Dr.Babasaheb Ambedkar Marathwada University
Chhatrpati Sambhajinagar – 431 004, Maharashtra, India
NACC 'A^{+}' Grade

डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ
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नॅक 'अ$^{+}$' दर्जा प्राप्त

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संदर्भ क्र. /अभ्यासक्रम विभाग/ ८३७ दिनांक :-२७ / ०५ / २०२५

प्रति,
मा. विभाग प्रमुख,
कॉम्प्युटर सायन्स ॲण्ड आय.टी. विभाग,
डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ,
छत्रपती संभाजीनगर.

विषय:- बी. एस्सी. डाटा सायन्स (एईडिपी) या नवीन अभ्यासक्रमाबाबत.
संदर्भ :- १. मा. विद्यापरिषदेने दिनांक ०९/ ०५/ २०२५ रोजी घेतलेल्या ठरावान्वये.
२. आपले CSIT/ 2024-25/865 दिनांक ०२.०५.२०२५ रोजीचे पत्र.

महोदय,

उपरोक्त संदर्भिय विषयाच्या अनुषंगाने आपणास कळविण्यात येते की, "4 Years B. Sc. Data Science (Apprenticeship Embedded Degree Programme) in the Department of Computer Science & IT" **या नविन अभ्यासक्रमास मा. विद्यापरिषदेने दिनांक ०९ मे २०२५ रोजी मान्यता दिलेली आहे.**

करिता, आपल्या माहितीस्तव तथा पुढिल योग्य त्या कार्यवाहीस्तव कळविण्यात येत आहे.

उपकुलसचिव,
अभ्यासक्रम विभाग.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,

CHHATRAPATI SAMBHAJINAGAR

NAAC Reaccredited A+ Grade

FACULTY OF SCIENCE & TECHNOLOGY

4 Years B.Sc. Data Science

(Apprenticeship Embedded Degree Programme (AEDP))

Course Structure

For University Department

(Effective from 2025-26)

BSc Data Science Honours– Apprenticeship Embedded Degree Programme (AEDP)

A. Preamble

Welcome to Department of Computer Science and Information Technology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. The department is one of the most vibrant departments on the university campus and also recognized by Department of Science and Technology (**DST**) **FIST**, University Grants Commission (**UGC**) **SAP** (DRS – PHASE 1, PHASE 2) programs of Government of India.

We observe that the 21st century has witnessed an unprecedented data revolution, transforming industries, governance, and societal frameworks through the power of data-driven decision-making. As artificial intelligence, machine learning, and big data analytics redefine global technological paradigms, the demand for skilled data scientists with both academic expertise and practical industry experience has surged exponentially.

Recognizing this critical need and aligning with the visionary National Education Policy (NEP) 2020, the Department of Computer Science at Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar, proudly introduces the **BSc Data Science Honours – Apprenticeship Embedded Degree Programme (AEDP)**. This innovative programme, commencing in the academic year 2025–26, is meticulously designed to bridge the gap between theoretical knowledge and real-world application, fostering a new generation of data professionals equipped to lead in the digital economy.

The BSc Data Science Honours AEDP is a pioneering initiative that integrates rigorous academic coursework with immersive apprenticeship training, ensuring students gain hands-on experience in cutting-edge data science applications. Structured in accordance with the **University Grants Commission (UGC) AEDP Guidelines** and the **Government of Maharashtra's GR dated 22nd April 2025**, the programme emphasizes:

- **Multi-disciplinary and Flexible Learning**: Offering multiple entry and exit options with certifications at UG Certificate (44 credits), Diploma (88 credits), Degree (132 credits), and Honours (176 credits) levels.
- **Industry-Aligned Apprenticeship**: A robust **50+ credit apprenticeship** component in Semesters VI to VIII, enabling students to work with leading organizations in data analytics, AI, and related sectors.
- **Holistic Skill Development**: A balanced curriculum combining core data science disciplines, specialized electives, research projects, and value-added courses in ethics, communication, and Indian Knowledge Systems.

- **Regional and National Industry Collaboration**: Strategic partnerships with enterprises in the **Aurangabad and Marathwada region**, as well as national tech hubs, to ensure apprenticeships meet evolving sectoral demands.

Developed through extensive consultation with **industry leaders, academic experts, and policymakers**, the programme adheres to the **National Skills Qualifications Framework (NSQF)** and **National Higher Education Qualifications Framework (NHEQF)**, guaranteeing global relevance and employability.

By merging academic excellence with experiential learning, the BSc Data Science Honours AEDP aspires to cultivate **analytical thinkers, problem solvers, and innovators** capable of harnessing data to drive transformative change. Graduates will emerge not just as degree holders, but as **industry-ready professionals** poised to excel in careers spanning analytics, AI research, business intelligence, and beyond.

This programme stands as a testament to the university's commitment to **future-ready education**, empowering students to thrive in an era where data is the cornerstone of progress.

Program Objectives of BSc Data Science

1. **Develop Core Competencies**
    - Equip students with strong foundations in data science, statistics, machine learning, and programming to solve complex real-world problems.
2. **Bridge Industry-Academia Gap**
    - Provide hands-on apprenticeship experience through structured industry collaborations, ensuring graduates are job-ready with practical skills.
3. **Foster Research & Innovation**
    - Cultivate research capabilities in emerging areas like AI, big data analytics, and IoT through project-based learning and industry partnerships.
4. **Promote Ethical Data Practices**
    - Instill professional ethics and awareness of data privacy, security, and responsible AI usage in line with global standards.
5. **Encourage Entrepreneurial Mindset**
    - Develop business acumen and entrepreneurial skills to enable graduates to launch tech startups or drive innovation in existing organizations.
6. **Enhance Employability**
    - Align curriculum with current industry demands and global certifications to maximize career opportunities in diverse sectors.
7. **Support Lifelong Learning**
    - Prepare graduates for continuous professional development through flexible learning pathways and credit bank systems.
8. **Develop Interdisciplinary Skills**

- Integrate domain knowledge from fields like healthcare, finance, and social sciences to create versatile data professionals.

9. **Strengthen Problem-Solving Abilities**
   - Train students to apply analytical thinking and data-driven approaches to address challenges across various domains.
10. **Cultivate Leadership & Teamwork**
    - Develop communication and collaborative skills needed to lead data science projects and work effectively in multidisciplinary teams.

Program Distinctiveness :

- Industry-integrated curriculum with 50+ apprenticeship credits
- Balanced focus on theoretical foundations and practical implementation
- Multiple entry-exit options with stackable certifications
- Emphasis on both technical mastery and professional skills
- Alignment with National Education Policy 2020 objectives

These objectives are designed to produce graduates who are not only technically competent but also industry-ready, ethically grounded, and capable of driving innovation in the data science field. This program creates skilled, work-ready data science professionals.

B. Eligibility and Selection Criteria

Minimum eligibility is 10+2 in science stream with Mathematics as a subject or equivalent qualification as per university norms. Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination.

C. Duration

Duration of the Only **BSc Data Science Apprenticeship Embedded Degree Programme (AEDP)** shall be 3 years/ 6 semesters. (132 Credits) & **BSc Data Science Honours – Apprenticeship Embedded Degree Programme (AEDP)** shall be 4 years/ 8 semesters. (176 Credits)

D. Programme Structure and Credit Distribution

Award Level	Minimum Credits	NSQF Level	Duration
UG Certificate	44	Level 5	After 1st Year
UG Diploma	88	Level 6	After 2nd Year
UG Degree	132	Level 7	After 3rd Year
UG Honours Degree	176	Level 8	After 4th Year

E. Exam or Evaluation scheme :

Evaluation Scheme will be as per UG courses evaluation scheme of our university.

