Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Empowered Autonomous)

Four Year Degree Program in BBA (CA)

(Faculty of Commerce and Management)

CBCS Syllabus

TYBBA (C.A.) Semester -V

For Department of BBA (Computer Application)

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2025-2026

Title of the Programme: T.Y.BBA (Computer Application)

Preamble

AES‟s Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of BBA (Computer Application) and related subjects, the Board of Studies in BBA (Computer Application) at Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the fourth semester of T.Y. BBA (Computer Application), which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designedunder the framework of the Choice Based Credit System (CBCS), taking into considerationthe guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

BBA (Computer Application) is Undergraduate Degree Program with Computer Applications and Management Subjects. This program provides sound knowledge of theory and practical‟s. The different subjects helps the students to design, develop and implement software Applications, to learn emerging computer technologies and produce skilled human resource to face the professional challenges.

Overall, revising the BBA (Computer Application) syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Outcome For NEP 2020 (With Effect from June 2025-26)

Commerce and Management (Under Graduate Programme)

PO1: A Fundamental Knowledge and Coherent Understanding:

Student should be able to acquire broad multidisciplinary knowledge in different educational domains and their links to various field of study like Banking, Accounting, Management, Logistics, Marketing, Human Resource Management and Computer Science and Applications.

PO2: Procedural Knowledge for Skill Enhancement:

Students should be able to acquired complete procedural knowledge for deep understanding of every subject and enhancing the subject skills.

PO3: Critical Thinking and Problem-Solving Skills:

Students should be able to solve all types of issues in both known and unknown circumstances, as well as apply what they have learned to real-life situations. Students will be able to conduct investigation on complex problem solving through the design of experiments, analysis and interpretation of data to arrive at valid conclusion.

PO4: Communication Skills:

With the help of various languages students will enhance the communication skills which will improve the personality of the students with the help of interpersonal and intrapersonal communication skills. Students should be able to construct logical arguments using correct technical language related to a field of learning. Also Students should be able to communicate effectively, analyze the concepts and participate in healthy arguments and portray skill in communication and in writing. Possess skills related with banking and other business.

PO5: Analytical Reasoning Skills:

The students should be able to demonstrate the capability to evaluate the reliability and relevance of situation and select the proper course of action. Strengthen analytical skills in business operations and analyze the positive aspects and limitations of conducting trade and trade-related activities according to their extensive knowledge.

PO6: Innovation, Employability and Entrepreneurial Skills:

The students should be able to identify opportunities and pursue those opportunities to create value and wealth for the betterment of the individual and society at large as well as be suitable for employment, as an entrepreneur focused, and serve as a role model for ethical and responsible economic professionals.

PO7: Multidisciplinary Competence:

The student should be able to demonstrate the acquisition of knowledge of the values and beliefs of multiple disciplines. The student should be able to perceive knowledge as an environmental friendly, extensive, interconnected, and interconnected faculty of consciousness that encourages design, interpersonal, and empathetic and understanding environmental challenges across disciplines.

PO8: Value Inculcation through Community Engagement:

The students should be able to implement the acquired knowledge and attitude to embrace constitutional, humanistic, ethical, and moral values in life. Students should be able to participate in community-engaged activities for promoting the well being of the society.

PO9: Traditional Knowledge into Modern Application:

Students should be able to acquire and apply traditional knowledge system in to modern and professional domain.

PO10: Design and Development of System:

Students should be able to design and develop efficient solutions for complex real world computing problems and design system components or processes that meet the specifies needs with appropriate consideration for public health and safety and the cultural, social and environmental considerations.

PO11: Ethical and Social Responsibility:

Students should be able to acquire knowledge of ethics and ethical standards and an ability to apply these with a sense of responsibility within the workplace and community. Understand and accept the moral aspects, accountability, and value system for a nation and society. Students should be able to demonstrate academic accountability, intellectual authenticity, and personal integrity. Students also acquire abilities to comprehend and implement professional ethics.

PO12: Research-Related skills:

The students should be able to acquire the understanding of basic research process, methodology and ethics in practicing personal and social research work, regardless of the field of study

PO13: Teamwork:

The students should be able to able to work constructively, cooperatively, effectively and respectfully as part of a team.

