



Re-Accredited 'B++' 2.86 CGPA by NAAC

VEER NARMAD SOUTH GUJARAT UNIVERSITY

University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.

વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી

યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.

Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888

E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

-: પરિપત્ર :-

કોમ્પ્યુટર સાયન્સ એન્ડ ઈન્ફોર્મેશન ટેકનોલોજી વિદ્યાશાખા હેઠળની તમામ બી.સી.એ.નો અભ્યાસક્રમ ચલાવતી કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, NEP-2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૪-૨૫ થી અમલમાં આવનાર B.C.A. (Data Science and Analytics) Specialization Program Sem.-1 & 2 નો એકેડેમિક કાઉન્સિલની તા.૧૫/૦૬/૨૦૨૪ ના રોજ ડીનશ્રીના અધ્યક્ષસ્થાને નીમેલ સમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ અને અભ્યાસક્રમનું માળખું મંજૂર કરવા કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૦૧/૦૩/૨૦૨૪ની સભાના ઠરાવ ક્રમાંક:૧૦૪ અન્વયે માન.કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત ઈ.યા.માનનીય કુલપતિશ્રી દ્વારા મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

ખિડાણ: ઉપર મુજબ

ક્રમાંક : એસ./સિલેબસ/પરિપત્ર/૧૫૩૭૪/૨૦૨૪

તા.૧૮-૦૭-૨૦૨૪

Wijes
કુલસચિવ

પ્રતિ,

૧) બી.સી.એ.નો અભ્યાસક્રમ ચલાવતી કોલેજોના આચાર્યશ્રીઓ.

.....આપશ્રીની કોલેજના સંબંધિત શિક્ષકો તથા વિદ્યાર્થીઓને જણ કરી અમલ કરવા સારું.

૨) ડીનશ્રી, કોમ્પ્યુટર સાયન્સ એન્ડ ઈન્ફોર્મેશન ટેકનોલોજી વિદ્યાશાખા.

૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

૪) એકેડેમિક વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

૫) જોડાણ વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારું.

Veer Narmad South Gujarat University, Surat



Computer Science, Application and I.T. Faculty
Syllabus for (Semester-I and Semester-II) of
B.C.A. (Data Science and Analytics)(Honours)

As per NEP-2020

To be implemented from

Academic Year: June, 2024-2025

(Including Winter Session)

Veer Narmad South Gujarat University, Surat
Bachelor of Computer Application (Data Science and Analytics) (Honours))
Under the Faculty of
Computer Science and Information Technology

Name of Program:	Bachelor of Computer Application (Data Science and Analytics) (Honours)
Abbreviation:	B.C.A. (Data Science and Analytics) (Honours): Four-year Integrated Program. With Multi-Level Entry and Exit option
Multi-level Exit Criteria:	i) Under Graduate Certificate in Computer Application: If the student wish to exit after completion of First year (Semester-1 and Semeter-2) without any back-log and secure additional 4 credits from work based skill oriented university approved courses /vocational courses / summer internship / Apprenticeship in addition to 6 credits from skill-based courses earned during first and second semester. ii) Diploma in Data Science and Analytics : If the student wish to exit after completion of Second year (Semester-1 to Semeter-4) without any back-log and secure additional 4 credits from work based skill oriented university approved courses /vocational courses / summer internship / Apprenticeship offered at end of first or second year in addition to 6 credits from skill-based courses earned during first four semesters. iii) B.C.A. (Bachelor's in Computer Application) (Data Science and Analytics) : If the student wish to exit after completion of Third year (Semeste-1 to semester-6) without any back-log and secure additional 4 credits from work based skill oriented university approved courses /vocational courses / summer internship / Apprenticeship offered at end of first or second year in addition to 6 credits from skill-based courses earned during first four semesters.
Multi-Level Entry Criteria:	As per the norms of the Veer Narmad South Gujarat University.
Duration:	4 year of B.C.A. (Data Science and Analytics) (Honors) degree program with multi level exit options at 1 st , 2 nd and 3 rd Year to obtain Certificate, Diploma, Degree and Honours Degree in Computer Application respectively.
Eligibility:	Candidate must have passed standard 12th (H.S.C.) Examination in Science (Any Group) / Commerce / vocational / General stream from Gujarat Higher Secondary Board (G.H.S.E.B.) or any other equivalent board (C.B.S.E. / I.C.S.E. etc. which must be approved and possess equivalence certificate from Veer Narmad South Gujarat University) with English as one of the subject. In case of candidates passed out from 12th Board from General Stream; Statistics/Economics/Business Mathematics/Accountancy/Computer must be one of the subjects. In case of Students passed out with 12th (H.S.C.) vocational stream, Computer and English must be one of the subject.
Objective of the Program:	The objective of the B.C.A. (Data Science and Analytics) program is to equip students with a strong foundation in computer applications while focusing on specialized skills in data science and analytics. Through a blend

	of theoretical knowledge and practical application, the program aims to prepare students to handle large datasets, analyze data using statistical methods and machine learning techniques, and derive meaningful insights to support decision-making processes in various industries. Students will also gain proficiency in programming languages, data visualization tools, and database management systems, enabling them to pursue careers as data analysts, data scientists, or pursue further studies in related fields.
Program Outcome:	PO1: Develop Proficiency in Data Analysis**: Equip students with skills to collect, clean, analyze, and interpret data using statistical methods and advanced analytics techniques. PO2: Master Programming and Tools: Provide a strong foundation in programming languages (such as Python, R) and tools (like SQL, Tableau) essential for manipulating and visualizing data. PO3: Apply Machine Learning Algorithms: Enable students to apply machine learning algorithms to solve real-world problems, including supervised and unsupervised learning approaches. PO4: Understand Data Ethics and Security: Educate students about the ethical considerations and security challenges inherent in handling large datasets and implementing data-driven solutions. PO5: Prepare for Industry Roles: Prepare graduates to excel in roles such as data analysts, business analysts, or entry-level data scientists by integrating practical projects, internships, and industry-relevant skills into the curriculum.
Program Specific Outcome:	PSO1: Provide a solid foundation in computer science and mathematics necessary for data science, including programming languages, discrete mathematics, and calculus. PSO2: Train students in collecting, cleaning, and preprocessing large datasets from various sources to ensure data quality and readiness for analysis. PSO3: Equip students with statistical techniques such as hypothesis testing, correlation analysis, and regression analysis to derive insights and make data-driven decisions. PSO4: Develop proficiency in applying machine learning algorithms for tasks such as classification, clustering, regression, and natural language processing, supported by practical applications. PSO5: Familiarize students with tools and techniques for handling big data, including distributed computing frameworks like Hadoop and Spark, and NoSQL databases. PSO6: Enable students to effectively visualize data using tools like matplotlib, seaborn, or Tableau, and interpret visualizations to communicate insights effectively.

	PSO7: Educate students on the ethical implications and legal considerations related to data collection, storage, and usage, emphasizing privacy, security, and regulatory compliance. PSO8: Offer opportunities for students to engage in capstone projects and internships with industry partners, allowing them to apply their skills in real-world scenarios and gain practical experience in data science and analytics roles.									
PO and PSO mapping:		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
	PO1									
	PO2									
	PO3									
	PO4									
	PO5									
	PO6									
Medium of Instruction:	English									
Program Structure:	Semester-wise Breakup of the course is given as follows :									



Veer Narmad South Gujarat University, Surat
Program Structure: F.Y.B.C.A. (Data Science and Analytics) (Honours)
(SEM – 1 and SEM – 2)

(w.e.f. Academic Year June, 2024-2025)

Bachelor of Computer Application (B.C.A.) (Data Science and Analytics) : Three Year Program

Bachelor of Computer Application (B.C.A.(Hon.) (Data Science and Analytics)) : Four Year Integrated Program

SEMESTER – 1

Course Code	Course Title	Course Category	Level of Course	Course Credits	Teaching Hours/week	
				Th.+Pra.	Theory	Practical/Fieldwork/Project/Internship
101	Communication Skills (AEC-01) [Modern Indian Language (MIL) & English language focused on language and communication skills.]	Ability Enhancement Course	100-199 Foundation/Introductory	2	2	0
102	Mathematics (Student will opt any one course of multi-disciplinary nature from other than the computer Science and Application faculty).	Multi-Disciplinary/Inter-Disciplinary	100-199 Foundation/Introductory	4	4	0
103	Fundamentals of Computer	Minor Course	100-199 Foundation/Introductory	4	4	0
104	Computer Programming and Programming Methodology (CPPM)	Major Course	200-299 Intermediate Level Course	4	2	4
105-04	Basics of Data Science	Major Course	200-299 Intermediate Level Course	4	2	4
	Practical (Based on Course Code:104 and 105-04)	No separate credits allocated for practical. The Practical exam/viva-voce will be based on Course 104.				
106	Skill Enhancement Course-I (SEC-01) [The student will undergo field training/ internship training <u>OR</u> Select minimum one University approved and recognized 2 credit certificate course from the skill based courses list offered by the respective institute/department.] (The student need to enrol separately and pay the fees as decided by the respective institute/department)	Skill Enhancement Course	100-199 Foundation / Introductory	2	-	2
107	Value Addition Course – I (VAC-01) [The student will select minimum one University approved and recognized 2 credits certificate course from the Value Addition courses list offered by the respective institute/department.] (The student need to enrol separately and pay the fees as decided by the respective institute/department)	Value Addition Course	100-199 Foundation/Introductory	2	2	-
Other Activities	The student is expected to participate in activities related to National Service Scheme (NCC), National Cadet Corps (NCC), adult education/literacy initiatives, mentoring school students, Elderly literacy program/ Environment preservation activities and other similar activities.			-	-	-
Total				22	16	10

Course Code	Course Title	Course Credit	University Exam Type	Exam Duration	External Marks	Internal Marks	Total Marks
101	Communication Skills (AEC-01)	2	Theory/ Written	1 Hours	25	25	50
102	Mathematics	4	Theory/ Written	2 Hours	50	50	100
103	Fundamentals of Computer	4	Theory/ Written	2 Hours	50	50	100
104	Computer Programming and Programming Methodology (CPPM)**	4	Theory/ Written : Practical :	1 Hours 2 Hours	25 25	25 25	100
105-04	Basics of Data Science	4	Theory/ Written : Practical:	1 Hours 2 Hours	25 25	25 25	100
106	Skill Enhancement Course-I# (SEC-01)	2	-	-	25	25	50 [#]
107	Value Addition Course-I# (VAC-01)	2	-	-	25	25	50 [#]
Total		22			275	275	550

For Practical and Project:

- Batch Size – 40 Maximum (Desirable). Maximum 45 students can be accommodated in a batch. Separate batch should be considered if the student strength exceed 45 numbers.
- Practical includes Practical sessions for course-104 and 105-04. **Minimum** Four Practical hours (for course-104 and 105-04) per week should be allocated per batch.
- The journal must be certified by the concerned faculty and by the Head of the Department, failing which the student will not be allowed to appear for External Practical Examination. Student will submit softcopy of Minor Project duly certified by the internal guide.