F. Attendance

B.Sc. Data Science is full time course; therefore, it is necessary for the student to attend all theory as well as practical schedule precisely. The students must have 75% of attendance in each Discipline Specific Core Courses (DSC), Discipline Specific Elective Courses (DSEC),Open Electives(OE),Ability Enhancement Courses (AEC) or Value Education Course (VEC), Co-curricular Course (CC), On Job Training (OJT), Vocational Skill Courses (VSC), Skill Enhancement Course(SEC)and listed courses for appearing the Internal Evaluations(IE)and/or External Evaluation (EE) examination. However, student having 65% attendance with medical certificate may apply to the Head of Department for commendation of attendance. The student failing to produce such permission or failing in achieving the required attendance, he/she will not be allowed to submit examination form so attend the examination

G. Grade Awards

In order to pass the examination will be followed. Ten point rating scale shall be used for evaluation of performance of the student to provide Letter Grade for each course and overall grade for this course. Grade points are based on the total number of marks obtained by him / her in all the heads of the examination of the course. These grade points and their equivalent range of the marks are shown separately in following:

Table – I: Ten Point grades and grade description

Sr. No.	Equivalent Percentage	Grade points for SGPAand CGPA	Grade	Grade Description
1.	90 – 100	9.00 – 10	O	Outstanding
2.	80 – 89.99	8.00 – 8.99	A++	Excellent
3.	70 – 79.99	7.00 – 7.99	A+	Exceptional
4.	60 – 69.99	6.00 – 6.99	A	Very Good
5.	55 – 59.99	5.50 – 5.99	B+	Good
6.	50 – 54.99	5.00 – 5.49	B	Fair
7.	45 – 49.99	4.50 – 4.99	C+	Average
8.	**40.01 – 44.99**	**4.01 – 4.49**	C	Below Average
9.	40	4.00	D	Pass
10.	Below 40	0.00	F	Fail

In the event of student registered for the examination (i.e. Internal Tests/End Semester Examination/Practical/Seminar/Project Viva-voce), non-appearance shall be treated as the student deemed to be absent in the respective course.

Minimum D grade shall be the limit to clear /pass the course/subject. A student with F grade will be considered as 'failed' in the concerned course and he/she has to clear the course by reappearing in the next successive semester examinations.

Using table – I, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and Cumulative Grade Card with CGPA will be given on completion of the course.

Computation of SGPA (Semester Grade Point Average) &CGPA (Cumulative Grade Point Average)

The computation of SGPA and CGPA will be as below:

Semester Grade Point Average (SGPA) is the weighted average of points obtained by a student in a semester and will be computed as follows:

$$\text{SGPA} = \frac{\text{Sum(Course Credit * Number of Points in concern course gained by the student)}}{\text{Sum (Course Credit)}}$$

The SGPA for all four semesters will be mentioned at the end of every semester.

The Cumulative Grade Point Average (CGPA) will be used to describe the overall performance of a student in all semesters of the course and will be computed as follows:

$$\text{CGPA} = \frac{\text{Sum(All Four semester SGPA)}}{\text{Total number of semesters}}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

H. Tripartite Agreement for Apprenticeship (Mandatory)

A formal agreement for Apprenticeship will be signed between:

- University Department
- Industry/Company/Startup
- Student (Apprentice)

B Sc Data Science Fees Structure (Per Semester):

Sr.No	Subject	BSC Data Science (AEDP) (Non-Granted)
1	Student Fees W.F	Rs. 10/-
2	Sport	Rs. 10/-
3	Ashwamedh & SSI	Rs. 12/-
4	E- Service	Rs. 50/-
5	**Avi, Ind etc	Rs. 29/-
6	Other Charges	Rs. 00/-
7	Reg.fees	Rs. 50/-
8	Lib.Fees/Other stu.Acti	Rs. 500/-
9	Admin.Fees	Rs. 200/-
10	Gym.Fees	Rs. 25/-
11	Medi.Exam	Rs. 05/-
12	Lab.Fees/ Comp.Lab/Apprenticeship fees	Rs. 10,850/-
13	Other Fees/study Tour	Rs. 00/-
14	Uniform	Rs. 00/-
15	Placement	Rs. 00/-
16	Development fees	Rs. 00/-
17	Industrial/ Placement	Rs. 00/-
18	Other	Rs. 00/-
19	Amount of Tuition Fees (Indian Student)	Rs. 20,000/-
	Total	Rs. 31,741/-

B Sc Data Science Total fees per year is Rs 63,482/-

09/09/25

HOD
HEAD
Department of Computer Science & Information Technology
Dr. Babasaheb Ambedkar Marathwada University,
Chatrapati Sambhajinagar (M.S.)

COURSE STRUCTURE

SEMESTER(I)			CREDITS			HOURS/WEEK		SCHEMEOFEXAMINATIONS			
Course Type	**Course Code**	**Course Name**	**COURSE CREDIT**	**THEORY CREDITS**	**PR CREDITS**	**TH HRS**	**PR HRS**	**MAX**	**IA**	**UA**	**MIN MARKS**
Discipline SpecificCore (DSC)	DS/DSC-1/T/100	Foundation of Data Science-Part I	4	2	-	2	-	50	20	30	20
	DS/DSC-2/T/101	Introduction to Python Programming	4	2	-	2	-	50	20	30	20
	DS/DSC-3/T/102	Operating Systems	4	2	-	2	-	50	20	30	20
	DS/DSC-1/P/126	Practical based on Foundation of Data Science -Part I	-	-	2	-	4	50	20	30	20
	DS/DSC-2/P/127	Practical based on Introduction to Python Programming	-	-	2	-	4	50	20	30	20
	DS/DSC-3/P/128	Practical Based on Operating Systems	-	-	2	-	4	50	20	30	20
Open Elective(Choose any one from Pool of courses)	DS/OE-1/T/100	**Choose any one from pool of courses**	2	2	-	2	-	50	20	30	20
SEC	DS/SEC-1/T/100	Concepts of Cyber Security	2	1	-	1	-	50	20	30	20
	DS/SEC-1/P/126	Practical Based on Concepts of Cyber Security			1	-	2	50	20	30	20
AEC/IKS	AEC-1	Professional English-I	2	2	-	2	-	50	20	30	20
	IKS-1	Indian Knowledge Systems-Vedic Math's	2	2	-	2	-	50	20	30	20
CC/OJT	CC-1	Yoga for health and wellness-I	2		2	-	4	50	20	30	20
		Total	**22**	**13**	**9**	**13**	**18**	**600**	**240**	**360**	**240**

COURSE STRUCTURE

SEMESTER (II)			CREDITS			HOURS/WEEK		SCHEMEOFEXAMINATIONS			
Course Type	**Course Code**	**Course Name**	**COURSE CREDIT**	**THEORY CREDITS**	**PR CREDITS**	**TH HRS**	**PR HRS**	**MAX**	**IA**	**UA**	**MIN MARKS**
Discipline Specific Core (DSC)	DS/DSC-4/T/150	Foundation of Data Science - Part II	4	2	-	2		50	20	30	20
	DS/DSC-5/T/151	Statistics and Probability for data science	4	2	-	2		50	20	30	20
	DS/DSC-6/T/152	Database Concepts	4	2	-	2		50	20	30	20
	DS/DSC-4/P/176	Practical based on Foundation of Data Science -Part II	-	-	2		4	50	20	30	20
	DCS/DSC-5/P/177	Practical based on Statistics and Probability for data science	-	-	2		4	50	20	30	20
	DS/DSC-6/P/178	Practical based on Database Concepts	-	-	2		4	50	20	30	20
Open Elective(Choose any one from pool of courses)	DS/OE-2/T/150	**Open elective open for other discipline**	2	2	-	2		50	20	30	20
SEC	DS/VSC-1/T/150	Basics of Hardware	2	1	-	1		50	20	30	20
	DS/VSC-1/P/176	Practical Based on Basics of Hardware			1		2	50	20	30	20
AEC/IKS	AEC-2	ProfessionalEnglish-2	2	2	-	2		50	20	30	20
	VEC-1	Constitution of India	2	2	-	2		50	20	30	20
CC/OJT	CC-2	Yoga for health and wellness-II	2		2		4	50	20	30	20
		Total	**22**	**13**	**9**	**13**	**18**	**600**	**240**	**360**	**240**