PO14: Area Specific Expertise:

The students should be able to apply various subjective concepts, theories and model in the area of Accounting, Taxation, Marketing, Finance and Human Resource Management, Computer after better understanding of the subject and its contents.

PO15: Environmental Awareness:

The students should be able to manage environmental- related risk from an organization's operation as well as identify environmental hazards affecting air, water and soil quality. The students should be able to manage and controls to reduce and eliminate environmental risk.

Programme Specific Outcomes (PSOs)

PSO1. **Knowledge:** To understand and apply the fundamental principles, concepts, and methods in diverse areas of computer science, computer applications, management,mathematics, statistics, etc.

PSO2. **Problem Analysis:** Identify, analyze and formulate complex real-life computing problems. Attain substantiated conclusions to solve the problems using fundamentalprinciples of computer science and application domains by using various tools and emerging technologies.

PSO3. **Design and Development:** Design and develop efficient solutions for complex real-world computing problems and design system components or processes that meet thespecified needs with appropriate consideration for public health and safety and the cultural, societal, and environmental considerations.

PSO4.**Conduct investigations of complex problems:** Ability to research, analyze and Investigate complex computing problems through the design of experiments, analysis, and interpretation of data, and synthesis of the information to arrive at valid conclusions.

PSO5. **Modern Tool Usage:** Create, identify and apply appropriate techniques, skills, andmodern computing tools to computing activities.

PSO6.**Ethics and Social Responsibility:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

PSO7.**Individual and Team Work:** Ability to work effectively as an individual, and as a member or leader as per need in, multidisciplinary teams.

PSO8.**Life-Long Learning:** Recognize the need and have the ability to engage in Independent continuous reflective learning in the context of technological advancement.

PSO9. **Project Management:** Understand and apply computing, management principles to manage projects.

PSO10.**Communication:** Able to use interpersonal skills and communicate effectively with the professionals and with society to convey technical information effectively and accurately and able to comprehend and write effective reports, design documentation,and make effective presentations.

PSO11.**Innovation, employability, and Entrepreneurial skills:** Identify opportunities, and pursue those opportunities to create value and wealth for the betterment of the individual and society at large.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Empowered Autonomous)

Board of Studies (BOS) in BBA (Computer Application)

From 2025-26 to 2027-28

Sr. No.	Name	Designation
1.	Ms. Madhuri Saste	Chairman
2.	Ms. Reshma Babar	Member
3.	Mrs. Ashwini Bhosale	Member
4.	Mr. Dattatray Aarde	Member
5.	Ms. Trupti Bhosale	Member
6.	Mrs. Salma Shaikh	Member
7.	Dr. Shashikant Nakate	Member
8.	Mr.Vishal Shaha	Member
9.	Dr. Poonam Ponde	Expert from SPPU Pune
10.	Dr. Sagar Jambhorkar	Expert from other University
11.	Dr. Kamlesh Meshram	Expert from other University
12.	Mr. Akshay Jaisinghani	Industry Expert
13.	Mrs.Pooja Shinde	Meritorious Alumni
14.	Ms. Harshada Pingle	Student Representative
15.	Mr. Swapnil Kale	Student Representative

Credit Distribution Structure for T.Y.BBA (Computer Applications) 2025-2026

Level	Semester	Major		Minor	VSC, SEC, (VSEC)	OJT, FP, CEP, CC, RP	Cum. Cr / Sem	Degree/ Cum.Cr.
		Mandatory	Electives					
4.5	V	BBACA-301-MJM: Data Analytics Using Python (2 credits)	BBACA-306-MJE(A): Software Project Management (2 credits)	BBACA-311-MN: Digital Marketing (2 credits)	BBACA-321-VSC: Practical Lab on .Net Framework (2 credits)	BBACA-335-FP: Field Project (2 credit)	22	UG Certificate 44 credits
		BBACA-302-MJM: .Net Framework (2 credits)	BBACA-306-MJE(B) Block Chain (2 credits)	BBACA-312-MN: Practical Lab on Digital Marketing (2 credits)				
		BBACA-303-MJM: Cloud Computing (2 credits)	BBACA-306-MJE(C): Digital Image Processing (2 credits)					
		BBACA-304-MJM: Cyber Security (2 credits)						
		BBACA-305-MJM: Practical Lab on Data Analytics Using Python (2 credits)						
	VI	BBACA-351-MJM Android Programming (2 credits)	BBACA-356-MJE(A): Machine Learning (2 credits)	BBACA-361-MN: Ecommerce (2 credits)		BBACA-385-OJT: On Job Training (4 credits)	22	
		BBACA-352-MJM:Data Mining (2 credits)	BBACA-356-MJE(B): Big Data (2 credits)	BBACA-362-MN : Practical Lab on Software tools for Business Communication (2 credits)				
		BBACA-353-MJM: Artificial Intelligence (2 credits)	BBACA-356-MJE(C): Recent trends in IT (2 credits)					