Internship: A student who wish to exit after successfully completion of first year (Semester-1 and Semester-2) without any backlog is required to obtain Four credits at the end of the year either through the summer internship or university approved skill based certificate courses(two courses of 2-credits each or one 4-credit course). Student is required to enrol for the certificate courses separately by paying the course fees as decided by the college/institute. For summer training, the Institute/college will grant the permission and evaluate the training outcomes. Based on satisfactory completion of the summer training, the Institute head will recommend to the university to grant four credits for summer training. The Internship/summer training/skill based certificate courses will be an audit course.[The internship cost/fees will be bear by the student.]

Skill Enhancement Course : As per NEP(National Education Policy-2020), it is mandatory for students to select a 2 credit skill enhancement course out of the choices given by the college/institute (From available basket of courses as per University norms). It will be mandatory for the student to opt minimum one 2-credit Skill enhancement course out of offered courses recognised by University during semester-1 to semester-5.
(The student need to enrol separately and pay the fees as decided by the respective institute/department)

Value Addition Course: As per NEP(National Education Policy-2020), it is mandatory for students to select a 2 credit Value Addition Course out of the choices given by the college/institute (From available basket of courses as per University norms). It will be mandatory for the student to opt minimum one 2-credit Value Addition Course out of offered courses recognised by the University during semester-1 to semester-4.
(The student need to enrol separately and pay the fees as decided by the respective institute/department)

Marks: : The students will enrol for the course from the given university approved list of certificate courses offered by the respective college/department. The student will select and enrol separately for any of the offered list of courses at college/department/institute and obtain respective credits. The institute will evaluate the performance (preferably continuous evolution) as per the SOP of certificate courses and on successfully completion of the course, the student will be eligible to obtain respective credits for the course. These credits will be considered and reflect in student's mark-sheet as well as in ABC(Academic Bank of Credit). These courses are mandatory and student is required to obtain the specified credits in process to acquire the certificate/diploma/degree.
[The student is required to pay separately for these courses as prescribed by the college. The college will decide the fees for these courses based on the University norms certificate course per credit fees.]

**** Major Practical based Subjects:** Course 104 and 105-04 are major courses carrying 4 credits (2 Hours of theory and 4 hours of practical per week). These subject carry 100 marks of exam weightage (50 theory and 50 practical). External and Internal distribution of marks are in ratio of 50:50 respectively. Students are required to acquire minimum passing marks from theory and practical collectively. Practical exams for course-104 (2 Hours) and course-105 (2 hours duration) will be conducted on same day.

External exam marks : (Course-104 : 25 marks and Course-105-04 : 25 marks)

Division of marks are: Exam evaluation: 20 marks + Viva-voce: 5 Marks.

Students are required to pass in combined head (Theory + Practical) for each course.

It is mandatory to remain present in internal and external theory and practical exams for course code – 104 and 105.

Program Passing Rules:	As per University rules.
Program Fees : (Per Semester) (One time fees and exam fees are additional as prescribed by the university) (w.e.f. Academic Year : 2024-25)	Semester Tuition Fees : Rs. 19,000/- Semester Laboratory Utilization Fees : As per B.C.A. program Semester University Exam Fees : Rs. 1200/- [Other one time /affiliation /exam fees, will be as per the norms of the University] [The fees for all certificate courses, Skill Enhancement Courses and Value Addition Courses; fees will be as per the prescribed limit for per credit as per the SOP of certificate courses decided by the university.]



SEMESTER – 2

Course Code	Course Title	Course Category	Level of Course	Course Credits	Teaching per week	
					Theory	Practical/ Fieldwork/ Project/ Internship
201	Ability Enhancement Course-II (AEC-02) [Modern Indian Language (MIL) & English language focused on language and communication skills.]	Ability Enhancement Course	100-199 Foundation/ Introductory	2	2	0
202	Inter-Disciplinary Course / Multi-Disciplinary Course (MDC-02)	Inter / Multi-Disciplinary	100-199 Foundation/ Introductory	4	4	0
203	Operating System	Minor Course	100-199 Foundation/ Introductory	4	4	0
204	Programming Skills	Major Course	200-299 Intermediate Level Course	4	2	4
205-04	Data Analysis using Python	Major Course	200-299 Intermediate Level Course	4	2	4
	Practical (Based on Course Code: 204 & 205 : Equally Divided)	-	200-299 Intermediate Level Course	No separate credits allocated for practical. The Practical exam/viva-voce will be based on Course-204 and 205.		
206	Skill Enhancement Course-II (SEC-02)	Skill Enhancement Course (Audit Course)	100-199 Foundation / Introductory	2	0	2
207	Value Addition Course – II (VAC-02) [To be selected minimum one University approved and recognized 2 credit certificate course from the Value Addition Courses list offered by the respective institute/department.] (The student can select and enrol separately for the course offered by the respective institute/department and need to pay separately as decided by the institute as per norms of university for certificate courses.)	Value Addition Course	100-199 Foundation / Introductory	2	2	-
Other Activities	The student is expected to participate in activities related to National Service Scheme (NCC), National Cadet Corps (NCC), adult education/literacy initiatives, mentoring school students, Elderly literacy program / Environment preservation activities and other similar activities.			-	-	-
Total				22	16	10

Course Code	Course Title	Course Credit	University Exam Type	Exam Duration	External Marks	Internal Marks	Total Marks
201	Ability Enhancement Course (AEC -02)%	2	Theory/ Written	1 Hours	25	25	100
202	Inter-Disciplinary / Multi-Disciplinary Course (MDC-02)	4	Theory/ Written	2 Hours	50	50	100
203	Operating Systems	4	Theory/Written :	2 Hours	50	50	100
204**	Programming Skills	4	Theory/Written : Practical :	1 Hours 2 Hours	25 25	25 25	100
205-04**	Data Analysis using Python	4	Theory/ Written: Practical :	1 Hours 2 Hours	25 25	25 25	100
	Practical Based on Course Code:204 & 205-04	-	Practical	Practical Exam will be conducted based on Course-204 and Course-205-04 separately at the end of the semester. The duration for exam will be 2 hours for each course.			
206	Skill Enhancement Course – II (SEC-02)	2	Audit Courses	-	25	25	50 [#]
207	Value Added Course – II (VAC-02)	2	Audit Course	-	25	25	50 [#]
Total		22			275	275	550

For Practical and Project:

- Batch Size – 40 Maximum (Desirable). Maximum 45 students can be accommodated in a batch. Separate batch should be considered if the student strength exceed 45 numbers.
- Practical includes Practical sessions for course-204 and course-205-04. **Minimum** Four Practical hours (for course-204 and 205-04) per week should be allocated per batch.
- The journal must be certified by the concerned faculty and by the Head of the Department, failing which the student will not be allowed to appear for External Practical Examination. Student will submit softcopy of Minor Project duly certified by the internal guide.

Internship: A student who wish to exit after successfully completion of first year (Semester-1 and Semester-2) without any backlog is required to obtain Four credits at the end of the year either through the summer internship or university approved skill based certificate courses(two courses of 2-credits each or one 4-credit course). Student is required to enrol for the certificate courses separately by paying the course fees as decided by the college/institute. For summer training, the Institute/college will grant the permission and evaluate the training outcomes. Based on satisfactory completion of the summer training, the Institute head will recommend to the university to grant four credits for summer training. The Internship/summer training/skill based certificate courses will be an audit course.[The internship cost/fees will be bear by the student.]

Skill Enhancement Course : As per NEP(National Education Policy-2020), it is mandatory for students to select a 2 credit skill enhancement course out of the choices given by the college/institute (From available basket of courses as per University norms). It will be mandatory for the student to opt minimum one 2-credit Skill enhancement course out of offered courses recognised by University during semester-1 to semester-5.
(The student need to enrol separately and pay the fees as decided by the respective institute/department)

Value Addition Course: As per NEP(National Education Policy-2020), it is mandatory for students to select a 2 credit Value Addition Course out of the choices given by the college/institute (From available basket of courses as per University norms). It will be mandatory for the student to opt minimum one 2-credit Value Addition Course out of offered courses recognised by the University during semester-1 to semester-4.
(The student need to enrol separately and pay the fees as decided by the respective institute/department)

Marks: : The students will enrol for the course from the given university approved list of certificate courses offered by the respective college/department. The student will select and enrol separately for any of the offered list of courses at college/department/institute and obtain respective credits. The institute will evaluate the performance (preferably continuous evolution) as per the SOP of certificate courses and on successfully completion of the course, the student will be eligible to obtain respective credits for the course. These credits will be considered and reflect in student's mark-sheet as well as in ABC(Academic Bank of Credit). These courses are mandatory and student is required to obtain the specified credits in process to acquire the certificate/diploma/degree.
[The student is required to pay separately for these courses as prescribed by the college. The college will decide the fees for these courses based on the University norms certificate course per credit fees.]

**** Major Practical based Subjects:** Course 204 and 205-04 are major courses carrying 4 credits (2 Hours of theory and 4 hours of practical per week). These subject carry 100 marks of exam weightage (50 theory and 50 practical). External and Internal distribution of marks are in ratio of 50:50 respectively. Students are required to acquire minimum passing marks from theory and practical collectively. Practical exams for course-204 (2 Hours) and course-205-04 (2 hours duration) will be conducted on same day.

External exam marks : (Course-204 : 25 marks and Course-205-04 : 25 marks)

Division of marks are: Exam evaluation: 20 marks + Viva-voce: 5 Marks.

Students are required to pass in combined head (Theory + Practical) for each course.

It is mandatory to remain present in internal and external theory and practical exams for course code – 204 & 205-04.

Program Passing Rules:	As per University rules.
Program Fees : (Per Semester) (One time fees and exam fees are additional as prescribed by the university) (w.e.f. Academic Year : 2024-25)	Semester Tuition Fees : Rs. 19,000/- Semester Laboratory Utilization Fees : As per B.C.A. program Semester University Exam Fees : Rs. 1200/- [Other one time /affiliation /exam fees, will be as per the norms of the University] [The fees for all certificate courses, Skill Enhancement Courses and Value Addition Courses; fees will be as per the prescribed limit for per credit as per the SOP of certificate courses decided by the university.]