COURSE STRUCTURE

SEMESTER (III)			CREDITS			HOURS/WEEK		SCHEMEOFEXAMINATIONS			
Course Type	**Course Code**	**Course Name**	**COURSE CREDIT**	**THEORY CREDITS**	**PR CREDITS**	**TH HRS**	**PR HRS**	**MAX**	**IA**	**UA**	**MIN MARKS**
Discipline Specific Core	DS/DSC-7/T/200	Data Analytics using Power BI	4	2	-	2	-	50	20	30	20
	DS/DSC-8/T/201	RDBMS	4	2	-	2	-	50	20	30	20
	DS/DSC-7/P/226	Practical based on Data Analytics using Power BI	-	-	2	-	4	50	20	30	20
	DS/DSC-8/P/227	Practical based on RDBMS	-	-	2	-	4	50	20	30	20
Minor	DS/Mn-1/T/200	Minor-I	2	1	-	1	-	50	20	30	20
	DS/Mn-1/P/226	Practical based on Minor-I	-	-	1	-	2	50	20	30	20
	DS/Mn-2/T/201	Minor -2	2	1	-	1	-	50	20	30	20
	DS/Mn-2/P/227	Practical based on Minor-2	-	-	1	-	2	50	20	30	20
OE(Choose any One from pool of courses)	DS/OE-3/T/200	Open elective open for other discipline	2	2	-	2	-	50	20	30	20
VSC	DS/VSC-2/T/200	Advance Hardware	2	1	-	1	-	50	20	30	20
	DS/VSC-2/P/226	Practical Based on Advance Hardware	-	-	1	-	2	50	20	30	20
AEC	AEC-3	Soft Skills-I	2	2	-	2	-	50	20	30	20
VEC	**VEC-2**	Environmental Studies	2	2	-	2	-	50	20	30	20
OJT/ FP/CEP/CC/RP	CC-3	Yoga for health and wellness-III	2	-	2	-	4	50	20	30	20
Total			**22**	**13**	**9**	13	18	**700**	**280**	**420**	**280**

COURSE STRUCTURE

SEMESTER (IV)			CREDITS			HOURS/WEEK		SCHEME OF EXAMINATIONS			
Course Type	**Course Code**	**Course Name**	**COURSE CREDIT**	**THEORY CREDITS**	**PR CREDITS**	**TH HRS**	**PR HRS**	**MAX**	**IA**	**UA**	**MIN MARKS**
Discipline Specific Core	DS/DSC-7/T/200	Data Visualization	4	2	-	2	-	50	20	30	20
	DS/DSC-8/T/201	Software Engineering	4	2	-	2	-	50	20	30	20
	DS/DSC-7/P/226	Practical based on Data Visualization	-	-	2	-	4	50	20	30	20
	DS/DSC-8/P/227	Practical based on Software Engineering	-	-	2	-	4	50	20	30	20
Minor	DS/Mn-1/T/200	Minor I	2	1	-	1	-	50	20	30	20
	DS/Mn-1/P/226	Practical based on Minor 1	-	-	1	-	2	50	20	30	20
	DS/Mn-2/T/201	Minor 2	2	1	-	1	-	50	20	30	20
	DS/Mn-2/P/227	Practical based on Minor 2	-	-	1	-	2	50	20	30	20
OE(Choose any one from pool of courses)	DS/OE-3/T/200	Open elective open for other discipline	2	2	-	2	-	50	20	30	20
SEC	DS/VSC-2/T/200	Web Designing	2	1	-	1	-	50	20	30	20
	DS/VSC-2/P/226	Practical Based on Web Designing	-	-	1	-	2	50	20	30	20
AEC	AEC-3	Soft Skills-I	2	2	-	2	-	50	20	30	20
OJT/ FP/CEP/CC/RP	**VEC-2**	Field Project	4	-	4	-	8	50	20	30	20
		Total	**22**	**11**	**11**	**11**	**22**	**650**	**260**	**390**	**260**

COURSE STRUCTURE

SEMESTER (V)			CREDITS			HOURS/WEEK		SCHEME OF EXAMINATIONS			
Course Type	**Course Code**	**Course Name**	**COURSE CREDIT**	**THEORY CREDITS**	**PR CREDITS**	**TH HRS**	**PR HRS**	**MAX**	**IA**	**UA**	**MINMARKS**
Discipline Specific Core	DS/DSC-11/T/300	Computer Networks	4	2	-	2	-	50	20	30	20
	DS/DSC-12/T/301	Data Warehousing and Data Mining (DWDM)	4	2	-	2	-	50	20	30	20
	DS/DSC-11/P/326	Practical based on Computer Networks	-	-	2	-	4	50	20	30	20
	DS/DSC-12/P/327	Practical based on Data Warehousing and Data Mining (DWDM)	-	-	2	-	4	50	20	30	20
DSE	DS/DSE-1/T/300	Machine Learning	4	2	-	2	-	50	20	30	20
	DS/DSE-1/P/326	Practical based on Machine Learning	-	-	2	-	4	50	20	30	20
Minor Choose any two	DS/Mn-1/T/300	Minor 1	2	1	-	1	-	50	20	30	20
	DS/Mn-1/P/326	Practical based Minor 1	-	-	1	-	2	50	20	30	20
	DS/Mn-2/T/301	Minor 2	2	1	-	1	-	50	20	30	20
	DS/Mn-2/P/327	Practical based Minor 2	-	-	1	-	2	50	20	30	20
VSC	DS/VSC-3/T/300	PC Maintenance and Trouble Shooting	2	1	-	1	-	50	20	30	20
	DS/VSC-3/P/326	Practical Based PC Maintenance and Trouble Shooting	-	-	1	-	2	50	20	30	20
FP/CEP	FP-2/CEP-1	Field Project /Community Engagement	4	-	4	-	8	50	20	30	20

Total	**22**	**9**	**13**	**9**	**26**	**650**	**260**	**390**	**260**

COURSE STRUCTURE

SEMESTER (V)			CREDITS			HOURS/WEEK		SCHEME OF EXAMINATIONS			
Course Type	**Course Code**	**Course Name**	**COURSE CREDIT**	**THEORY CREDITS**	**PR CREDITS**	**TH HRS**	**PR HRS**	**MAX**	**IA**	**UA**	**MINMARKS**
Discipline Specific Core	DS/DSC-11/T/300	Computer Networks	4	2	-	2	-	50	20	30	20
	DS/DSC-12/T/301	Data Warehousing and Data Mining (DWDM)	4	2	-	2	-	50	20	30	20
	DS/DSC-11/P/326	Practical based on Computer Networks	-	-	2	-	4	50	20	30	20
	DS/DSC-12/P/327	Practical based on Data Warehousing and Data Mining (DWDM)	-	-	2	-	4	50	20	30	20
DSE	DS/DSE-1/T/300	Machine Learning	4	2	-	2	-	50	20	30	20
	DS/DSE-1/P/326	Practical based on Machine Learning	-	-	2	-	4	50	20	30	20
Minor	DS/Mn-1/T/300	Minor 1	2	1	-	1	-	50	20	30	20
Choose any two	DS/Mn-1/P/326	Practical based Minor 1	-	-	1	-	2	50	20	30	20
	DS/Mn-2/T/301	Minor 2	2	1	-	1	-	50	20	30	20
	DS/Mn-2/P/327	Practical based Minor 2	-	-	1	-	2	50	20	30	20

