real world

Section A

[Answer all questions. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Define Artificial Intelligence with two real-world applications. [CO1]
2. Differentiate between Narrow AI and General AI with examples. [CO1]
3. List three everyday tools that use AI. [CO1]
4. Define Supervised and Unsupervised learning with examples. [CO2]
5. What is reinforcement learning? Give a daily life use case. [CO2]
6. What are “features” and “labels” in Machine Learning? [CO3]
7. Explain the importance of training data in ML models. [CO3]
8. Mention two ethical concerns in the use of AI. [CO4]
9. How can AI help in the field of agriculture or education? [CO4]
10. Explain what is meant by case-based thinking in AI. [CO5]

Section B

[Answer all questions. Each question carries 6marks] (Ceiling: 36 Marks)

11. Describe the history and evolution of AI with examples of modern tools. [CO1]
12. Write a short note on different types of AI with relevant examples. [CO1]
13. Explain three types of machine learning and how they differ in operation. [CO2]
14. Illustrate how face recognition or spam filtering works using ML concepts. [CO2]
15. Demonstrate the idea of features and labels using a simple case (e.g., house price prediction). [CO3]

16. Using any online tool, explain how a machine can be trained with examples. [CO3]
17. Discuss bias and fairness in AI with real-world implications. [CO4]
18. Propose two ways to make AI usage more ethical and responsible. [CO4]

Section C

[Answer any One. Each question carries 10 marks]

19. Using any real-life scenario (e.g., school admissions, movie recommendations), simulate how AI/ML can help in pattern identification and decision-making. [CO5]
20. Prepare a mini case study describing an AI tool (e.g., Google Maps or YouTube recommendation) and discuss how it learns and adapts over time. [CO5]

23. APPENDICES

1. Format of the Internship/ Apprenticeship Report

1. Title Page:

- Title of the report, Name of the organization, Name of the intern, Duration of the internship, Date of submission.

2. Certificate, Declaration and Acknowledgments:

- Internship / Apprenticeship completion certificate from the organization
- Include a declaration stating that the internship/ Apprenticeship report is original work and has not been submitted elsewhere.
- Express gratitude.

3. Table of Contents:

- Provide a list of sections and subsections with corresponding page numbers.

4. Introduction:

- Introduce the organization where the internship/ Apprenticeship was conducted, including its background, mission, products/services, industry sector, and any other relevant information.
- State the objectives of the internship/ Apprenticeship report.

5. Description of the Organization:

- Provide a detailed overview of the organization, its history, organizational structure, core functions, target market, competitors, and industry trends.
- Describe the department or division where the internship/ Apprenticeship was undertaken and its role within the organization.

6. Internship / Apprenticeship Experience:

- Describe the tasks, projects, and responsibilities undertaken during the internship/ Apprenticeship.
- Discuss the skills, knowledge, and competencies acquired or enhanced through practical experience.
- Provide examples of significant achievements, challenges faced, and how they were overcome.

7. Learning Outcomes:

- Reflect on the key learning and insights gained from the internship/ Apprenticeship experience.
- Discuss how the internship/ Apprenticeship contributed to personal and professional development, including skill development, industry knowledge, and career aspirations.

8. Recommendations:

- Offer recommendations for the organization based on observations and experiences during the internship/ Apprenticeship.
- Suggest areas for improvement, future opportunities, or strategies to enhance organizational effectiveness. 168

9. Conclusion: Summarize the main findings and outcomes of the internship/ Apprenticeship

experience

10. Appendices:

11. Include any references, sources, or materials cited in the internship report

2. Format of Internship Daily Report

INTERNSHIP DAILY RECORD	
Intern Name:	
Department/Division:	
Supervisor/Mentor:	
Objective/Task for the Day:	
Work Activities:	
Challenges Faced:	
Learning and Insights:	
Feedback and Comments:	
Signature:	
Signature of Mentor	
Date	

3. Format Of Internship Weekly Report

INTERNSHIP WEEKLY REPORT	
Name of the Intern:	
Register Number:	
Department:	
Company Name:	
DATE	ACTIVITIES/ WORK DONE
Signature of Supervisor	

4. Format Of Internship Certificate

Certificate of Internship Completion

This is to certify that [Intern's Name] has successfully completed the internship program at [Organization Name] from [Start Date] to [End Date].

During this period, [he/she] actively participated in [brief description of internship responsibilities and projects], demonstrating [list of skills developed] and achieving [mention any notable achievements].

[Signature]

[Name and Title of Signatory]

Signature and Name of Faculty in Charge

Signature of HoD

Date

5. Format of Optional Project report

Sl.No	Content
1	Introduction 1.1 Background of the Study 1.2 Statement of the Problem 1.3 Relevance & Scope of the Study 1.4 Objectives of the Study
2	Review of Literature 2.1 An Overview of Earlier Studies 2.2 Uniqueness of Research Study
3	Methodology of the study 3.1 Research Approach and design 3.2 Sources of Data 3.3 Sampling Design – Reliability & Content Validity 3.4 Data Analysis Tools 3.5 Report Structure 3.6 Limitations of the Study
4	Data Analysis, Interpretation and Inference
5	Findings and Conclusion
6	Suggestions
7	Appendix Bibliography