Semester - 1
Course Code: 101
Course Title: COMMUNICATION SKILLS

Course Code	101																																																						
Course Title	Communication Skills																																																						
Credits	2																																																						
Course Category	Ability Enhancement Course (AEC-01)																																																						
Level of Course	100-199 (Foundation / Introductory)																																																						
Teaching per Week	2 Hrs																																																						
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)																																																						
Review / Revision	-																																																						
Implementation Year:	A.Y. 2024-2025																																																						
Purpose of Course	Effective communication is vital for the success in various situations. This course will help students develop and improve English Communication skills.																																																						
Course Objective	The course aim at enabling the students to acquire and demonstrate the core linguistic skills, including critical reading and expository and academic writing skills that help students articulate their arguments and present their thinking clearly and coherently and recognize the importance of language as a mediator of knowledge and identity. They would also enable students to acquaint themselves with the cultural and intellectual heritage of the chosen MIL and English language, as well as to provide a reflective understanding of the structure and complexity of the language/literature related to both the MIL and English language. The courses will also emphasize the development and enhancement of skills such as communication, and the ability to participate/conduct discussion and debate.																																																						
Pre-requisite	Knowledge of English at H.Sc.(12 th) Level																																																						
Course Outcomes	CO1 : To make students understand the importance of effective communication skills in personal and professional life. CO2 : student’s will be able to enhance their ability in reading ,writing ,listening and speaking as per the demand of corporate world. CO3 : To develop students individual as well as team work efficiency CO4; To enhance the inquisitiveness in students for updating knowledge to solve problems, and lead to build a successful professional career. CO5; Students will be able to understand the importance of digital communication.																																																						
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)	<table><tr><td></td><td>PSO 1</td><td>PSO 2</td><td>PSO 3</td><td>PSO 4</td><td>PSO 5</td><td>PSO 6</td><td>PSO 7</td><td>PSO 8</td></tr><tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>C04</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>		PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	CO1									CO2									CO3									C04									CO5								
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CO2																																																							
CO3																																																							
C04																																																							
CO5																																																							
Course Outcome	After studying the course, students will be able to Implement their skills at their workplace on varied roles such as computer operator and programmer.																																																						
Course Content	Unit : 1 : Fundamentals of Communication 1.1 Definition and Meaning, Overview 1.2 Process of Communication 1.3 Features and Process of Professional communication																																																						

	1.4 Role of creative and critical thinking in communication 1.5 Different forms of communication 1.6 Communication Network in an Organization 1.7 Barriers to communication Unit : 2 :Developing Listening skills 2.1 Listening Vs Hearing 2.2 Effective Listening 2.3 Process of Listening 2.4 Types of Listening 2.5 Barriers to effective listening Unit : 3 : Speaking Skills 3.1 Non-verbal Communication 3.2 Group –discussions- Conducting G.D on giventopics(Oral Practical) 3.3 Dynamics of Professional presentation/DraftingPresentation on given topics 3.4 Public speaking 3.5 Conversations and Dialogue writing Unit : 4 Reading Skills 4.1 Need for Developing Efficient Reading 4.2 Benefits of Effective Reading 4.3 Basic steps To Effective Reading 4.4 Types of Reading 4.5 Reading Comprehension Unit : 5 Writing Skills 5.1 Resume writing 5.2 The art of Condensation 5.3 Business Reports 5.4 E-mail writing 5.5 Blog Writing.
Reference Books	1.Handbook of practical Communication skills – Chrisle W. JAICO 2.Basic Managerial Skills for all – S. J. McGrath - PHI 3.Reading to learn – Sheila Smith & Thomas M. Methuen (London) 4.Communication conversation Practice _ Tata McGraw Hill 5. Communication in English – R. P. Bhatnagar & R. T. Bell – Orient Longman 6. Good English – G. H. Vallins – Rups & Co 7. Let’s talk English – M. I. Joshi 8. Essentials of Business Communications – Pat & Sons, S. Chand
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. 50% External assessment.

Course Code: 102
Course Title: Multi-Disciplinary / Inter Disciplinary Course

Course Code	102
Course Title	[Title of the course will be the one selected by the student from courses offered by college/institute out of the course basket offered by the University under the Multi-Disciplinary courses or Inter-disciplinary courses.]
Credits	4
Course Category	Multidisciplinary / Inter-Disciplinary Course
Level of Course	100-199 (Foundation / Introductory)
Teaching per Week	4 Hours/week.
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)
Review / Revision	-
Implementation Year:	A.Y. 2024-2025
Purpose of Course	- This is constituent discipline of the major courses and it helps learners to acquire core competence in relevant or any other independent courses of their choices. This course may be major specific or other discipline specific. Learner shall have option to choose the course from available pool of courses or from any other institutions as the learner's choice. - Interdisciplinary course can help to gain the skills needed to adapt to a rapidly changing workplace, combining theory with practice to help students develop valuable transferable skills. - Multi-disciplinary course allows the student to understand the power of new ideas. It helps student to develop a pragmatic attitude by allowing them to decide what subjects they will opt for and what could be their possible benefits. They get time to make a decision by calculating the risks & advantages.
Course Objective	- Integration of Knowledge and Skills: One objective of a multidisciplinary course is to foster the integration of knowledge and skills from different disciplines. By combining various areas of study, students can gain a holistic understanding of a particular topic or problem. This objective aims to break down the traditional boundaries between subjects and encourage students to see connections and relationships across different fields. - Promoting Critical Thinking and Problem Solving: Another objective is to enhance students' critical thinking and problem-solving abilities. Multidisciplinary courses often involve complex real-world issues that require a multifaceted approach. By engaging with diverse perspectives and methodologies, students develop the capacity to analyze problems from multiple angles, think creatively, and propose innovative solutions. - Enhancing Collaboration and Communication Skills: Collaboration and effective communication are essential skills in today's interconnected world. Multidisciplinary courses aim to cultivate these skills by providing opportunities for students to work collaboratively with peers from different disciplines. Through group projects, discussions, and presentations, students learn how to articulate their ideas, listen actively to others, and collaborate effectively to achieve common goals. This objective prepares students for interdisciplinary work environments and encourages the exchange of ideas across disciplinary boundaries.
Pre-requisite	Fundamentals of knowledge about the subject at 10 th Grade Level
Course Outcomes	CO1: Analyze complex societal issues using multiple disciplinary perspectives, fostering a comprehensive understanding of interconnected factors. CO2: Apply interdisciplinary knowledge and skills to propose innovative solutions to real-world problems, demonstrating the practical application of cross-disciplinary approaches.

	CO3: Critically evaluate and synthesize information from diverse sources, developing the ability to integrate and make connections between different disciplinary perspectives. CO4: Collaborate effectively with peers from various backgrounds, demonstrating strong teamwork and communication skills in multidisciplinary settings. CO5: Demonstrate adaptability and flexibility in navigating and addressing interdisciplinary challenges, showcasing the ability to think creatively and embrace diverse viewpoints.
Course Outcome	- The course outcome of a multidisciplinary course is typically to provide students with a comprehensive understanding of a specific topic or problem by integrating knowledge and perspectives from multiple disciplines. This outcome aims to develop critical thinking skills, problem-solving abilities, interdisciplinary collaboration, and the capacity to apply diverse approaches to real-world issues. Ultimately, the course seeks to prepare students for interdisciplinary work environments and equip them with the skills necessary to tackle complex, multifaceted challenges. - The course outcome of an interdisciplinary course is to enable students to integrate knowledge and methodologies from different disciplines in order to gain a holistic understanding of a specific topic or problem. This outcome aims to develop students' ability to think critically across disciplinary boundaries, synthesize information from diverse sources, and apply interdisciplinary approaches to address complex real-world challenges. The course also seeks to enhance students' communication and collaboration skills, preparing them to work effectively in interdisciplinary teams and contribute to cross-disciplinary discussions and solutions.
Course Content	Course content will be based on the selected course from the basket of courses of Multi-Disciplinary courses or Inter-Disciplinary courses.
Reference Books	- As mentioned in the course structure for the selected course.
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. 50% External assessment.

Course Outcome	On completion of this course, students will get knowledge about functional units, number System, devices and memory and storage and fundamentals of Data and data storage.
Course Content	UNIT-1: Introduction 1.1 Introduction of Computer 1.2 Applications of Computer 1.3 Types of Computers – Super Computers, Mainframes, Mini Computers, Micro computers(Desktop, Laptop, Notebook, Tablet, Smart Phones) 1.4 Block Diagram and functional units of computer 1.5 Concepts of Address Bus and Data Bus 1.6 Concept of virtual memory and cache memory 1.7. Hardware Components 1.7.1. Motherboard 1.7.2. Types of Processor (CPU and GPU) 1.7.3. Memory: RAM(SRAM,DRAM, SDRAM), ROM, EPROM, EEPROM 1.8. Introduction to Software 1.8.1. Purpose and significance of Operating System 1.8.2. Concept of System Software and Application Software UNIT-2: Number System 2.1. Introduction of Decimal, Binary, Octal and Hexadecimal number Systems. 2.2 Conversion of Decimal to Binary and Binary to Decimal 2.3 Binary addition & subtraction 2.4 ASCII and ANSI character code Unit-3: Concepts of Internet 3.1. Concepts of Internet and WWW 3.1.1 Types of Internet Services 3.1.2 Hardware – Modem, Router, Blue tooth, Fire-Stick 3.1.3 Internet connections using Hotspot, WiFi, cable 3.2 Introduction of Cloud 3.2.1 Concepts of cloud 3.2.2 Purpose and application of Cloud (Example of GoogleDoc) 3.2.3 Concepts of Online Data Backup 3.3 Introduction of Web Browser and relevant terminologies : 3.3.1 URL, Address bar, Domain, Links, Navigation Buttons 3.3.2 Tabbed browsing, Bookmarks, History Unit-4: Concepts of Data 4.1 Concepts of Data and information 4.2 Types of Data (Quantitative and Qualitative) 4.3 Difference between structured and un structured data 4.3 Storage and processing concepts of data 4.3.1 Introduction of Data warehouse 4.3.2 Introduction of Data lake 4.3 Concepts of Data Science 4.3.1 Evolution of Data Science 4.3.2 Roles of Data Science 4.4 Applications of Data Science in various fields UNIT-5: Understanding Data Collection and Data Pre-Processing 5.1 Introduction of Data and Datasets 5.2 Samples of Data and Datasets 5.3 Data Pre-Processing Overview 5.4 Concepts and need of data pre-process 5.5 Concepts of Data Cleaning

Reference Books	1. How computer work: Ron White – Tech media 2. Introduction to computers: 4th Edition – Peter Norton 3. Fundamentals of Computers: V. Rajaraman 4. Computer Fundamentals: Pradeep K. Sinha & Priti Sinha (BPB) 5. Introduction to Networking Rechar McMohan Tata McGraw Hill Publication 6. HTML Black Book – Steven Holzner – Dreamtech Press 7. Computer Network Fundamentals and application – R S Rajesh Vikas Publication 8. HTML for the World Wide Web, Fifth Edition, with XHTML and CSS- Peachpit Press 9. "Data Science from Scratch: First Principles with Python" by Joel Grus, ISBN: 978-1492041139, Publisher: O'Reilly Media. 10. "Data Science for Business" by Foster Provost and Tom Fawcett, ISBN: 978-1449361327, Publisher: O'Reilly Media 11. "Python for Data Analysis" by Wes McKinney, ISBN: 978-1491957660, Publisher: O'Reilly Media 12. "The Elements of Statistical Learning: Data Mining, Inference, and Prediction" by Trevor Hastie, Robert Tibshirani, and Jerome Friedman, ISBN: 978-0387848, 570, Publisher: Springer
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. 50% External assessment.