VSC	DS/VSC-3/T/300	PC Maintenance and Trouble Shooting	2	1	-	1	-	50	20	30	20
	DS/VSC-3/P/326	Practical Based PC Maintenance and Trouble Shooting	-	-	1	-	2	50	20	30	20
FP/CEP	FP-2/CEP-1	Field Project /Community Engagement	4	-	4	-	8	50	20	30	20
Total			**22**	**9**	**13**	9	26	**650**	**260**	**390**	**260**

COURSE STRUCTURE

Sr. No.	Course Name	Sixth Semester			Scheme of Examination			
		Course Code	Course Type	Credits	Max Marks	IA	UA	Min Marks
1	Apprenticeship	DS/AEDP/01	Apprenticeship	22	500	200	300	200
Total				22	500	200	300	200

Fourth Year (Semester VII & VIII) - Honors with Research

r. No.	Course Name	Seventh Semester			Scheme of Examination			
		Course Code	Course Type	Credits	Max Marks	IA	UA	Min Marks
1	Apprenticeship	DS/AEDP/02	Apprenticeship	22	500	200	300	200
Total				22	500	200	300	200
Sr. No.	**Course Name**	**Eighth Semester**			**Scheme of Examination**			
		Course Code	**Course Type**	**Credits**	**Max Marks**	**IA**	**UA**	**Min Marks**
1	Apprenticeship	DS/AEDP/03	Apprenticeship	22	500	200	300	200
Total				22	500	200	300	200

Minor 1

Track	Sem-III (DS/Mn-1/T/200) & (DS/Mn-1/P/226)	Sem-IV (DS/Mn-1/T/250) & (DS/Mn-1/P/276)	Sem-V (DS/Mn-1/T/300) & (DS/Mn-1/P/326)
Remote Sensing	Fundamentals of Remote Sensing	GIS	Spatial and Temporal System
IoT	Introduction to Microcontrollers and programming	Sensors and Actuators	Fundamental of IoT
AI	Concepts of AI	Reinforcement Learning	Generative AI
NLP	Introduction to Natural Language and Linguistic Structures	Semantics, Pragmatics, and Understanding	Advances in Natural Language Technologies

Minor 2

Sem-III (DS/Mn-2/T/201) & (DS/Mn-2/P/227)	Sem-IV (DS/Mn-2/T/251) & (DS/Mn-2/P/277)	Sem-V (DS/Mn-2/T/301) & (DS/Mn-2/P/327)
Core Java	Advance Java	Advance Java using OOPS
Advance C++	VB.Net-I	VB.Net-II
Python	Advance Python	Advance Python using OOPS

Open Elective Designed for the students of other faculty

Sem-I	Sem-II	Sem-III	Sem-IV
Introduction to Computing for Behavioural Sciences	Data Analysis for Psychology	Human-Computer Interaction & Behavioural Technology	----

Semester I

Course No: (DS/DSC-1/T/100):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week		Total No. of Lectures /Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-4/T/150	DSC	Theory	02	02		30		----	----	----

Course Title of the Course: (Foundation of Data Science -Part I):
Course Outcome (CO):
After completion of course students will be able to:
CO1: Understand basic concepts and applications of data science in real-world domains.
CO2: Identify and differentiate types of data, formats, and their characteristics.
CO3: Perform data collection, cleaning, and transformation for analysis.
B Apply basic statistical techniques for data summarization.

Foundation of Data Science -Part I	Total Hrs: 30
Unit-I	10 hrs
Introduction to Data Science: Definition and scope of data science, Data science life cycle, Roles in data science: Data analyst, data scientist, Types of data: Structured, unstructured, semi-structured, Data formats: CSV, JSON, XML, Applications of data science in various domains	
Unit-II	10 hrs
Data Collection and Preparation: Data collection methods: Files, APIs, web scraping, Data cleaning: Handling missing values, duplicates, noise, Data transformation: Scaling, normalization, encoding, Data types and conversions, Introduction to data wrangling using tools like Pandas	
Unit-III	10 hrs
Data Analysis and Visualization: Descriptive statistics: Mean, median, mode, variance, standard deviation, Introduction to data exploration and EDA, Data visualization techniques: Bar charts, histograms, boxplots, scatter plots, Tools for visualization: Matplotlib, Seaborn, Basics of interpreting and communicating insights from data	

Books Recommended:

Provost, F., & Fawcett, T. (2013). *Data science for business: What you need to know about data mining and data-analytic thinking*. O'Reilly Media.
VanderPlas, J. (2016). *Python data science handbook: Essential tools for working with data*. O'Reilly Media.
Grus, J. (2019). *Data science from scratch: First principles with Python* (2nd ed.). O'Reilly Media.

McKinney, W. (2022). *Python for data analysis: Data wrangling with pandas, NumPy, and Jupyter* (3rd ed.). O'Reilly Media.
Kelleher, J. D., & Tierney, B. (2018). *Data science: An introduction*. MIT Press.
James, G., Witten, D., Hastie, T., & Tibshirani, R. (2021). *An introduction to statistical learning: With applications in R* (2nd ed.). Springer.

Course No: (DS/DSC-2/T/101):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-2/T/101	DSC	Theory	02	02	30		-	-	-

Course Title of the Course (Introduction to Python Programming):
Course Outcome (CO):
After completion of course students will be able to:
CO1: To familiarize students with Python syntax, data types, and control structures.
CO2: To develop problem-solving skills through algorithm design and coding.
CO3: To introduce the concept of modular and object-oriented programming in Python.
CO4: To equip students with the ability to handle files, work with libraries, and process data.
CO5: To prepare students to solve real-world problems through case-study-based assignments

Introduction to Python Programming	**Total Hrs: 30**
UNIT-I	**10 hrs**
Python Basics and Control Structures: Introduction to Python, Features, and Applications, Python Installation and IDEs (IDLE, Jupiter Notebook, VS Code), Basic Syntax, Variables, Data Types, and Type Casting, Operators: Arithmetic, Relational, Logical, Assignment, Bitwise, Control Structures: if, if-else, nested if, switch-case equivalent, Looping: for, while, nested loops, loop control statements (break, continue, pass),BasicInput/OutputinPython.	
Unit-II	**10 hrs**
Functions, Data Structures: Functions: Defining, Calling, Arguments, Return Values, Scope (Local s Global), Lambda Functions, Recursion, Data Structures: Strings, Lists, Tuples,Sets, Dictionaries with Operations and Methods, Comprehensions: List ,Dictionary, Set Comprehensions	
Unit-III	**10 hrs**
File Handling, Exceptions and Working with Libraries: File Handling: Reading, Writing, Appending, Working with CSV files, Exception Handling :try, except, finally, raise, Working with Modules and Packages:	

Introduction to Popular Libraries like NumPy for numerical computation, Pandas for data analysis, Matplotlib for data visualization, Introduction to Python for Automation and Scripting	