		BBACA-354-MJM : NoSQL (2 credits)						
		BBACA-355-MJM: Practical Lab on Android Programming (2 credits)						
	Cum Cr.	20	8	8	2	6	44	

Course Structure for T.Y.BBA (C.A.) (2023 Pattern)

Sem	Course Type	Course Code	Course Title	Theory/ Practical	Credits
V	Major Mandatory	BBACA-301-MJM	Data Analytics Using Python	Theory	02
	Major Mandatory	BBACA-302-MJM	.Net Framework	Theory	02
	Major Mandatory	BBACA-303-MJM	Cloud Computing	Theory	02
	Major Mandatory	BBACA-304-MJM	Cyber Security	Theory	02
	Major Mandatory	BBACA-305-MJM	Practical Lab on Data Analytics Using Python	Practical	02
	Major Elective (MJE)	BBACA-306-MJE(A)	Software Project Management	Theory (Any two)	04
	Major Elective (MJE)	BBACA-306-MJE(B)	Block Chain		
	Major Elective (MJE)	BBACA-306-MJE(C)	Digital Image Processing		
	Minor	BBACA-311-MN	Digital Marketing	Theory	02
	Minor	BBACA-312-MN	Practical Lab on Digital Marketing	Practical	02
	Vocational Skill Course (VSC)	BBACA-321-VSC	Practical Lab on .Net Framework	Practical	02
	Field Project(FP)	BBACA-335-FP	Field Project	Practical	02
				Total Credits Semester-V	**22**
VI	Major Mandatory	BBACA-351-MJM	Android Programming	Theory	02
	Major Mandatory	BBACA-352-MJM	Data Mining	Theory	02
	Major Mandatory	BBACA-353-MJM	Artificial Intelligence	Theory	02
	Major Mandatory	BBACA-354-MJM	NoSQL	Theory	02
	Major Mandatory	BBACA-355-MJM	Practical Lab on Android Programming	Practical	02
	Major Elective(MJE)	BBACA-356-MJE(A)	Machine Learning	Theory (Any two)	04
	Major Elective(MJE)	BBACA-356-MJE(B)	Big Data		
	Major Elective(MJE)	BBACA-356-MJE(C)	Recent trends in IT		
	Minor	BBACA-361-MN	Ecommerce	Theory	02
	Minor	BBACA-362-MN	Practical Lab on Software tools for Business Communication	Practical	02
	On Job Training(OJT)	BBACA-385-OJT	On Job Training	Practical	04
				Total Credits Semester-VI	**22**
				Total Credits Semester-V+ VI	**44**

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)
Programme Code : BBACA
Class : T.Y. BBA (C.A)
Semester : V
Course Type : Major Mandatory (Theory)
Course Code : BBACA-301-MJM
Course Title : Data Analytics using Python
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. Introduce fundamental concepts of Python programming, including data types, control structures, functions, and data manipulation techniques.
2. Provide an understanding of the basics of Data Science, including the Data Science process and various types of analytics.
3. Develop proficiency in data analysis and visualization using Python libraries such as NumPy, Pandas, and Matplotlib.
4. Introduce statistical concepts like probability, correlation, and regression for data-driven decision-making.
5. Explore data preprocessing techniques and data handling methods for effective analysis.
6. Provide hands-on experience in supervised and unsupervised machine learning techniques, including classification, regression, and clustering.
7. Enable students to apply Python programming and data science techniques to solve real-world problems.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Write Python programs using standard data types, control structures, and functions for various applications.