Course Code: 104**Course Title: Computer Programming & Programming Methodology (CPPM)**

Course Code	104																																																															
Course Title	Computer Programming & Programming Methodology (CPPM)																																																															
Credits	4																																																															
Course Category	Major Course																																																															
Level of Course	200-299 (Intermediate Level)																																																															
Teaching per Week	4 Hrs. (2 Hours Theory + 4 Hours Practical work)																																																															
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)																																																															
Review / Revision	-																																																															
Implementation Year:	A.Y. 2024-2025																																																															
Purpose of Course	- Computer programming is a process that leads from an original formulation of a computing problem to executable computer programs. - Programming involves activities such as analysis, developing, understanding, generating algorithms, verification of requirements of algorithms including their correctness, and implementation (commonly referred to as coding) of algorithms in a target programming language. - To emphasis on concepts of Compiler based programming language, structure of code, algorithms, flow-charts, problem solving attitude, concepts of variables and declaration mechanism of different datatypes, simple I/O statements, conditional statements, loops, compound iterations, strings and certain inbuilt functions, header files, concepts of arrays and one dimensional numeric array operations, numeric inbuilt functions and concepts of pointers																																																															
Course Objective	To introduce students the essentials of computer Programming and programming methodology using C Programming language.																																																															
Pre-requisite	-																																																															
Course Outcomes	CO1: Students will be able to learn advanced programming concept of compiler based programming language. CO2: Students will be proficient working on conditional statements, iterative Statements and fundamentals of programming concepts using C and Python. CO3: Students will be able to represent compound data using lists, tuples and dictionaries in Python programs. CO4: Students will be able to develop real world application. CO5: Students will learn important libraries like Numpy, Pandas which are useful in Data analysis, Machine Learning.																																																															
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)	<table><tr><td></td><td>PSO1</td><td>PSO2</td><td>PSO3</td><td>PSO4</td><td>PSO5</td><td>PSO6</td><td>PSO7</td><td>PSO8</td></tr><tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>											PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	CO1									CO2									CO3									CO4									CO5								
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CO3																																																																
CO4																																																																
CO5																																																																
Course Content	UNIT-1: Introduction 1.1 Concepts of Programming Language 1.1.1 Introduction of Source Code, Object Code and executable code 1.1.2 Algorithm and Flowchart 1.1.3 Concepts of Structured Programming Language 1.2 Concepts of Editor, Interpreter and Compiler 1.2.1 Introduction of C program body structure 1.2.2 Character Set, concepts of variables and constants 1.2.3 Identifiers, literals, Key words 1.2.4 Data types (signed and unsigned) (Numeric : int, short int, long, float,																																																															

	double) , (Character type: char, string) and void. 1.2.5 Concepts of source code, object code and executable code. UNIT-2: Input/Output Statements and Operators: 2.1 Input/Output statements: 2.1.1 Concepts of Header files (STDIO,CONIO) 2.1.1.1 Concepts of pre-compiler directives. 2.1.1.2 Use of #include and #define 2.2 Input/Output Statements: 2.2.1 Input statements : scanf(),getc(), getch(), gets(), getchar() 2.2.2 Output Statements: printf(), putc(),puts(), putchar() 2.2.3 Type specifiers (formatting strings) : %d, %ld, %f, %c, %s, %lf 2.3 Operators : 2.3.1 Arithmetic operators (+, -, *, /, %, ++, --,) 2.3.2 Logical Operators (&&, , !) 2.3.3 Relational Operators (>, =, <=, !=) 2.3.4 Bit-wise operators (&, , ^, <>) 2.3.5 Assignment operators (=, +=, -=, *=, /=, %=) 2.3.6 Ternary Operator and use of sizeof() function. 2.4 Important Built-in functions: 2.4.1 Use of : (strlen, strcmp, strcpy, strcat, strrev) 2.4.2 Use of : (abs(), floor(), round(), ceil(), sqrt(), exp(), log(), sin(), cos(), tan(), pow() and trunc()) UNIT-3: Decision Making statements : 3.1 if statements : 3.1.1 simple if statements 3.1.2 if...else statements 3.1.3 if...else if....else statements 3.1.4 Nested if statements. 3.2 Switch..case statements 3.2.1 Use of break and default 3.2.2 Difference between switch and if statements. UNIT-4: Iterative statements : 4.1 Use of goto statement for iteration 4.2 while loop 4.3 do..while loop 4.4 for loop 4.5 Nested while, do..while and for loops 4.6 Jumping statement: (break and continue) UNIT-5: Concepts of Arrays and pointer 5.1 Concepts of Single-dimensional Array 5.1.1 Numeric single dimensional Array 5.1.2 Numeric single dimensional array operations: 5.1.2.1 Sorting array in ascending or descending. (Bubble and selection) 5.1.2.2 Searching element from array (Linear Search) 5.1.3 Character Single dimensional Array 5.1.3.1 Character Single dimensional array operations: 5.1.3.2 Use of \0, \n and \t 5.2 Pointers: 5.2.1 Concepts of Pointers 5.2.2 Declaring and initializing int, float, char and void pointers 5.2.3 Pointer to single dimensional numeric array.
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Reference Books	1. Programming in C, Balaguruswami – TMH 2. C: How to Program, Deitel & Deitel - PHI 3. C Programming Language, Kernigham & Ritchie - TMH 4. Programming in C, Stephan Kochan - CBS 5. Mastering Turbo C, Kelly & Bootle - BPB 6. C Language Programming – Byron Gottfried - TMH 7. Let us C, Yashwant Kanetkar - BPB Publication 8. Magnifying C, Arpita Gopal - PHI 9. Problem Solving with C, Somashekara - PHI 10. Programming in C, Pradip Dey & Manas Ghosh – Oxford
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. 50% External assessment.

Course Code: 105-04
Course Title: Basics of Data Science

Course Code	105-04								
Course Title	Basics of Data Science								
Credits	4								
Course Category	Major Course								
Level of Course	200-299 (Intermediate Level)								
Teaching per Week	Theory/Lectures: 2 Hours/Week and Lab./Practical Hours: 4 Hours/Week								
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)								
Review / Revision	-								
Implementation Year:	A.Y. 2024-2025								
Purpose of Course	This course is designed to introduce the fundamental concepts of Data Science to beginners. It covers essential methodologies and tools needed to understand, analyse, and interpret data effectively. The course provides hands-on experience with real-world data, preparing students for further studies and careers in Data Science.								
Course Objective	To learn and obtain the skills related to i) Understand the basics of Data Science and its applications. ii) Gain proficiency in statistical analysis and handling of various types of data. iii) Learn to use python for Data Science tasks. iv) Understand and apply machine learning algorithms. v) Develop skills in data visualization and interpretation.								
Pre-requisite	-								
Course Outcomes	CO1: Identify and apply the right Concepts of Data Science and tools to solve problems. CO2: Manipulate and analyze data effectively using python. CO3: Implement basic machine learning algorithms to solve real- world problems. CO4: Create meaningful data visualizations to interpret and present data insights. CO5: Critically evaluate data analytics techniques in the context of various business and research scenarios.								
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
Course Content	Unit 1: Concepts of Data Science 1.1 Introduction to Data Science 1.2 Definition of Data Science 1.3 Importance and Scope of Data Science 1.4 Data Analytics life cycle 1.5 Understanding data: 1.5.1 Types of Data: Numeric, Categorical, Graphical, High Dimensional Data Unit-2 : Classification of digital Data: 2.1 Structured, Semi-Structured and Un Structured 2.2 Sources of Data: 2.2.1 Time Series								

	2.2.2 Transactional Data 2.2.3 Biological Data 2.2.4 Spatial Data 2.2.5 Social Network Data 2.2.6 Example Applications. UNIT-3: Concepts of Database: 3.1 Database characteristics: 3.1.1 Data Independence (Logical and Physical) 3.1.2 Components of Database (User, Application , DBMS, Database) 3.1.3 Database Architecture (1-tier, 2-tier, 3-tier) 3.1.3.1 Comparison, advantages and disadvantages. 3.2 Database Models (Hierarchical, Network, E/R, Relational) 3.2.1 E/R model : Entity, Relationship, Attribute 3.2.2 E/R Diagram : One to one, one to many , many to one, many to many 3.2.3 Strong entity, weak entity 3.2.4 key attribute, derived attribute, Multi-valued attribute 3.3 Types of keys : 3.3.1 Super key, candidate key, Primary key, Composite key, Foreign key, Unique key. UNIT-4: Normalization and Introduction of SQL: (Max.Weightage: 20%) 4.1 Normalization (Insertion, Updating, Deletion anomalies) 4.2 Normalization Rules: 4.2.1 Concepts of Dependency, Transitive Dependency 4.2.2 Armstrong Axioms 4.2.3 1st Normal Form, 2nd Normal Form, 3rd Normal Form, B.C.N.F. Unit-5: Structured Query Language: (Max.Weightage: 25%) 5.1 Concepts of Structure Query Language (SQL) 5.1.1 SQL datatypes : int, float, double, char, varchar, number, varchar2, Text, date 5.2 DDL Statements : 5.2.1 Create , Drop, Truncate, Rename, Alter 5.3 DML and DQL(Data Query Language) Statements : 5.3.1 Insert, Update, Delete 5.3.2 select 5.4 Working with Tables. 5.4.1 Create,Drop,Alter tables 5.4.2 Insert, Update, Delete, Select queries on table 5.5 Constraints (Table level and Attribute Level) 5.5.1 NOT NULL, CHECK, DEFAULT 5.5.2 UNIQUE, Primary Key, Foreign Key 5.5.3 On Delete Cascade
Reference Books	1. "Data Science from Scratch" by Joel Grus - A clear introduction to the field, using Python. 2. "Python Data Science Handbook" by Jake VanderPlas - Comprehensive guide to the Python ecosystem for data analysis and visualization. 3. "Practical Statistics for Data Scientists" by Peter Bruce and Andrew Bruce - Covers essential statistical methods for data analysis in Data Science. 4. "Machine Learning Yearning" by Andrew Ng - Insights on how to structure Machine Learning projects. 5. "Storytelling with Data" by Cole Nussbaumer Knafllic - Teaches the fundamentals of data visualization and how to communicate effectively with data.

	6. "Data Science from Scratch" by Joel Grus - A clear introduction to the field, using Python. 7. "Python Data Science Handbook" by Jake VanderPlas - Comprehensive guide to the Python ecosystem for data analysis and visualization. 8. "Practical Statistics for Data Scientists" by Peter Bruce and Andrew Bruce - Covers essential statistical methods for data analysis in Data Science. 9. "Machine Learning Yearning" by Andrew Ng - Insights on how to structure Machine Learning projects. 10. "Storytelling with Data" by Cole Nussbaumer Knaflic - Teaches the fundamentals of data visualization and how to communicate effectively with data.
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. 50% External assessment.