Books Recommended:

- Python Crash Course–EricMatthes,No Starch Press
- Learning Python– MarkLutz, O'Reilly Media, 6th Edition(also available at https://cfm.ehu.es/ricardo/docs/python/Learning_Python.pdf)
- Automate the Boring Stuff with Python–AlS weigart (also available at https://automatetheboringstuff.com/)
- Python Programming:Using Problem Solving Approach–Reema Thareja, Oxford University Press

Course No: (DS/DSC-3/T/102):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-3/T/102	DSC	Theory	02	02	30		----	----	----

Course Title of the Course: (Operating System)

Course Outcome (CO):

After completion of course students will be able to:

CO1: *Understand the basic functions, structure, and types of operating systems.*

CO2: Describe and analyze process management mechanisms

CO3: Use memory management and page replacement techniques

Operating System	**Total Hrs: 30**
Unit-I	**10 hrs**
Introduction to Operating Systems: Definition and Purpose, Types of Operating Systems (Batch, Time-Sharing, Distributed, Real-Time, etc.), Operating System Services, Functions of Operating System, Memory allocation techniques (Worst-fit, Best-fit, First-fit)	
Unit-II	**10 hrs**
Process Synchronization: General structure of a typical process, race condition, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors **CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, SRTF, Priority, RR, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling), Thread Scheduling	
Unit-III	**10 hrs**

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Concept of Deadlock Avoidance , Banker's Algorithm Deadlock Detection and Recovery by resource preemption technique and wait-for graph technique.	

Books Recommended:

- **"Operating System Concepts"**, by Abraham Silberschatz, Peter B. Galvin, Greg Gagne.
- "**Modern Operating Systems**", by Andrew S. Tanenbaum.

Course No: (DS/DSC-1/P/126):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-1/P/126	DSC	Practical	02	04	60		----	----	----

Course Title of the Course: (Practical based on Foundation of Data Science-Part I):
Course Outcome (CO):
After completion of course students will be able to:
CO1: Set up a data science environment and import datasets.
CO2: Clean and preprocess raw datasets using Python libraries.
CO3: Perform descriptive analysis and compute basic statistics.
CO4: Create effective visualizations using Matplotlib and Seaborn.

Practical based on Foundation of Data Science-Part I	**Total Hrs: 60**
Unit-I	**20 hrs**
• Python/R basics for data science • Importing/exporting datasets (CSV, Excel) • Handling missing data • Data normalization techniques	
Unit-II	**20 hrs**
• Calculating descriptive statistics • Creating basic visualizations • Performing EDA on a dataset • Detecting and handling outliers • Working with probability distributions • Conducting hypothesis tests	
Unit-III	**20 hrs**

• Correlation analysis • Simple linear regression • Data aggregation techniques • Feature engineering basics • Mini-project: Applying concepts to a real-world problem	

Books Recommended:

- VanderPlas, J. (2016). *Python Data Science Handbook*. O'Reilly.
- Wickham, H. & Grolemund, G. (2017). *R for Data Science*. O'Reilly.
- James, G., et al. (2021). *An Introduction to Statistical Learning*. Springer.
- Provost, F. & Fawcett, T. (2013). *Data Science for Business*. O'Reilly.
- Grus, J. (2019). *Data Science from Scratch*. O'Reilly.

Course No: (DS/DSC-2/P/127):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-2/P/127	DSC	Practical	2	04	60	--	-	-	-

Course Title of the Course: (Practical based on Introduction to Python Programming):

Course Outcome (CO):

After completion of course students will be able to:

CO1: Write Python programs using control structures, functions, and data structures

CO2: Apply object-oriented concepts to Python programming.

CO3: Utilize Python libraries for data manipulation and file handling.

Practical based on Introduction to Python Programming	**Total Hrs: 60**
1. Develop a simple calculator that performs basic arithmetic operations through user input.	
2. Create a student grading system that accepts scores and computes grades using conditional logic.	
3. Build a contact book application using dictionaries for contact storage and basic add/search functionality.	
4. Analyze a text file to compute the frequency of each word, demonstrating fileI/O and string manipulation.	
5. Implement a basic inventory management system using lists and tuples to track products and quantities.	
6. Design a bank account system applying classes and objects, facilitating deposits, with drawls ,and balance inquiry.	
7. Develop a quiz application that uses functions and data structures to store questions and validate user responses.	

8. Write a temperature conversion tool supporting Celsius, Fahrenheit,and Kelvin ,incorporating user input and exception handling.	
9. Create a reminder app that reads and writes reminders to a file,with error handling for file access.	
10. Simulate a library catalogue with options to add, delete, search, and display books, utilizing object-oriented programming concepts and file storage	

Books Recommended:

- Python Crash Course–EricMatthes,No Starch Press
- Learning Python– MarkLutz, O'Reilly Media, 6th Edition(also available at https://cfm.ehu.es/ricardo/docs/python/Learning_Python.pdf)
- Automate the Boring Stuff with Python–AlS weigart (also available at https://automatetheboringstuff.com/)
- Python Programming:Using Problem Solving Approach–Reema Thareja, Oxford University Press

Course No (DS/DSC-3/P/128):

Course No.		Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-3/P/128		DSC	Practical	02	04	60		----	----	----

Course Title of the Course: (Practical based on Operating system):

Course Outcomes (COs):

After completion of course students will be able to:

CO1: Implement basic file handling and system-level operations to interact with the operating system.

CO2: Simulate memory management techniques such as First-fit, Best-fit, and Worst-fit for efficient memory allocation.

CO3: Apply process synchronization and simulate CPU scheduling algorithms including FCFS, SJF, Priority, and Round-Robin.

CO4: Design and implement deadlock handling techniques including detection, avoidance (Banker's Algorithm), prevention, and recovery methods.

Practical based on Operating system	**Total Hrs: 60**
Unit-I	**20 hrs**

1. Write a program to create a file named myfile.txt and write the line "Hello, this is a file." into it. The program should check if the file is successfully opened before writing, and display a success message after writing. 2. Write a program to display system information. 3. Write a program to simulate the Worst-fit contiguous memory allocation technique. 4. Write a program to simulate the Best-fit contiguous memory allocation technique. 5. Write a program to simulate the First-fit contiguous memory allocation technique.	
Unit-II	**20 hrs**
1. Write a program to simulate producer-consumer problem using Semaphores. 2. Write a program to stimulate the CPU scheduling algorithm Shortest job first (Non- Preemption) 3. Write a c program to simulate the CPU scheduling algorithm First Come First Serve (FCFS) 4. Write a program to simulate the CPU scheduling priority algorithm. 5. Write a program to simulate the CPU scheduling algorithm round-robin.	
Unit-III	**20 hrs**
1. Write a program to detect a deadlock 2. Write a program to simulate bankers algorithm for Dead Lock Avoidance (Banker's Algorithm) 3. Write a program to implement deadlock prevention technique 4. Write a program to simulate deadlock recovery by resource preemption technique 5. Write a program to simulate deadlock recovery by using a wait-for graph technique.	

Course No: (DS/SEC-1/T/100):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/SEC-1/T/100	SEC	Theory	01	01	15	-	----	----	----

Course Title of the Course: (Concepts of Cyber Security):

Course Outcome (CO):

After completion of course students will be able to:

CO1: Explain the core concepts and terminologies of cyber security.

CO 2: Identify potential security threats and assess vulnerabilities.

CO3: Apply appropriate defense mechanisms and security tools.