CO2. Understand the fundamental concepts of Data Science and apply different types of analytics.

CO3. Perform data analysis and manipulation using NumPy and Pandas, including data cleaning, merging, and transformation.

CO4. Utilize data visualization techniques with Matplotlib to represent data insights effectively.

CO5. Apply statistical inference methods and regression techniques to analyze data trends and patterns.

CO6. Implement machine learning algorithms, including decision trees, classification, regression, and clustering models.

CO7. Develop real-world projects involving Python programming, data analysis, and machine learning techniques.

Topics and Learning Points	Teaching Hours
Unit 1: Introduction to Python Programming 1.1 Introduction to Python Python Programming Language, History, features, Applications, Installing Python 1.2 Standard data types in Python – Dictionary, List, Tuple, Indexing, different methods, Slicing 1.3 Conditional & Looping statement in Python 1.4 User Defined functions in Python	10
Unit 2: Introduction to Data Science and Basics of Data 2.1What is Data Science? 2.2 Data Science Process 2.3 Stages in Data Science Project 2.4 Basics of Data Analytics	08

2.5 Types of Analytics –Descriptive, Predictive, Prescriptive

2.6 Statistical Inference

2.7 Populations and Samples

2.8 Statistical Modelling,

2.9 Probability

2.10 Distribution

2.11 Correlation

2.12 Regression

Unit 3: Data Analytics and Visualization using Matplotlib 12

3.1 What is Numpy? Arrays, Array Creation Methods

3.2 Types of Array One Dimensional Array, N-Dimensional Array

3.3 Array Broadcasting

3.4 Data Analysis and Manipulation using Pandas-

3.4.1 Importing Data by different methods

3.4.2 Creating a DataFrame & Series

3.4.3 Different Methods Indexing

3.4.4 Merge ,Join and Sorting of Data Frames

3.4.5 Apply Function Pivot Table Crosstab

3.4.6 Iterating over rows of a Data Frame

3.4.7 Data Preprocessing methods for DataFrame

3.5 Data Visualizations using Matplotlib

3.5.1 Basic Principles

3.5.2 Various Tools for Data Visualization

3.5.3 Types of Visualization Methods in matplotlib

3.5.4 Tree Visualization

3.5.5 Subplots & Subplot2Grid Method

References:

1. Applied statistics and probability for engineers. Montgomery, Douglas C., and George C. Runger. John Wiley & Sons, 2010
2. Scaling up Machine Learning to White “Hadoop: The Definitive Guide” Third Edition, Bekkerman et al., O‟reilly Media, 2012.
3. “Mining of Massive Datasets”, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012. 5. Developing Analytic Talent: Becoming a Data Scientist, Vincent Granville wiley, 2014
4. The elements of statistical learning. Hastie, Trevor, etal., Vol.

Website Reference Link:

1. https://www.python.org
2. https://www.geeksforgeeks.org/introduction-to-data-science/
3. https://www.simplilearn.com/tutorials/data-science-tutorial

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (SEM V) **Subject:** BBA (C.A)
Course: Data Analytics Using Python **Course Code:** BBACA-301-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes (POs)															
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3	3	2		2					2				3	
CO2	2	2	3		2	2				2		2		3	
CO3	2	3	3		3					3				3	
CO4		2	3	3	3					2				2	
CO5	2	3	3		3	2				2		2		2	
CO6	2	3	3		3	2				3		2		3	
CO7	3	3	3	2	2	3				3	2	3	3	3	

PO1: A Fundamental Knowledge and Coherent Understanding:

CO1, CO2, CO3, CO5, CO6 and CO7 are strongly and moderately mapped which provide a solid foundation in Python programming and Data Science, enabling students to understand interdisciplinary business and technological domains.

PO2: Procedural Knowledge for Skill Enhancement:

Through CO1, CO3, CO5, CO6, and CO7 are strongly and others moderately mapped students gain hands-on experience with tools like NumPy, Pandas, and ML libraries, enhancing procedural and technical proficiency.