Course code: 106
Course Title: Skill Enhancement Course (SEC-01)

Course Code	106
Course Title	Skill Enhancement Course - I (SEC – 01)
Credit	2
Category of Course	Skill Enhancement Course
Level of Course	100-199 (Foundation / Introductory)
Teaching per Week	2 Hrs (Any or Combination of Theory/Practical/Fieldwork/Internship/Project)
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)
Review / Revision	2022-2023
Implementation Year:	A.Y. 2023-2024
Purpose of Course	- As per NEP(National Education Policy-2020), it is mandatory for students to select a 2 credit Skill Enhancement Course out of the choices given by the college/institute. - It will be mandatory for the student to opt minimum one 2-credit Skill Enhancement Course out of the list of offered courses recognised by the University during semester-1 to semester-5. - The student can start an alternative career in the field by obtaining higher degree of knowledge in the area. - It's aimed at imparting practical skills, embedded internship, hands-on training, soft skills, life skills, such approved online courses etc. to enhance the employability of students. This may also include courses as per the need of new evolving technology.
Course Objective	Obtaining skill in particular field along with the regular curriculum of the selected program is essential. It not only enhance the skill but also provide an opportunity to develop skill in particular area where one can pursue career in future. Skill enhancement provides the opportunity and knowledge for an individual to develop and strengthen the necessary skills to gain, maintain, and advance in a chosen area. Skill enhancement programs are focused around training that combines the best practices from varieties of areas. Skill enhancement or training typically uses a combination of cognitive and behaviour problem solving approaches, both of which are used to strengthen a person's positive skill develop.
Pre-requisite	-
Course outcome	CO1: Student select the area of skill as per his/her interest. The choices will be given by the institute/department. CO2: The student acquire basic and fundamental level of knowledge in the field that the student opted. CO3: Understand the insight of the area and possibility of to explore more in the field. CO4: Understand effective representation of problems in terms addressing the problems. CO5: Learn to upskill and upgrade the knowledge in the area of selected subject.
Course Content and Implementation road-map.	(i) University has categorised and prepared the basket of the courses including approved online courses that can be offered as Skill Enhancement Course. (ii) The institute/college/department can design and implement skill enhancement course by getting approval from the relevant apex body of the university considering the SOP of the certificate course policies of the University. (iii) The institutes/college/departments can select more than one course out of the given sets of courses and offer them to their students. (iv) The students can select any of the courses offered by the institute/college/department from the given choices and enrol for the course.

	(v) The institute/college/department will arrange appropriate resource person(s) for the course. (vi) The course evaluation will be taken place at the college/institute/department level based on the nature of the course. (vii) The institute/college/department will assess the student based on the nature of the course. The student will be granted the credits on successful completion of the course.
Reference Books	- The reference materials and books will be decided by the Institutes/Colleges/Departments based on the selected Courses. - Minimum five copies of relevant topics are recommended to keep in the library.
Teaching Methodology	Class Work/ Discussion/ Self-Study/ Seminars/ field works/ practical training/ field work and/or Assignments.
Evaluation Method	50% Internal assessment. 50% External assessment. Maximum Marks: 50

Course code: 107
Course Title: Value Addition Course-I (VAC-01)

Course Code	107
Course Title	Value Addition Course - I (VAC – 01)
Credit	2
Category of Course	Value Addition Course
Level of Course	100-199 (Foundation / Introductory)
Teaching per Week	2 Hrs (Any or Combination of Theory/Practical/Fieldwork/Internship/Project)
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)
Review / Revision	-
Implementation Year:	A.Y. 2023-2024
Purpose of Course	As per NEP(National Education Policy-2020), it is mandatory for students to select a 2 credit Value Addition Course out of the choices given by the college/institute. It will be mandatory for the student to opt minimum one 2-credit Value Addition Course out of the list of offered courses recognised by the University during semester-1 to semester-4. The student can start an alternative career in the field by obtaining higher degree of knowledge in the area.
Course Objective	Obtaining knowledge in all or any of the components/fields like (i) Understanding India (ii) Environmental Science/Education (iii) Digital/Technological solutions (iv) Health & Wellness, Yoga education, sports, and fitness are essential for holistic development (v) Indian Knowledge system(IKS). The course components should be among these five categories/fields and as per the Curriculum and Credit Framework for Undergraduate Programmes of the UGC (Page-22 of the document). The purpose is to impart knowledge and understand the necessities of these aspects in life to make the healthy society and nation. It help in development of a dedicated and responsible citizen of the country by adding value to the life.
Pre-requisite	-
Course outcome	CO1: Student select the area of Value addition as per his/her interest. The choices will be given by the institute/department. CO2: The student acquire basic and fundamental level of knowledge in the field that the student opted. CO3: Understand the insight of the area and possibility of to explore more in the field. CO4: Understand effective representation of problems, solutions and insights of the challenges and problems of the peer subject relevant to value addition. CO5: Learn to upskill and upgrade the knowledge in the area of selected subject.
Course Content and Implementation road-map.	(i) The university has categorised and prepared the list of the courses that can be offered as Value Addition Course. (ii) The institute/college/department can design and implement skill enhancement course by getting approval from the relevant apex body of the university considering the SOP of the certificate course policies of the University. (iii) The institutes/college/departments can select more than one course out of the given sets of courses and offer them to their students. (iv) The students can select any of the courses offered by the institute/college/department from the given choices and enrol for the course. (v) The institute/college/department will arrange appropriate resource person(s) for the course. (vi) The evaluation will be taken place at the college/institute/department based on the nature of the course. (vii) The institute/college/department will assess the student based on the nature of the course. The student will be granted the credits on successful completion of the course.

Reference Books	- The reference materials and books will be decided by the Institutes/Colleges/Departments or as per the university guidelines based on the selected Courses. - Minimum five copies of relevant topics are recommended to keep in the library.
Teaching Methodology	Class Work/ Discussion/ Self-Study/ Seminars/ field works/ practical training/ field work and/or Assignments.
Evaluation Method	50% Internal assessment. 50% External assessment. Maximum Marks: 50

Internship: Student willing to exit the program at the end of the two semesters and to avail the Certificate in Computer Application or exit the program at the end of the first four semesters and to avail the Diploma in Computer Application, it is essential to acquire four credits from internship. A key aspect of the internship is induction into actual work situations. Internships involve working with local industry, government or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning. In option to these internships, the student can avail such four credits by availing two 2-credit university approved courses during any of these semesters. The student is required to enroll and avail these 4-credits and produce the evidence in process to opt the multi-level exit option after successfully completion of first year (two semester) or second year(four semesters).

Semester - 2

Course Code: 201

Course Title: Ability Enhancement Course-02

Course Code	201
Course Title	Ability Enhancement Course – 02
Credits	2
Course Category	Ability Enhancement Course (AEC-02)
Level of Course	100-199 (Foundation / Introductory)
Teaching per Week	2 Hours
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)
Review / Revision	-
Implementation Year:	A.Y. 2023-2024
Purpose of Course	This will be an elective course. Can be selected from the list of elective options available under the basket of Ability Enhancement certificate Courses offered by the University.
Course Objective	The course aim at enabling the students to acquire and demonstrate the core linguistic skills, including critical reading and expository and academic writing skills that help students articulate their arguments and present their thinking clearly and coherently and recognize the importance of language as a mediator of knowledge and identity. They would also enable students to acquaint themselves with the cultural and intellectual heritage of the chosen MIL and English language, as well as to provide a reflective understanding of the structure and complexity of the language/literature related to both the MIL and English language. The courses will also emphasize the development and enhancement of skills such as communication, and the ability to participate/conduct discussion and debate.
Pre-requisite	Knowledge of English at H.Sc.(12 th) Level
Course Outcomes	The list of Electives are showing individual course's Course Outcomes.
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)	As per the course outcome (CO) of selected course out of the basket of 2-credit university approved certificate courses offered by University under the category Ability Enhancement Course. Mapping between Course Outcomes(CO) with Program Specific Outcomes (PSO) is based on selected course.
Course Content	As per the selected course out of the basket of approved courses offered by University under the category Ability Enhancement Course.
Reference Books	- The list of reference books will be decided by the Institutes/Colleges/Departments or as per the university guidelines based on the selected Courses. - Minimum five copies of five different titles relevant topics are recommended to keep in the library. Electives are showing individual course's reference books.
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	30% Internal assessment. 70% External assessment.

Course Code: 202
Course Title: Multi-Disciplinary / Inter Disciplinary Course

Course Code	202
Course Title	[Title of the course will be the one selected by the student from courses offered by college/institute out of the course basket offered by the University under the Multi-Disciplinary courses or Inter-disciplinary courses.]
Credits	4
Course Category	Multidisciplinary / Inter-Disciplinary Course
Level of Course	100-199 (Foundation / Introductory)
Teaching per Week	4 Hours/week.
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)
Review / Revision	-
Implementation Year:	A.Y. 2023-2024
Purpose of Course	- This is constituent discipline of the major courses and it helps learners to acquire core competence in relevant or any other independent courses of their choices. This course may be major specific or other discipline specific. Learner shall have option to choose the course from available pool of courses or from any other institutions as the learner's choice. - Interdisciplinary course can help to gain the skills needed to adapt to a rapidly changing workplace, combining theory with practice to help students develop valuable transferable skills. - Multi-disciplinary course allows the students to understand the power of new ideas. It helps them to develop a pragmatic attitude by allowing them to decide what subjects they will opt for and what could be their possible benefits. They get time to make a decision by calculating the risks & advantages.
Course Objective	- Integration of Knowledge and Skills: One objective of a multidisciplinary course is to foster the integration of knowledge and skills from different disciplines. By combining various areas of study, students can gain a holistic understanding of a particular topic or problem. This objective aims to break down the traditional boundaries between subjects and encourage students to see connections and relationships across different fields. - Promoting Critical Thinking and Problem Solving: Another objective is to enhance students' critical thinking and problem-solving abilities. Multidisciplinary courses often involve complex real-world issues that require a multifaceted approach. By engaging with diverse perspectives and methodologies, students develop the capacity to analyze problems from multiple angles, think creatively, and propose innovative solutions. - Enhancing Collaboration and Communication Skills: Collaboration and effective communication are essential skills in today's interconnected world. Multidisciplinary courses aim to cultivate these skills by providing opportunities for students to work collaboratively with peers from different disciplines. Through group projects, discussions, and presentations, students learn how to articulate their ideas, listen actively to others, and collaborate effectively to achieve common goals. This objective prepares students for interdisciplinary work environments and encourages the exchange of ideas across disciplinary boundaries.
Pre-requisite	Fundamentals of knowledge about the subject at 10 th Grade Level
Course Outcomes	CO1: Analyze complex societal issues using multiple disciplinary perspectives, fostering a comprehensive understanding of interconnected factors.

	CO2: Apply interdisciplinary knowledge and skills to propose innovative solutions to real-world problems, demonstrating the practical application of cross-disciplinary approaches. CO3: Critically evaluate and synthesize information from diverse sources, developing the ability to integrate and make connections between different disciplinary perspectives. CO4: Collaborate effectively with peers from various backgrounds, demonstrating strong teamwork and communication skills in multidisciplinary settings. CO5: Demonstrate adaptability and flexibility in navigating and addressing interdisciplinary challenges, showcasing the ability to think creatively and embrace diverse viewpoints.
Course Outcome	- The course outcome of a multidisciplinary course is typically to provide students with a comprehensive understanding of a specific topic or problem by integrating knowledge and perspectives from multiple disciplines. This outcome aims to develop critical thinking skills, problem-solving abilities, interdisciplinary collaboration, and the capacity to apply diverse approaches to real-world issues. Ultimately, the course seeks to prepare students for interdisciplinary work environments and equip them with the skills necessary to tackle complex, multifaceted challenges. - The course outcome of an interdisciplinary course is to enable students to integrate knowledge and methodologies from different disciplines in order to gain a holistic understanding of a specific topic or problem. This outcome aims to develop students' ability to think critically across disciplinary boundaries, synthesize information from diverse sources, and apply interdisciplinary approaches to address complex real-world challenges. The course also seeks to enhance students' communication and collaboration skills, preparing them to work effectively in interdisciplinary teams and contribute to cross-disciplinary discussions and solutions.
Course Content	Course content will be based on the selected course from the basket of courses of Multi-Disciplinary courses or Inter-Disciplinary courses.
Reference Books	- As mentioned in the course structure for the selected course.
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. 50% External assessment.