Course Title : Concepts of Cyber Security	**Total Hrs: 15**
Unit-I	**05 hrs**
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance– Challenges and Constraints, Computer Criminals, CIA Triad,	
Unit-II	**05 hrs**
Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defence, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyberterrorism, CyberEspionage ,etc.,Comprehensive Cyber Security Policy, cybercrime	
Unit-III	**05 hrs**
Types of Attacks and Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow	

Books Recommended:

- Cyber Security :Understanding Cyber Crimes,Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure,Wiley INDIA.
- Cyber Security Essentials,JamesGraham,Richard Howard and Ryan Otson,CRC Press.
- IntroductiontoCyberSecurity,Chwan-Hwa(john)Wu,J.DavidIrwin.CRCPressTsFGroup.
- William Stallings, Network Security Essentials: Applications and Standards, Pearson(available at https://www.emgywomenscollege.ac.in/templateEditor/kcfinder/upload/files/Network-security-essentials.pdf)InformationTechnologyAct,2000(with latest amendments).

Course No: (Practical Based on Concepts of Cyber Security):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/SEC-1/P/126	SEC	Practical	01	02	30	-	----	----	----

Course Title of the Course: (Practical Based on Concepts of Cyber Security):
Course Outcome (CO):

After completion of course students will be able to:
CO1: Interpret and comply with basic cyber laws and ethical practices.
CO 2: Practically working on potential security threats and assess vulnerabilities.
CO3: Demonstrate problem-solving skills through real time application on tools..

Practical Based on Concepts of Cyber Security	**Total Hrs: 30**
1. Phishing Simulations Analysis–Identify phishing email characteristics and analyze an example campaign. 2 Password Security Audit–Evaluate password strength and implement multi-factor authentication. 3.Wireshark Traffic Analysis Capture and analyze network packets to detect suspicious activity. 4.Firewall Rule Configuration–Implement basic firewall rules to block specific threats. 5.Ransomware Case Study–Study a real-world ransom wareattack and recommend preventive strategies. 6.Web Application Vulnerability Test–Conduct basic testing for XSS and SQL Injection. 7.Incident Report Preparation–Draft an incident response report for a simulated breach. 8.CryptographyLab–Implement AES encryption and decryption for sample data. 9. Cyber Law Violation Case–Analyze a real-life cyber law violation and its legal outcome. 10.Security Policy Drafting–Create a simple security policy for a small organization.	

Books Recommended:

- Cyber Security :Understanding Cyber Crimes,Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure,Wiley INDIA.
- Cyber Security Essentials,JamesGraham,Richard Howard and Ryan Otson,CRC Press.
- IntroductiontoCyberSecurity,Chwan-Hwa(john)Wu,J.DavidIrwin.CRCPressTsFGroup.
- William Stallings, Network Security Essentials: Applications and Standards, Pearson(available at https://www.emgywomenscollege.ac.in/templateEditor/kcfinder/upload/files/Network-security-essentials.pdf)InformationTechnologyAct,2000(with latest amendments).

Course No: (AEC-1):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
AEC-1	AEC	Theory	02	02	30	-	----	----	----

Course Title of the Course: (Professional English-I):

Course Outcome (CO):

After completion of course students will be able to:

CO1: Demonstrate a clear understanding of basic grammar, vocabulary, and sentence structures for professional communication.

CO 2: Apply appropriate verbal and non-verbal communication techniques in formal and workplace settings.

CO3: Develop well-structured professional documents such as emails, memos, reports, and resumes using correct format and tone.

Professional English-1	**Total Hrs: 30**
Unit-I	**10 hrs**
Fundamentals of Professional Communication, Introduction to Professional English, Principles of Effective Communication, Basic Grammar, Types of Communication: Verbal, Non-verbal, Written, and Visual, Barriers to Communication and Strategies to Overcome Them, Listening Skills: Active Listening and Note-Taking, Speaking Skills: Clarity, Tone, and Pronunciation.	
Unit-II	**10 hrs**
Workplace and Interpersonal Communication, Professional Etiquette and Communication Ethics, Group Discussions and Public Speaking, Business Presentations: Structure, Delivery, and Visual Aids, Interview Skills: Preparation, Response Strategies, and Follow-up, Cross-Cultural Communication and Sensitivity, Telephone and Virtual Meeting Etiquette.	
Unit-III	**10 hrs**
Writing for Professional Purposes, Principles of Business Writing, Formal Emails: Format, Tone, and Content, Writing Memos, Circulars, and Notices, Resume and Cover Letter Writing, Report Writing and Minutes of Meeting, Proposals and Executive Summaries.	

Books Recommended:

- **"English for Professionals"** by S. K. Sharma & D. Mohan.
- **"Business Communication"** by Meenakshi Raman & Prakash Singh.

Semester II

Course No: (DS/DSC-4/T/150):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-4/T/150	DSC	Theory	02	02	30		----	----	----

Course Title of the Course: (Foundation of Data Science -Part II):
Course Outcome (CO):
After completion of course students will be able to:
CO1: Apply probability concepts to real-life data science problems.
CO2: Understand and use statistical methods for data interpretation.
CO3: Explain the basic principles of machine learning and its types.
CO4: Build and evaluate simple predictive models.

Foundation of Data Science -Part II	**Total Hrs: 30**
Unit-I	**10 hrs**
Introduction to Probability and Statistics: Basics of probability: Events, outcomes, and rules, Conditional probability and Bayes' theorem, Random variables and probability distributions, Measures of central tendency and dispersion, Introduction to statistical inference, Sampling techniques and sampling distributions.	
Unit-II	**10 hrs**
Introduction to Machine Learning Concepts: Difference between supervised and unsupervised learning, Overview of classification, regression, and clustering, Introduction to common algorithms: k-NN, decision trees, k-means, Model evaluation metrics: Accuracy, precision, recall, F1-score, Over fitting and under fitting, Basics of training and testing data.	
Unit-III :	**10 hrs**
Working with Real-World Data: Importing real-world datasets from open sources (e.g., UCI, Kaggle) Performing complete Exploratory Data Analysis (EDA), Data preprocessing for machine learning, Building and evaluating a simple classification or regression model, Introduction to pipelines and reproducible workflows, Communicating results through reports and visualization	

Books Recommended:

- Grus, J. (2019). *Data science from scratch: First principles with Python* (2nd ed.). O'Reilly Media.
- McKinney, W. (2022). *Python for data analysis: Data wrangling with pandas, NumPy, and Jupyter* (3rd ed.). O'Reilly Media.
- Geron, A. (2019). *Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems* (2nd ed.). O'Reilly Media.
- VanderPlas, J. (2016). *Python data science handbook: Essential tools for working with data.* O'Reilly Media.
- Allen, D. M. (2020). *Data science for beginners: 4 books in 1 - Python, Data Analysis, Data Science, Machine Learning.* Independently published.

Course No: DS/DSC-5/T/151

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-5/T/151	DSC	Theory	02	02	30	-	----	----	----

Course Title of the Course: (Statistics and Probability for Data Science):):
Course Outcome (CO):
After completion of course students will be able to:
Learning Outcomes:
CO1: Understand basics concepts of Statistics, used to describe data using numerical summaries.
CO2: Understand the applications of statistical tools and Create, download, manipulate, and analyse data sets.
CO3: Learning the basics of probability theory and its applications.