PO3: Critical Thinking and Problem-Solving Skills:

CO1 to CO7 are strongly and moderately mapped as encourage analytical thinking and enable students to solve real-life problems using statistical models, algorithms, and logical programming**.**

PO4: Communication Skills:

CO4 and CO7 help students communicate data insights visually and logically, fostering effective technical and interpersonal communication.

PO5: Analytical Reasoning Skills:

CO1 to CO7 are strongly and moderately mapped as promote deep analysis of data and business problems, enabling students to evaluate situations and make data-driven decisions.

PO6: Innovation, Employability and Entrepreneurial Skills:

CO2, CO5, CO6, and CO7are moderately and strongly mapped as cultivate an innovative mind-set, preparing students for entrepreneurship and employability in data and AI-driven industries.

PO10: Design and Development of System:

All COS are strongly and moderately mapped as enable students to develop data-driven systems and computing models with practical and social considerations.

PO11: Ethical and Social Responsibility:

CO7 help students understand ethical considerations in data science and machine learning, ensuring responsible use of technology.

PO12: Research-Related Skills:

CO2, CO5, CO6, and CO7 introduce students to basic research methodology, data collection, analysis, and model evaluation.

PO13: Teamwork:

CO7 promotes collaboration by involving students in group projects, developing cooperation and respect within team environments.

PO14: Area-Specific Expertise:

CO1 through CO7 collectively develop expertise in Python, analytics, visualization, and machine learning, supporting roles in accounting, finance, HR, and IT.

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)

Programme Code : BBACA

Class : T.Y. BBA (C.A)

Semester : V

Course Type : Major Mandatory (Theory)

Course Code : BBACA-302-MJM

Course Title : .Net Framework

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To understand the architecture and working of the .NET Framework.
2. To develop applications using C# programming concepts.
3. To implement Windows Forms applications with event-driven programming.
4. Gain an understanding of the ADO.NET architecture, focusing on the connection object for interacting with databases.
5. To handle database operations using ADO.NET.
6. To design web applications with ASP.NET and integrate reporting & deployment techniques.
7. Understand the basics of Crystal Reports and how to use it for reporting in .NET applications.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Explain the .NET Framework architecture and its components.

CO2: Develop programs using C# and object-oriented programming principles.

CO3: Design Windows Forms applications with event handling.

CO4: Implement database connectivity using ADO.NET.

CO5: Build ASP.NET web applications with security features.

CO6: Integrate reporting using Crystal Reports.

CO7: Deploy .NET applications efficiently.

	Topics and Learning Points	Teaching Hours
Unit 1	**Introduction to .NET & C# Programming** 1.1 Overview of .NET Framework, CLR, CLS, CTS 1.2 Assemblies, Namespaces, JIT Compilation 1.3 C# Basics: Variables, Data Types, Control Statements 1.4 Functions, Exception Handling 1.5 OOP Concepts: Classes, Objects, Inheritance 1.6 Interfaces, Abstract Classes, Method Overloading & Overriding	06
Unit 2	**Windows Forms and Event-Driven Programming** 2.1 Introduction to Windows Forms 2.2 Working with Controls (Buttons, Labels, TextBox) 2.3 Event Handling in Windows Forms 2.4 Menus, Dialog Boxes, MDI Forms 2.5 Multithreading in C# 2.6 Delegates and Events	06
Unit 3	**Database Programming with ADO.NET** 3.1 ADO.NET Architecture, Connection Object 3.2 Command Object, DataReader, DataAdapter 3.3 DataSet, DataTable, DataGridView 3.4 CRUD Operations: Insert, Update, Delete 3.5 Data Binding & Navigation in Windows Forms 3.6 Entity Framework & LINQ (Overview)	06
Unit 4	**Crystal Reports, Deployment & Mini Project** 4.1 Introduction to Crystal Reports in .NET 4.2 Creating Reports and Integrating in Application 4.3 Application Deployment in .NET 4.4 Best Practices in .NET Development	06

4.5 Mini Project Wor k and Review

4.6 Case studies

Unit 5 **ASP.Net Web Forms** 06

5.1 Introducing ASP.NET Web Forms

5.2 Interacting with HTTP Request

5.3 The Life Cycle of an ASP.NET Web Page

5.4 Master Pages, and Themes Nature of Web Controls,

5.5 Building the ASP.NET Web Site,

5.6 The Role of the Validation Controls

References:

1. "Programming in C#" – Balagurusamy, McGraw Hill
2. "Professional C# and .NET" – Christian Nagel, Wrox Publications
3. "ASP.NET 4.0 in Simple Steps" – Kogent Learning Solutions Inc.
4. "ADO.NET: The Complete Reference" – Michael Otey, McGraw Hill
5. "Mastering Crystal Reports" – David McAmis, Sybex

Website Reference Link:

1. Microsoft Docs for .NET Framework – https://learn.microsoft.com/en-us/dotnet/
2. C# Tutorial - W3Schools – https://www.w3schools.com/cs/
3. ASP.NET Official Documentation – https://dotnet.microsoft.com/en-us/apps/aspnet
4. TutorialsPoint - .NET Framework – https://www.tutorialspoint.com/asp.net/index.htm
5. Crystal Reports Guide – https://www.crystalreports.com/

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (SEM V) **Subject:** BBA (C.A)

Course: .Net Framework **Course Code:** BBACA-302-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)														
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3									3					
CO2	3	3	3							3				3	
CO3			3							3					
CO4	3	3			3					3				3	
CO5	3									3	3			3	
CO6					3									3	
CO7	3					3				3	3		3		3

PO1: A Fundamental Knowledge and Coherent Understanding:

Understanding the .NET framework architecture (CO1) and developing programs in C# (CO2) requires a strong foundational knowledge of software architecture and programming concepts. Database connectivity (CO4), ASP.NET security (CO5), and deploying applications (CO7) also require a deep understanding of the framework's design and operations.

PO2: Procedural Knowledge for Skill Enhancement:

Writing C# programs (CO2) and implementing database connectivity using ADO.NET (CO4) enhance procedural and hands-on knowledge by applying structured logic and methodologies.

PO3: Critical Thinking and Problem-Solving Skills:

Developing applications using OOP principles (CO2) and designing Windows Forms with event handling (CO3) help students to address real-time scenarios and enhance critical problem-solving abilities.

PO5: Analytical Reasoning Skills:

Connecting and managing data using ADO.NET (CO4) and interpreting data in Crystal Reports (CO6) promote analytical thinking. Students analyze data flows and reporting logic for better decision-making.

PO6: Innovation, Employability and Entrepreneurial Skills:

Efficient deployment of applications (CO7) aligns with professional software development practices, enhancing employability and entrepreneurial capacity through real-world implementation.

PO10: Design and Development of System:

Understanding .NET architecture (CO1), developing applications (CO2), event-handling in GUI apps (CO3), data connectivity (CO4), securing web applications (CO5), and deploying software (CO7) are all essential for the design and development of real-world systems.

PO11: Ethical and Social Responsibility:

ASP.NET security (CO5) promotes responsible development. Deployment (CO7) includes ethical aspects like secure data handling and maintaining user privacy.

PO13: Teamwork:

Deployment of .NET applications (CO7) often involves collaboration and integration, fostering teamwork in planning, development, and testing.

PO14: Area Specific Expertise:

C# programming (CO2), ADO.NET (CO4), ASP.NET (CO5), and Crystal Reports (CO6) build specific expertise in software, business applications, and computer systems.

PO15: Environmental Awareness:

Efficient deployment practices (CO7) include resource optimization and mindful use of computing environments, aligning with sustainable software development.

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)
Programme Code : BBACA
Class : T.Y. BBA (C.A)
Semester : V
Course Type : Major Mandatory (Theory)
Course Code : BBACA-303-MJM
Course Title : Cloud Computing
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. Understand Cloud Computing Concepts: Gain a fundamental understanding of cloud computing, its characteristics, importance, benefits, and challenges.
2. Analyze Cloud Architectures and Service Models: Learn about cloud service models (SaaS, PaaS, IaaS) and cloud deployment models (Public, Private, Hybrid, Community).
3. Explore Virtualization Technologies: Understand the role of virtualization in cloud computing, including hardware, software, storage, and network virtualization.
4. Gain Hands-on Experience with Cloud Platforms: Learn about cloud platforms like AWS, Microsoft Azure, and Google Cloud, and their key services such as computing, storage, and databases.
5. Understand Cloud Security Challenges and Solutions: Identify key security threats in cloud computing and explore best practices for confidentiality, integrity, and availability.
6. Analyze Cloud Applications in Various Domains: Explore real-world cloud applications in healthcare, business, geosciences, and social networking.
7. Learn Migration Strategies and Emerging Trends: Understand cloud migration methodologies and trends such as edge computing, AI in cloud computing, and serverless architectures.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Explain the fundamental concepts of cloud computing by describing its characteristics, benefits, and challenges.