Course Code: 203
Course Title: Operating System

Course Code	203
Course Title	Operating System
Credits	4
Course Category	Minor Course - Minor discipline is the broader understanding course beyond the major discipline course. - Student can opt the course from the available basket with open, generic-electives of the courses offered by the college/institute from the pool of courses offered by University from available basket. - Minor subjects may be from same or different disciplines as per choice of the students. - Student may make choices according to their interest/need, from ODL courses also.
Level of Course	100-199 (Foundation / Introductory)
Teaching per Week	4 Hrs.
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)
Review / Revision	2022-2023
Implementation Year:	A.Y. 2023-2024
Purpose of Course	- An Operating System (OS) is a software that manages computer hardware and software resources and provides common services for computer programs. The operating system is an essential component of the system software in a computer system. Application programs usually require an operating system to function. The course is based on open source operating systems like Linux. - It helps students to gain broader knowledge in addition to relevant major disciplines courses as per their choices.
Course Objective	1.To understand functionality provided by an Operating System. 2.To make aware with basic concepts of Windows O. S. Management. 3.To learn about device management.
Pre-requisite	Basic knowledge of computer fundamentals.
Course Outcomes	CO1: Students will learn how operating system is important for computer system and what is the role of an OS, and also learn different types of operating system and their services. CO2: Students will be able to understand the structure and organization of file system. CO3: To differentiate between windows and linux OS CO4: To install and maintain linux workstation and also able to manage user accounts. CO5: To understand devices, usage of devices, scheduling algorithms and decide which is the best one. CO6: Students will be able to develop application the coordinate with respective OS in a much better way which is an essential.

Mapping between Course Outcomes(CO) with Program Outcomes(PSO)		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								
Course Content	Unit 1. Operating System Concepts 1.1.Evolution of Operating System & History 1.1.1 Need of an Operating System 1.1.2 Single User & Multi User Operating System 1.2. Elements of an Operating System 1.3. Operating System as a Resource Manager 1.4 Introduction to File System and File Management 1.4.1 File Concept 1.4.2 Operations on File 1.4.3 File Access Methods 1.4.4 Sequential Access and Direct Access) 1.5 Directory Systems File Management Functions. 1.6 File System and Directory Structure organization. Unit 2: Process and Memory Management 2.1 Process Concepts and States 2.1.1 Concepts of Process Scheduling 2.1.2 Process Synchronization and Deadlocks 2.1.3 Inter-process Communication 2.1.4 Threads and Multithreading 2.2 Memory Management 2.2.1 Memory Hierarchy and Address Binding 2.2.2 Logical and Physical Address Spaces 2.2.3 Memory Allocation Techniques 2.2.4 Virtual Memory Concepts and Paging Unit 3. Introduction of Linux 3.1.Introduction of Linux versions 3.2.Components of Linux 3.3.Comparison of Windows and Linux Unit 4. Linux Administration 4.1. Installing Linux 4.2. Installation of Open Source Software 4.3.Maintaining User Accounts 4.4.System Config Services (Package) Unit 5. Device Management and 5.1.Device Management Function 5.2.Device Characteristics 5.3.Disk space Management 5.4.Allocation and Disk Scheduling Methods								

Reference Books	1. Operating System Concepts: – James Peterson: – McGraw Hill 2. Operating System: – Stallings - PHI 3. Operating System Principles: – Silberschatz, Galvin, Gagne - Willey, India 4. Operating Systems – A. S. Godbole – Tata McGraw Hill 5. Linux – The Complete Reference – Richard Petersen – Tata McGraw Hill 6. "Operating System Concepts" Author: Abraham Silberschatz, Greg Gagne, Peter B. Galvin ISBN: 978-1118063330 Publisher: Wiley 7. "Linux System Programming: Talking Directly to the Kernel and C Library" Author: Robert Love ISBN: 978-1449339531 Publisher: O'Reilly Media 8. "Linux Bible" Author: Christopher Negus ISBN: 978-1118999875 Publisher: Wiley 9. "Understanding the Linux Kernel" Author: Daniel P. Bovet, Marco Cesati ISBN: 978-0596005658 Publisher: O'Reilly Media 10. "Linux Command Line and Shell Scripting Bible" Author: Richard Blum ISBN: 978-1118983843 Publisher: Wiley
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. 50% External assessment.

Course Code: 204
Course Title: Programming Skills

Course Code	204									
Course Title	Programming Skills									
Credits	4									
Course Category	Major Course									
Level of Course	200-299 (Intermediate Level)									
Teaching per Week	4 Hrs.									
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)									
Review / Revision	2022-2023									
Implementation Year:	A.Y. 2023-2024									
Purpose of Course	- To understand concepts of programming using Compiler based programming language C and Interpreter based programming Language Python. - To compare the code structures of Compiler based programming language ‘C’ and interpreter based programming language ‘Python’. [Python codes can be executed using any open source IDE. This is not IDE specific course.]									
Course Objective	i) Advance programming skills using compiler based programming language C. ii) Introduction of Interpreter based Programming language Python. iii) Enhancing basic programming skills using Interpreter based and Compiler based programming languages									
Pre-requisite	Fundamental knowledge of computer programming using ‘C’ language. Knowledge of Python and Python IDE installation is recommended.									
Course Outcomes	CO1: Students will be able to learn advanced programming concept of compiler based programming language. CO2: Students will be proficient working on conditional statements, iterative Statements and fundamentals of programming concepts using C and Python. CO3: Students will be able to represent compound data using lists, tuples and dictionaries in Python programs. CO4: Students will be able to develop real world application. CO5: Students will learn important libraries like Numpy, Pandas which are useful in Data analysis, Machine Learning.									
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
	CO1									
	CO2									
	CO3									
	CO4									
	CO5									
Course Outcome	- On completion of the course, the Students will be conceptually clear about the two dimensional arrays, structures and unions using ‘C’ programming language. - Concept of conditional statements, iterative Statements and fundamentals of programming concepts using Python.									
Course Content	UNIT-1: Arrays, Structure & Union and User defined function in C programming Language 1.1 Concepts of Two-Dimensional Numeric Array 1.1.1 Declaring Two-Dimensional numeric array 1.1.2 Two-Dimensional numeric Array operations (Addition, Subtraction, Multiplication, Transpose)									

- 1.1.3 Element Address in array(Row major and Column major)
- 1.1.4 Two-Dimensional Character Array:
 - 1.1.4.1 Declaring& Initializing Two-Dimensional character array
 - 1.1.4.2 Two-Dimensional character Array operations (Searching elements, copying, merging, finding length of given string)
- 1.2 Concepts of structure and Union
 - 1.2.1 Defining, declaring and Initializing structure and Union
 - 1.2.2 Typedef and accessing structure member
 - 1.2.3 Difference between structure and union
- 1.3 User defined functions
 - 1.3.1 Function return type, parameter list, local function variables
 - 1.3.2 Passing arguments to function
 - 1.3.3 Calling function from main() function or from other function.
 - 1.3.4 Function with No arguments and no return value, No arguments and are turn value, with arguments and no return value, with arguments and are turn value.
 - 1.3.5 Recursive Function

UNIT-2: Python Fundamentals

- 2.1 Concepts of Interpreter based programming language
 - 2.1.1 Structure of Python Programming language.
 - 2.1.2 Python code Indention and execution
- 2.2 Python Variables
 - 2.2.1 Naming of variables and Dynamic declaration of variables
 - 2.2.2 Comments in Python
 - 2.2.3 Assigning values to multiple variables
 - 2.2.4 Global variables
- 2.3 Python Data types
 - 2.3.1 Text(str), Numeric Type(int, float, complex), Boolean(bool)
 - 2.3.2 Setting Data types
 - 2.3.3 Type conversion(int, float, complex), casting(int, float, str)
- 2.4 User defined function.
 - 2.4.1 Defining function, Function with Parameters
 - 2.4.2 Parameter with default value, Function with return value

UNIT-3: Python Strings and Operators

- 3.1 Python Strings
 - 3.1.1 Multiline string, String as character array, triple quotes
 - 3.1.2 Slicing string, negative indexing, string length, concatenation
 - 3.1.3 String Methods: (centre, count, join, len, max, min, replace, lower, upper, replace, split)
- 3.2 Operators
 - 3.2.1 Arithmetic Operators(+, -, *, /, %, **, //)
 - 3.2.2 Assignment Operators(=, +=, -=, /=, *=, //=)
 - 3.2.3 Comparison Operators (==, !=, >, <, >=, <=)
 - 3.2.4 Logical Operators(and, or, not)
 - 3.2.5 Identity and member operators(is, is not, in, not in)

UNIT-4: Python conditional and iterative statements

- 4.1 If statement, if..elif statement, if..elif...else statements, nested if

	4.2 Iterative statements 4.2.1 While loop, nested while loop, break, continue statements. 4.2.2 for loop, range, break, continue, pass and Else with for loop, nested for loop. 4.3 List: creating list, indexing, accessing list members, range in list, List methods (append, clear, copy, count, index, insert, pop, remove, reverse, sort). UNIT-5: Python Collections and Library 5.1 Python Collections 5.1.1 Tuples: Declaring tuple, indexing tuple, changing tuple values, adding and removing data from tuple, Use of tuple() method to create tuple, count() and index() methods. 5.1.2 Sets: declaring set, access set data, set methods (add, clear, copy, discard, pop, remove, union, update). 5.1.3 Dictionary 5.1.3.1 Creating Dictionary, Adding, Accessing and Removing element 5.1.3.2 Dictionary methods: get(),pop(), popitem(),clear(),copy() 5.2 Introduction to Numpy and Pandas 5.2.1 Overview of numpy 5.2.1.1 Numpy methods (Mean, Median, Mode, Standard Deviation and Variance) 5.2.1.2 Implementation of Numpy methods on numeric data set created using list. 5.2.2 Pandas Dataframe 5.2.2.1 Creating dataframe using list 5.2.2.2 Creating dataframe using dict of equal length list 5.2.2.3 Reading data using csv file(read_csv()) 5.2.2.4 Retrieving rows and columns from data frame using index 5.2.2.5 Retrieving rows and columns using loc and iloc functions.
Reference Books	1.Programming in C, Balaguruswami - TMH 2. C Programming Language, Kernigham & Ritchie - TMH 3. The spirit of C, Cooper H & Mullish H - Jaico Pub. 4. Programming in C, Stephan Kochan - CBS 5. Mastering Turbo C, Kelly & Bootle - BPB 6. C Language Programming, Byron Gottfried –TMH 7. Learning Python -Mark Lutz : O'Reilly Media 8. Core Python Programming – by Wesley J Chun ISBN-13: 978- 0132269933 9. Python for Everybody: Exploring Data in Python 3, by Charles Severance (Author), Aimee Andrion (Illustrator), Elliott Hauser (Editor), Sue Blumenberg (Editor) 10. An Introduction to Python - by van Rossum Guido ISBN: 9780954161767, 0954161769 11. Core Python Application Programming – by Wesley J Chun Prentice Hall
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. 50% External assessment.