Statistics and Probability for Data Science	**Total Hrs: 30**
Unit-I	**10 hrs**
Introduction to Statistics and Data Science, Role of Statistics in Data Science, Types of Data Understanding different types of data (numerical, categorical, etc.) and their characteristics. Sample and Population. **Descriptive Statistics:** Summarizing and describing data using statistical measures like Measure of Central Tendency, Measure of Dispersion, Measure of Shape. **Inferential Statistics: Sampling methods**– Random and grouped, **Tests** – Z-test, T-test, Chi-square, ANOVA, **and Hypothesis testing.** Introduction to simple linear regression model.	
Unit-II	**10 hrs**
Probability Theory: Basic Concepts: Random experiments, sample space, events,	

and the algebra of events. Definitions of Probability: Classical, statistical. **Conditional Probability and Independence:** Understanding how events influence each other and the concept of independence. **Bayes' Theorem:** Its applications in updating probabilities based on new evidence. **Random Variables:** Discrete and continuous random variables, probability mass functions (PMF), probability density functions (PDF), and cumulative distribution functions (CDF). **Expectation and Variance:** Understanding expected values, variances, and their properties. Common Probability Distributions: Exploring discrete distributions (e.g., binomial, Poisson) and continuous distributions.	
Unit-III	**10 hrs**
Dataset and its Presentation: Different sources and types of data, Examples of real-life datasets. Frequency distributions, Line chart, Bar diagram, Pie chart, Multiple bar diagram, Leaf and Stem plot, Histogram, Boxplot and other relevant plots. Overview of: Statistics for Machine Learning, Exploratory Data Analysis (EDA) and Visualization, Statistical Software Tools.	

Books Recommended:

1. Rohatgi, V.K. and Saleh, A.K. Md. E. (2015). An Introduction to Probability and Statistics (3rd Edition),Wiley Series in Probability and Statistics, India.
2. Introduction to Probability book by Joseph k. Blitzstein and Jessica Hwang.
3. Introduction To Probability And Statistics For Engineers And Scientists, Fifth Edition, Sheldon M. Ross, University of Southern California, Los Angeles, USA

Course No: (DS/DSC-6/T/152)**:**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-6/T/152	DSC	Theory	02	02	30		----	----	----

Course Title of the Course: (Database Concepts):
Course Outcome (CO):

After completion of course students will be able to:
CO1: Understand the purpose and functionality of database systems.
CO 2: Model real-world scenarios using the Entity-Relationship (ER) approach.
CO3: Apply relational concepts and normalization techniques to design efficient databases.

Database Concepts	**Total Hrs: 30**
Unit-I	**10 hrs**
Database Basics, Definition and Need for Databases Traditional File Systems vs. Database Systems Applications of Databases, Database System Architecture, Data Models, Database Languages(DDL, DML, DCL), Data Abstraction and Data	

Independence, Database Users and their roles	
Unit-II	**10 hrs**
Introduction to Data Modelling, Importance and Purpose of Data Modelling, Entity-Relationship (ER) Model, Enhanced ER (EER) Model, ER to Relational Mapping, Primary key, Composite Primary key, Reference key, Foreign key, SQL	
Unit-II	**10 hrs**
Relational Model and Normalization, Relational Model Concepts, Relational Algebra (Conceptual), Query Processing, Normalization, Transaction, ACID property, states of a transaction , Distributed databases	

Books Recommended:

- **"Database System Concepts"** by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan.
- **"Fundamentals of Database Systems"** by RamezElmasri and Shamkant B. Navathe.

Course No: (DS/DSC-4/P/176):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures /Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-1/P/176	DSC	Practical	02	04	60		----	----	----

Course Title of the Course (Practical based on Foundation of Data Science -Part II)
Course Outcome (CO):
After completion of course students will be able to:
CO1: Apply probability and statistical techniques to analyze data and interpret outcomes using Python.
CO2: Visualize statistical distributions and relationships using appropriate plotting tools.
CO3: Implement basic machine learning models such as regression, classification, and clustering.
CO4: Evaluate model performance using appropriate validation techniques and metrics.

Practical based on Foundation of Data Science -Part II	**Total Hrs: 60**
Unit-I	**20 hrs**
• Implementing Logistic Regression • Building Decision Tree models • Evaluating models using confusion matrix • Applying Random Forest on a dataset • Hyper parameter tuning with Grid Search CV	

Unit-II	20 hrs
• Dimensionality reduction using PCA • Implementing K-Means clustering • Basic Neural Network with TensorFlow / Keras • Creating a simple data pipeline	
Unit-III	**20 hrs**
• **Build and visualize a decision tree classifier** using scikit-learn. • **Perform k-means clustering** on a sample dataset and plot the results. • **Use confusion matrix and calculate classification metrics** (accuracy, precision, recall, F1-score). • **Conduct Exploratory Data Analysis (EDA)** on a real-world dataset (e.g., Titanic, Iris) • **Prepare a mini project/report**	

Books Recommended:

- Grus, J. (2019). *Data science from scratch: First principles with Python* (2nd ed.). O'Reilly Media.
- McKinney, W. (2022). *Python for data analysis: Data wrangling with pandas, NumPy, and Jupyter* (3rd ed.). O'Reilly Media.
- Geron, A. (2019). *Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems* (2nd ed.). O'Reilly Media.
- VanderPlas, J. (2016). *Python data science handbook: Essential tools for working with data*. O'Reilly Media.
- Wilke, C. O. (2019). *Fundamentals of data visualization: A primer on making informative and compelling figures*. O'Reilly Media.

Course No: DCS/DSC-5/P/177

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures /Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DCS/DSC-5/P/177	DSC	Practical	02	04	60		----	----	----

Course Title of the Course: (Practical based on Statistics and Probability for data science):

Course Outcome (CO):

After completion of course students will be able to:

CO1: Demonstrate an ability to design and develop R and Python programs for analysis of thedata and generate the related report or results.

CO2: Demonstrate an ability to design programming on probability distribution and computed allpossible outcomes or required reports

CO3: Apply the basic Statistical and Probability measures for data science.

Practical based on Statistics and Probability for data science	Total Hrs: 60
Unit-I	**20 hrs**
1. Write Python/R code to conduct various Descriptive Statistics tests and Visualization by writing Python code, by considering dataset. 2. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the data set. 3. Consider50 observations from given dataset, generating random data using functions provided, likerbinom, etc. 4. Performing basic statistical computations using built-in functions of R. 5. Measures of Central Tendency: Given a sample of 50 Observations (from any dataset), use functions R or Python and calculate mean, mode, median, range, and quintile. 6. Measures of Dispersion: Calculate sd, var. 7. Measures of Shape: Create histograms of the data to visually assess the shape of the distribution and confirm the calculated skewness and kurtosis values. 8. Create different charts for visualization of given set of data. 9. Write Python code to conduct various statistical tests including a T test, an ANOVA, and regression analysis. 10. Interpret the results of your statistical analysis after conducting hypothesis testing.	
Unit-II	**20 hrs**
1. Write Python Code to create Sets and perform Set operations. 2. Write Python Code to predict the probability of Tossing Coin experiment. 3. Write Python Code to investigate the probability distributions of discrete and continuous random variables. 4. Generate and draw the cdf and pdf of a normal distribution with given values. 5. Understanding the graphical representation of Probability Mass Functions and Probability Density Functions.	
Unit-III	**20hrs**
1. Practical Introduction to various datasets that are used for various experiments. 2. Analyze the frequency distribution to identify patterns, such as such as the most frequent values, the range of values etc. 3. To Apply and explore various plotting functions on given Dataset.	