CO2. Differentiate cloud service models (SaaS, PaaS, IaaS) and deployment models (Public, Private, Hybrid, Community) and analyze their use cases.

CO3. Apply virtualization techniques such as hardware, network, storage, and application virtualization in cloud environments.

CO4. Deploy and manage applications on cloud platforms like AWS, Microsoft Azure, or Google Cloud, utilizing cloud storage, computing, and database services.

CO5. Assess cloud security risks and apply mitigation strategies by implementing encryption, identity management, and security frameworks.

CO6. Analyze cloud-based applications across different industries such as healthcare, business, geosciences, and social networking.

CO7. Demonstrate an understanding of cloud migration strategies and emerging cloud trends like AI-driven cloud computing, server less computing, and edge computing.

Topics and Learning Points	Teaching Hours

Unit 1: Introduction to Cloud Computing 10

1.1 Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing,

1.2 Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing.

1.3 Cloud Service Models: SaaS, PaaS, IaaS, Storage.

1.4 Cloud Architecture: Cloud Computing Logical Architecture,

1.5 Developing Holistic Cloud Computing Reference Model, Cloud System Architecture,

1.6 Cloud Deployment Models.

Unit 2: Virtualization **10**

2.1 Introduction of Virtualization: Virtual infrastructures, Need for Virtualization

2.2 Types of Virtualization:

2.2.1 Hardware virtualization: Full Virtualization, Para Virtualization and Partial Virtualization

2.2.2 Network Virtualization: Internal and External

2.2.3 Software Virtualization: OS, Application and Service

2.2.4 Storage Virtualization: File level and block level

2.2.5 Memory Virtualization: Application-level integration and Operating System Level Integration

2.2.6 I/O Virtualization

2.3 Understating Hypervisors and Virtual Machine types:

2.3.1 Process Virtual Machine.and System Virtual Machine.

Unit 3: Cloud Platforms and Cloud Applications 06

3.1 Amazon Web Services (AWS): Amazon Web Services and Components, Amazon Simple DB

3.2 Elastic Cloud Computing (EC2), Amazon Storage System, Amazon Database services (DynamoDB).

3.3 Microsoft Cloud Services: Azure core concepts, SQL Azure, Windows AzuSre PlatformAppliance.

3.4 Cloud Computing Applications:

Healthcare: ECG Analysis in the Cloud

Biology: Protein Structure Prediction

Geosciences: Satellite Image Processing

Business and Consumer Applications: CRM and ERP, Social Networking,

Google Cloud Application: Google App Engine.

Unit 4: Security in Cloud Computing 04

4.1 Risks in Cloud Computing: Risk Management, Types of Risks in Cloud Computing.

4.2 Cloud Security Services: Confidentiality, Integrity and Availability, Security Authorization

4.3 Challenges in the Cloud, Security Issues in Cloud Computing

References:

1. Cloud Computing: Principles and Paradigms, Editors, RajkumarBuyya, James Broberg,Andrzej M. Goscinski, Wiley, 2011.

2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff,Cambridge University Press, 2010.

3. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, RussellcDean Vines, Wiley- India, 2010.

4. AWS, The ultimate guide from beginners to advanced, Maveric Koston.

5. Microsoft Azure: Planning, Deploying, and Managing Your Data Center in the Cloud, AnthonycPuca, Mike Manning, Marshal Copeland, Julian Soh, David Gollob.