Course Code: 205-04
Course Title: Concepts of Relational Database Management System

Course Code	205-04								
Course Title	Data Analysis using Python								
Credits	4								
Course Category	Major Course								
Level of Course	200-299 (Intermediate Level)								
Teaching per Week	4 Hrs. (2 Hours Theory + 4 Hours Practical work)								
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)								
Implementation Year:	A.Y. 2024-2025								
Purpose of Course	This course aims to equip learners with foundational skills in data analytics using Python. Student will learn to manipulate and analyse data stored in CSV files, perform descriptive and inferential statistics, and visualize data to uncover insights. Through hands-on projects and practical examples, students will gain proficiency in using key Python libraries such as Pandas, NumPy, and Matplotlib. By the end of the course, learners will be prepared to apply data analytics techniques to real-world problems, enhancing their ability to make data-driven decisions.								
Pre-requisite	Basic knowledge of programming Language								
Course Outcomes	CO1: Data Manipulation Proficiency: Students will be able to efficiently read, clean, and pre-process data from CSV files using Python, ensuring data is ready for analysis. CO2: Descriptive Statistics Mastery: Students will gain the ability to compute and interpret key descriptive statistics, providing a solid understanding of the dataset's characteristics. CO3: Students will be capable of creating informative and compelling data visualizations using libraries like Matplotlib and Seaborn, aiding in the communication of data insights. CO4: Students will learn to conduct thorough exploratory data analyses to identify patterns, correlations, and anomalies within datasets. CO5: Students will be able to apply learned data analytics techniques to real-world problems, performing analyses that support data-driven decision-making in various domains.								
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								

Course Content	Unit 1: Queries using SQL 1.1 Single Table queries : 1.1.1 Using where clause and operators with where clause: 1.1.1.1 In, between , like, not in, =, !=, >, =, <=, wildcard operators 1.1.1.2 Order by, Group by, Distinct 1.1.1.3 AND, OR operators, Exists and not Exists 1.1.1.4 Use of Alias Unit 2: Multiple Table handling : 2.1 Joining tables 2.2 Types of Joins : Outer join, inner join, full outer, full inner, self join 2.2.1 Performing queries by joining tables 2.3 SQL Functions : 2.3.1 Aggregate Functions: avg(), max(), min(), sum(), count(), first(), last(). 2.3.2 Scalar Functions: ucase(), lcase(), round(), mid(). 2.4 Creating sequence 2.5 Views : 2.5.1 Creating simple view, updating view, dropping view. 2.5.2 Difference between View and Table. Unit 3 : Working with CSV files : 3.1 Using `sqlite3` module to interact with SQLite databases 3.2 Executing SQL commands from Python 3.3 Fetching data from a database 3.4 Error handling and transactions 3.5 Understanding CSV format 3.5.1 Reading CSV files using the `csv` module 3.5.2 Writing CSV files using the `csv` module Unit 4 : Data Manipulation using Pandas 4.1 Introduction to the `pandas` library 4.1.1 DataFrame operations (creating, modifying and querying DataFrames) 4.1.2 Converting DataFrames to CSV 4.1.3 Converting CSV to DataFrames 4.2 Exporting queried data to a CSV file 4.3 Using `SQLAlchemy` for database operations 4.4 Handling large datasets Unit-5 : Basics for Data Analysis* 5.1 Introduction to Jupyter Notebooks 5.2 Data Cleaning and Pre-processing 5.2.1 Handling missing values 5.2.2 Data Type conversions 5.2.3 Removing duplicates, Data normalization and scaling 5.2.4 String operations and parsing Dates. 5.3 Exploratory Data Analysis (EDA) 5.3.1 Descriptive Statistics Using Python on CSV Files 5.3.1.1 Definition and importance 5.3.1.2 Types of descriptive statistics: 5.3.1.3 Measures of central tendency (mean, median, mode) 5.3.1.4 Measures of variability (range, variance, standard deviation) 5.3.1.5 Measures of shape (skewness, kurtosis) 5.3.1.6 Measures of frequency (count, frequency distribution) *[Using Python libraries : `pandas`, `numpy`, `scipy`, `matplotlib`]
Reference Books	1. "Python for Data Analysis", Wes McKinney, O'Reilly Media, ISBN: 978-1491957660 2. Pandas for Everyone: Python Data Analysis" Daniel Y. Chen, Pearson, ISBN: 978-0134546933 3. "Python Data Science Handbook", Jake VanderPlas, O'Reilly Media, ISBN: 978-1491912058

	4. "Data Science from Scratch: First Principles with Python", Joel Grus, O'Reilly Media, ISBN: 978-1492041139 5. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", Aurélien Géron, O'Reilly Media, ISBN: 978-1492032649 6. "Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python", Peter Bruce, Andrew Bruce, and Peter Gedeck, O'Reilly Media, ISBN: 978-1492072942 7. "Python Machine Learning", Sebastian Raschka, Vahid Mirjalili, Packt Publishing, ISBN: 978-1789955750 8. "Think Stats: Exploratory Data Analysis in Python", Allen B. Downey, O'Reilly Media, ISBN: 978-1491907337 9. "Data Visualization with Python and JavaScript: Scrape, Clean, Explore & Transform Your Data", Kyran Dale, O'Reilly Media, ISBN: 978-1491920510 10. "Machine Learning Yearning", Author: Andrew Ng, Publisher: Self-published (available online as a free PDF online)
Teaching Methodology	Lectures, hands-on labs, individual assignments, and group projects to foster collaborative learning and practical application of concepts.
Evaluation Method	50% Internal assessment. 50% External assessment..

Course code: 206
Course Title: Skill Enhancement Course (SEC-02)

Course Code	206
Course Title	Skill Enhancement Course - II (SEC – 02)
Credit	2
Category of Course	Skill Enhancement Course
Level of Course	100-199 (Foundation / Introductory)
Teaching per Week	2 Hrs (Any or Combination of Theory/Practical/Fieldwork/Internship/Project)
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)
Review / Revision	-
Implementation Year:	A.Y. 2023-2024
Purpose of Course	- As per NEP(National Education Policy-2020), it is mandatory for students to select a 2 credit Skill Enhancement Course out of the choices given by the college/institute. - It will be mandatory for the student to opt minimum one 2-credit Skill Enhancement Course out of the list of offered courses recognised by the University during semester-1 to semester-5. - The student can start an alternative career in the field by obtaining higher degree of knowledge in the area. - It's aimed at imparting practical skills, embedded internship, hands-on training, soft skills, life skills, such approved online courses etc. to enhance the employability of students. This may also include courses as per the need of new evolving technology.
Course Objective	Obtaining skill in particular field along with the regular curriculum of the selected program is essential. It not only enhance the skill but also provide an opportunity to develop skill in particular area where one can pursue career in future. Skill enhancement provides the opportunity and knowledge for an individual to develop and strengthen the necessary skills to gain, maintain, and advance in a chosen area. Skill enhancement programs are focused around training that combines the best practices from varieties of areas. Skill enhancement or training typically uses a combination of cognitive and behaviour problem solving approaches, both of which are used to strengthen a person's positive skill develop.
Pre-requisite	-
Course outcome	CO1: Student select the area of skill as per his/her interest. The choices will be given by the institute/department. CO2: The student acquire basic and fundamental level of knowledge in the field that the student opted. CO3: Understand the insight of the area and possibility of to explore more in the field. CO4: Understand effective representation of problems in terms addressing the problems. CO5: Learn to upskill and upgrade the knowledge in the area of selected subject.
Course Content and Implementation road-map.	(i) University has categorised and prepared the basket of the courses including approved online courses that can be offered as Skill Enhancement Course. (ii) The institute/college/department can design and implement skill enhancement course by getting approval from the relevant apex body of the university considering the SOP of the certificate course policies of the University. (iii) The institutes/college/departments can select more than one course out of the given sets of courses and offer them to their students.

	(iv) The students can select any of the courses offered by the institute/college/department from the given choices and enrol for the course. (v) The institute/college/department will arrange appropriate resource person(s) for the course. (vi) The course performance evaluation of student will be taken place at the college/institute/department level based on the nature of the course. (vii) The institute/college/department will assess the student based on the nature of the course. The student will be granted the credits on successful completion of the course.
Reference Books	- The reference materials and books will be decided by the Institutes/Colleges/Departments based on the selected Courses. - Minimum five copies of relevant topics are recommended to keep in the library.
Teaching Methodology	Class Work/ Discussion/ Self-Study/ Seminars/ field works/ practical training/ field work and/or Assignments.
Evaluation Method	50% Internal assessment. 50% External assessment. Maximum Marks: 50

Course code: 207
Course Title: Value Addition Course-II (VAC-02)

Course Code	207
Course Title	Value Addition Course - II (VAC – 02)
Credit	2
Category of Course	Value Addition Course
Level of Course	100-199 (Foundation / Introductory)
Teaching per Week	2 Hrs (Any or Combination of Theory/Practical/Fieldwork/Internship/Project)
Minimum weeks per Semester	15 (Including class work, examination, preparation etc.)
Review / Revision	-
Implementation Year:	A.Y. 2023-2024
Purpose of Course	As per NEP(National Education Policy-2020), it is mandatory for students to select a 2 credit Value Addition Course out of the choices given by the college/institute. It will be mandatory for the student to opt minimum one 2-credit Value Addition Course out of the list of offered courses recognised by the University during semester-1 to semester-4. The student can start an alternative career in the field by obtaining higher degree of knowledge in the area.
Course Objective	Obtaining knowledge in all or any of the components/fields like (i) Understanding India (ii) Environmental Science/Education (iii) Digital/Technological solutions (iv) Health & Wellness, Yoga education, sports, and fitness are essential for holistic development (v) Indian Knowledge system (IKS). The course components should be among these five categories/fields and as per the Curriculum and Credit Framework for Undergraduate Programmes of the UGC (Page-22 of the document). The purpose is to impart knowledge and understand the necessities of these aspects in life to make the healthy society and nation. It help in development of a dedicated and responsible citizen of the country by adding value to the life.
Pre-requisite	-
Course outcome	CO1: Student select the area of Value addition as per his/her interest. The choices will be given by the institute/department. CO2: The student acquire basic and fundamental level of knowledge in the field that the student opted. CO3: Understand the insight of the area and possibility of to explore more in the field. CO4: Understand effective representation of problems, solutions and insights of the challenges and problems of the peer subject relevant to value addition. CO5: Learn to upskill and upgrade the knowledge in the area of selected subject.
Course Content and Implementation road-map.	(viii) The university has categorised and prepared the list of the courses that can be offered as Value Addition Course. (ix) The institute/college/department can design and implement skill enhancement course by getting approval from the relevant apex body of the university considering the SOP of the certificate course policies of the University. (x) The institutes/college/departments can select more than one course out of the given sets of courses and offer them to their students. (xi) The students can select any of the courses offered by the institute/college/department from the given choices and enrol for the course. (xii) The institute/college/department will arrange appropriate resource person(s) for the course. (xiii) The evaluation will be taken place at the college/institute/department based on the nature of the course.