Books Recommended:

1. Rohatgi, V.K. and Saleh, A.K. Md. E. (2015). An Introduction to Probability and Statistics (3rd Edition),Wiley Series in Probability and Statistics, India.
2. Introduction to Probability book by Joseph k. Blitzstein and Jessica Hwang.
3. Introduction To Probability And Statistics For Engineers And Scientists, Fifth Edition, Sheldon M. Ross, University of Southern California, Los Angeles, USA

Course No: (DS/DSC-6/P/178):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/DSC-6/P/178	DSC	Practical	02	04	60		----	----	----

Course Title of the Course: (Practical based on Database Concepts)

Course Outcomes (COs):

After completion of course students will be able to:

CO1: Design and implement relational databases using SQL, including creating tables, defining primary/foreign keys, and inserting data.

CO2: Perform essential SQL operations such as data insertion, retrieval, modification, and deletion on structured data.

CO3: Normalize database schemas up to Third Normal Form (3NF) to eliminate redundancy and ensure data integrity.

CO4: Utilize advanced SQL features including SET operators (UNION, INTERSECT, MINUS) and pattern matching with string operators for effective data querying.

CO5: Demonstrate the ability to compare traditional file-based systems with relational databases, and apply query optimization techniques to improve performance.

Practical's based on Database Concepts	**Total Hrs: 60**
Unit-I	**20 hrs**
1. Create a database named college. Inside this database, create a table named students with the following fields: • student_id (INT, Primary Key) • name (VARCHAR(50)) • age (INT) • course (VARCHAR(30)) • admission_date (DATE) Write SQL commands to: • Create the database and table. • Insert 5 records into the students table. • Display all records. **2.** Simulate a traditional file system by creating a .txt or .csv file containing student data. Then, perform the same operation using a database table. **3.** Using the students table modify the table to add a new column email (VARCHAR (100)). **4.** Using the students table update the email of a student with student_id = 101 **5.** Using the students table delete the record of the student whose name = 'Amit'	
Unit-II	**20 hrs**
1. Create a Student table with the following fields: • RollNo (Primary Key) • Name • Department. 2. Create a Course table and an Enrollment table. The Enrollment table should	

have: • RollNo (Foreign Key referencing Student) • CourseID • Grade 3. Design two tables Department(course_id, course_name, Emp_name and Employee(Emp_id, Emp_name, Emp_address) Insert at least 5 records in it. 4. Execute SET operators (UNION, INTERSECT, MINUS) on the above two tables by taking your own data. 5. Execute String operators (Percent, Underscore) on the above two tables by taking your own data.	
Unit-III	**20 hrs**
1. Create following Unnormalized Table (UNF): • Student(RollNo, Name, Courses) • Data Example: (1, 'Amit', 'Math, Physics') (2, 'Neha', 'Chemistry') 2. Convert the above table to First Normal Form (1NF). 3. Convert the 1NF table into 2NF. 4. Convert this 2NF table into 3NF 5. Demonstrate the concept of query optimization by taking your own data.	

Course No: (DS/VSC-1/T/150):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures /Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/VSC-1/T/150	VSC	Theory	01	01	15	-	-	-	-

Course Title of the Course: (Basics of Hardware)**:**

Course Outcome (CO):

After completion of course students will be able to:

CO1: Understanding the working principle of PC and its different hardware components.

CO2: Understanding the concept of installing and working of different basic I/O devices.

CO3: Resolving of troubleshoot, Hardware issues.

Basics of Hardware	**Total Hrs: 15**
Unit-I	**05 hrs**
Computer Fundamental, Types of computer, Basic component of a computer, power systems / Supply, SMPS, UPS, Transistors, Microprocessor, Switches, logic Gates.	
Unit-II	**05 hrs**
Introduction of Basic I/O system, CMOS, POST, Motherboard, RAM/ROM, Hard Disk Drive, Optical Drive, Keyboard, Mouse, Monitor, Printers,	

Scanner, Virus and Types of Viruses, Malwares, Adwares, Spywares, Phishing Attacks, etc. Prevention and Curing Virus and Spywares, Installation of Antivirus, Internet Security Tools, Updates.	
Unit-III	**05 hrs**
Operating System Installations and Procedures/Booting Procedures, Disk Management Procedure, Windows Configurations & Adding Device Drivers, Install and configure Internet, Necessary backups for the security of customer data before repairs, Working on Internet using various browsers like IE, Chrome, Firefox, Opera, etc. Explaining URL, HTTP, HTTPS, etc. Clearing Browser Cache, Use of Internet Concepts, Surfing, Mailing & Social Media, Use of identifying different Desktop Icons. My Computer, My Documents.	

Books Recommended:

- Complete PC upgrade and maintenance guide, mark spaceman's, bpb publication
- PC hardware the complete reference Craig Zacker and John Rouske, php publications.

Course No: (DS/VSC-1/P/176):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DS/VSC-1/P/176	VSC	Practical	01	02	30				

Course Title of the Course: (Practical based on Basics of Hardware):
Course Outcome (CO):
After completion of course students will be able to:
CO1: identify different parts and understanding their functions.
CO2: Apply the knowledge for software and hardware devices on PC.

Basics of Hardware	**Total Hrs: 30**
1. To check & measure various supply voltage of PC.	
2. Study of layout of motherboard & different components.	
3. Study of explain slots, bus structure, & ports with color code.	
4. Study of functioning of SMPS with o/p voltage & connector.	
5. Study of HDD interfaces.	
6. Connecting H/W components for assemble of computers.	
7. Setting up of CMOS.	
8. How to install different S/W.	

9. Study of different bios setup.	
10. Performance trouble shooting.	
11. Partition of hard disk.	
12. To study various cards used in a system (display, LAN)	
13. To remove, study & replace (D-ROM)	
14. To install printer	
15. To increase the size of RAM	
16. To install for internet network cables connector.	
17. Install mouse & keyboards.	
18. Installing OS	
19. Study of routers.	
20. Study of printer files sharing.	

CO3: Analyzing troubleshooting problems.

Books Recommended:

- Complet pc upgrade and maintance guide, mark spacemaines, bpb publication
- PC hardware the complete reference Craig Zacker and John Rouske, php publications.

Course No: (AEC-2):

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures /Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
AEC-2	AEC	Theory	02	02	30		----	----	----

Course Title of the Course: (Professional English-2)

Course Outcome (CO):

After completion of course students will be able to:

CO1: Analyze and produce complex written content such as reports, proposals, and academic summaries using appropriate style and tone.

CO 2: Demonstrate advanced verbal communication skills in professional settings including debates, presentations, and negotiations.

CO3: Apply critical thinking and rhetorical strategies to communicate persuasively and effectively.

Professional English-2	**Total Hrs: 30**
Unit-I	**10 hrs**
Advanced Writing for the Workplace and Academia, Formal and Technical Report Writing, Project Proposals and Executive Summaries, Abstracts and Research Paper Writing (Basic structure), Email Etiquette and Professional Correspondence, Editing and Proofreading Techniques, Tone, Style, and Clarity in Advanced Writing.	
Unit-II	**10 hrs**
Oral Communication and Rhetorical Techniques, Advanced Presentation Skills (Persuasive & Informative), Debate and Argumentation Techniques, Negotiation and Conflict Resolution in Communication, Rhetorical Devices: Logos, Ethos, Pathos, Voice Modulation, Fluency, and Non-verbal Cues, Handling Q&A and Impromptu Speaking.	
Unit-III	**10 hrs**
Cross-Cultural and Collaborative Communication, Communication in Multicultural Environments, Global English and Cultural Sensitivity, Team Communication and Virtual Collaboration, Interpersonal Skills and Emotional Intelligence.	

Books Recommended:

- **"Business Communication: Building Critical Skills"** by Locker & Kaczmarek
- **"English for Effective Business Communication"** by Mable Chan