	(xiv) The institute/college/department will assess the student based on the nature of the course. The student will be granted the credits on successful completion of the course.
Reference Books	- The reference materials and books will be decided by the Institutes/Colleges/Departments or as per the university guidelines based on the selected Courses. - Minimum five copies of relevant topics are recommended to keep in the library.
Teaching Methodology	Class Work/ Discussion/ Self-Study/ Seminars/ field works/ practical training/ field work and/or Assignments.
Evaluation Method	50% Internal assessment. 50% External assessment. Maximum Marks: 50

Internship: Student willing to exit the program at the end of the two semesters and to avail the Certificate in Computer Application or exit the program at the end of the first four semesters and to avail the Diploma in Computer Application, it is essential to acquire four credits from internship. A key aspect of the internship is induction into actual work situations. Internships involve working with local industry, government or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning. In option to these internships, the student can avail such four credits by availing two 2-credit university approved courses during any of these semesters. The student is required to enroll and avail these 4-credits and produce the evidence in process to opt the multi-level exit option after successfully completion of first year (two semester) or second year(four semesters).

Guidelines for Question paper style

- 1) Ideally each unit of the course should carry equal weightage of marks. However, it will vary upon the content of the units of the course.**
- 2) The major and minor course's question papers will carry 70 marks and of 3 hours of exam duration.**
- 3) The objective of the written/theory exams for all courses are to analyze the student's understanding about the course contents, assessing the conceptual knowledge about the course contents and ability to explain the concepts in written forms.**
- 4) As the practical exams are conducted separately and viva-voce is also a part of the practical exam, the concepts and practical knowledge can be analyzed through the practical exams.**
- 5) Since the subjects/courses are technical in nature, the major objective is to evaluate conceptual and technical knowledge for major and minor courses instead of expecting student's ability to write lengthy literature writing skills and abilities.**
- 6) 20% of questions are recommended to ask from objective/short questions types having weightage of 1 to 2 marks per question. Purpose of such question is to analyze precise understanding for the topics/points/concepts.**
- 7) 30% of questions are expected to ask from short questions to answer in few lines having weightage of 3 to 4 marks. Purpose of such questions are to analyze conceptual understanding for the topics/points/concepts that can be describe in short.**
- 8) 50% of questions are expected to ask from long/descriptive/Short-notes questions to answer using charts/graphs/block diagrams/flowcharts/models having weightage of 5 to 7 marks. Purpose of such questions are to analyze the depth knowledge and ability to explain in detail emphasizing technical knowledge.**
- 9) The evaluation by the examiner expected to evaluate overall technical understanding of the student, ability to express the technical and conceptual knowledge, clarity of thoughts and understanding of the subject and concepts.**

B.C.A. (Honours) and B.C.A.(Honours) with specialization :

(I) Objective :

Looking at the current need of software industry and emerging need in specialization The student can pursue either pure applied program B.C.A. (Honours) or "B.C.A. (Honours)" program with specializations in "B.C.A. in Cyber Security and Data Protection," "B.C.A. in A.I. and Data Analytics," "B.C.A. in Semiconductor, Sensors, and IoT" or "B.C.A. in Data Science and Analytics".

(i) Comprehensive Skill Development: The program aims to provide students with comprehensive knowledge and practical skills in computer science and information technology, enabling them to excel in diverse career paths within the IT industry.

(ii) Specialization Opportunities: By offering specializations in Cyber Security and Data Protection, A.I. and Data Analytics, and Semiconductor, Sensors, and IoT, the program caters to the growing demand for specialized skills in these emerging fields of technology.

(iii) Addressing Industry Needs: The specialization courses are designed to address specific industry needs and trends, ensuring that students are equipped with the latest technologies, tools, and techniques relevant to their chosen field of specialization.

(iv) Future-Ready Skillset: The program aims to equip students with future-ready skills and competencies, enabling them to adapt to technological advancements and industry disruptions in the rapidly evolving IT landscape.

(v) Industry Collaboration and Internship Opportunities: Collaboration with industry partners and internship opportunities provide students with real-world exposure, practical experience, and networking opportunities, enhancing their employability and readiness for the IT industry.

(vi) Research and Innovation: Encouraging research and innovation initiatives within the program fosters creativity, critical thinking, and problem-solving skills among students, driving technological advancements and contributing to the growth of the IT industry.

(vii) Global Perspective: By offering a global perspective through industry-relevant curriculum, international collaborations, and exposure to best practices and trends, the program prepares students to compete and succeed in the global IT market, opening up opportunities for international careers and collaborations.

(II) Specialization Programs :

B.C.A. (Honours) Program with specialization in Data Science and Analytics :

Objectives:

Foundational Knowledge in Computing and Data Science: Equip students with a strong foundation in computer science principles, programming languages, and mathematical techniques essential for data science and analytics.

Proficiency in Data Analysis Tools and Techniques: Develop students' skills in using modern data analysis tools and techniques, including data cleaning, manipulation, visualization, and statistical analysis, with a focus on practical applications.

Advanced Analytical and Problem-Solving Skills : Foster the ability to apply advanced analytical methods, machine learning algorithms, and statistical models to solve complex, real-world problems across various domains.

Ethical and Responsible Data Handling: Instill a deep understanding of ethical issues, data privacy, and responsible data handling practices, ensuring students are prepared to address ethical challenges in data science.

Industry Readiness and Professional Development: Prepare students for successful careers in data science and analytics by providing industry-relevant projects, internships, and exposure to the latest trends and technologies, enhancing their employability and professional growth.

Suggested Courses to Cover :

1. Introduction to Computer Science
2. Mathematics for Computing
3. Programming in C/Python/C++
4. Basics of Electronics
5. Data Structures and Algorithms
6. Digital Electronics
7. Microprocessors and Microcontrollers
8. Sensors and Actuators
9. Embedded Systems
10. Internet of Things (IoT) Fundamentals
11. Signal Processing
12. Wireless Communication
13. IoT Protocols and Standards
14. Semiconductor Devices and Technology
15. Advanced IoT Applications
16. Smart Sensors and MEMS (Micro-Electro-Mechanical Systems)
17. Cloud Computing for IoT
18. Minor Project
19. IoT Security and Privacy
20. Industrial IoT
21. Emerging Technologies in Semiconductors and IoT
22. Major Project

(III) Eligibility of offering specialization programs :

As per the criteria mentioned in Framework of B.C.A. (Specialization) programs.

(IV) Student's Eligibility :

All students who possess the eligibility to enroll for B.C.A. are eligible to pursue the B.C.A. in specialization program. Student can select group of major courses from the Table-4 and acquired desired credits to become eligible for degree with specialization.

(V) Number of Courses and Credits essential for Specialization Program:

- > **For F.Y.:** Total 2 courses (in specialization subject) consists of 8 credits (4 each for both semester).
- > **For S.Y.:** Total 4 courses (in specialization subject) consists of 16 credits (8 each for both semester).
- > **For T.Y.:** Total 6 courses (in specialization subject) consists of 24 credits (12 each for both semester).
- > **For Fourth Year :** Total 32 credits (in specialization subject) (16 each for both semester).

To obtain the B.C.A. with specialization degree, total 48 credits need to obtain in major subjects relevant to specialization program.

To obtain the B.C.A.(Hons.) with specialization degree, total 48 credits need to obtain in major subjects relevant to specialization program.

(VI) Multi-level Entry and Exit option as per NEP-2020:

- iv) **Under Graduate Certificate in specialization program:** If the student wish to exit after completion of First year (Semester-1 and Semeter-2) without any back-log and secure additional 4 credits from work based skill oriented university approved courses /vocational courses / summer internship / Apprenticeship in addition to 6 credits from skill-based courses earned during first and second semester.
- v) **Diploma in Specialization program:** If the student wish to exit after completion of Second year (Semester-1 to Semeter-4) without any back-log and secure additional 4 credits from work based skill oriented university approved courses /vocational courses / summer internship / Apprenticeship offered at end of first or second year in addition to 6 credits from skill-based courses earned during first four semesters.
- vi) **B.C.A. (Bachelor's in Computer Application) (in Specialization Program) :** If the student wish to exit after completion of Third year (Semeste-1 to semester-6) without any back-log and secure additional 4 credits from work based skill oriented university approved courses /vocational courses / summer internship / Apprenticeship offered at end of first or second year in addition to 6 credits from skill-based courses earned during first four semesters.

NOMENCLATURE of DEGREE on MULTI-LEVEL EXIT :

	Exit after Completion of F.Y.	Exit After Completion of S.Y.	Exit After Completion of T.Y.	Exit After Completion of Fourth Year (Hons.)
1	Certificate in Data Science and Analytics	Diploma in Data Science and Analytics	B.C.A. (Data Science and Analytics)	B.C.A.(Hons.)(Data Science and Analytics)

(VII) Internship:

It is mandatory to undergo an Internship for all students and acquire four credits before entering to 2nd year from 1st year and 3rd year from 2nd year. A student who wish to exit after successfully completion of first year (Semester-1 and Semester-2) without any backlog is required to obtain Four credits at the end of the year either through the summer internship or university approved skill based certificate courses(two courses of 2-credits each or one 4-credit course). Student is required to enrol for the certificate courses separately by paying the course fees as decided by the college/institute. For summer training, the Institute/college will grant the permission and evaluate the training outcomes. Based on satisfactory completion of the summer training, the Institute head will recommend to the university to grant four credits for summer training. The Internship/summer training/skill based certificate courses will be an audit course.[The internship cost/fees will be bear by the student.]

(VI) Fees for the specialization program:

As per the fees mentioned in Framework for specialized program B.C.A.(A.I. and Data Analytics)

Table-4**(Students are required to opt following courses to avail degree in Data Science and Analytics)**

Year	Semester	Specialization Program	Course Code	Type of Course	Course Level	Credits
F.Y.	I	Data Science and Analytics	105-04	Major	200-299	4
	II		205-04	Major	200-299	4
S.Y.	III		304-07	Major	300-399	4
			305-07	Major	300-399	4
	IV		404-07	Major	300-309	4
			405-07	Major	300-399	4
T.Y.	V		503-07	Major	400-499	4
			504-07	Major	400-499	4
			505-07	Major	400-499	4
	VI		602-07	Major	400-499	4
			603-07	Major Project	400-499	8
Fourth Year (For Honours Degree)			Need to Acquire 18 credits from Semester-7 and Semester-8 from specialization courses.		500-599	18
➤ Students must acquire 8 credits from Major courses relevant to Data Science and Analytics in First Year and 4 credits from Internship to avail exit option and certificate.						
➤ Students must acquire 8 credits from Major courses relevant to Data Science and Analytics in First Year, 16 credits from Major courses relevant to Data Science and Analytics in Second Year and 4 credits from Internship to avail exit option after second year and Diploma.						
➤ Students must acquire 8 credits from Major courses relevant to Data Science and Analytics in First Year, 16 credits from Major courses relevant to Data Science and Analytics Second Year, 24 credits from Major courses relevant to Data Science and Analytics in Third Year and 4 credits from Internship to avail exit option after Third year and B.C.A.(Cyber Security and Data Protection) Degree.						
➤ Students must acquire 8 credits from Major courses relevant to Data Science and Analytics in First Year, 16 credits from Major courses relevant to Data Science and analytics in Second Year, 24 credits from Major courses relevant to Data Science and Analytics in Third Year, 32 credits from Major courses relevant to Data Science and Analytics in Fourth Year and 4 credits from Internship to avail B.C.A.(Honours)(Data Science and Analytics) degree.						