Website Reference Link:

1. https://www.w3schools.com/aws/aws_cloudessentials_cloudcomputing.php
2. https://www.geeksforgeeks.org/
3. https://www.shiksha.com/it-software/cloud-computing-syllabus-chp

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (Sem V) **Subject:** BBA (C.A)

Course: Cloud Computing **Course Code:** BBACA-303-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)														
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3	2	2	1	2	1	1	1	1	2					
CO2	3	3	3	2	3	2	1	1	1	2			2		
CO3	3	3	3	2	3	3	2	1	1	3	2	2	3	2	
CO4	3	3	3	2	3	3	2	1	1	3	2	3	3	2	
CO5	3	3	3	2	3	3	2	2	2	3	3	3	3	2	
CO6	3	3	3	2	3	3	3	2	2	3	3	3	3	2	
CO7	3	3	3	2	3	3	3	2	2	3	3	3	3	3	

PO1: A Fundamental Knowledge and Coherent Understanding

CO1, CO2, CO3, CO4, CO5, CO6, and CO7 are strongly mapped as students will gain foundational knowledge of cloud computing, including service models, virtualization, deployment strategies, security concerns, and emerging trends. These concepts provide a strong theoretical base essential for advanced learning.

PO2: Procedural Knowledge for Skill Enhancement

CO2, CO3, CO4, CO5, CO6, and CO7 are strongly mapped as students will acquire practical skills in cloud computing, including the use of cloud services, virtualization techniques, cloud deployment, and the implementation of security measures, which enhances their procedural knowledge in cloud environments.

PO3: Critical Thinking and Problem-Solving Skills

CO2, CO3, CO4, CO5, CO6, and CO7 are strongly mapped as students will critically evaluate and solve problems related to cloud computing by choosing appropriate cloud service models, applying virtualization and security techniques, and analyzing industrial use cases.

PO4: Communication Skills

CO1, CO2, CO4, CO6 are moderately mapped as students will develop their ability to communicate technical cloud concepts, deployment strategies, and industry analysis effectively, both in written and verbal formats.

PO5: Analytical Reasoning Skills

CO2, CO3, CO5, CO6 are strongly mapped as students will analyze and apply cloud models, security frameworks, and industry-specific applications using logical reasoning and analytical skills, particularly in evaluating different cloud technologies and architectures.

PO6: Innovation, Employability, and Entrepreneurial Skills

CO4, CO5, CO6, and CO7 are strongly mapped as students will learn to innovate and implement cloud-based solutions on platforms like AWS, Microsoft Azure, and Google Cloud, developing entrepreneurial skills to assess risks, explore cross-industry applications, and leverage new cloud trends.

PO7: Multidisciplinary Competence

CO3, CO4, CO6, and CO7 are strongly mapped as students will integrate cloud computing knowledge into various disciplines such as healthcare, geosciences, business, and social networking, developing competence across multiple fields by utilizing a range of IT, networking, and cybersecurity tools.

PO8: Value Inculcation through Community Engagement

CO5, CO6 are moderately mapped as students will learn to apply cloud computing technologies to socially relevant community-based IT projects, focusing on secure, ethical, and user-aware cloud applications that contribute to public digital services.

PO9: Traditional Knowledge into Modern Application

CO6, CO7 are moderately mapped as students will explore how traditional business processes and data systems evolve into cloud-based applications, leveraging modern cloud platforms, server less architectures, and AI-driven solutions.

PO10: Design and Development of Systems

CO3, CO4, CO5, and CO7 are strongly mapped as students will design and deploy secure, scalable systems using virtualization and cloud services, and migrate legacy systems to modern cloud environments.

PO11: Ethical and Social Responsibility

CO1, CO5, and CO6 are moderately mapped as students will evaluate the ethical implications of cloud computing, particularly concerning data privacy, identity management, and responsible digital practices in cloud applications across various domains.

PO12: Research-Related Skills

CO5, CO6, and CO7 are strongly mapped as students will engage in research-driven analysis of cloud computing trends, security frameworks, and industry-specific applications, fostering critical thinking and research skills in cloud-related topics.

PO13: Teamwork:

CO3, CO4, and CO5 are strongly mapped as students will gain hands-on experience with virtualization, cloud service deployment, and security, ensuring they possess a deep understanding of current digital technologies and their applications in cloud environments.

PO14: Area Specific Expertise:

CO1, CO3, and CO7 are moderately mapped as students will learn how cloud computing contributes to sustainable development by reducing the need for physical infrastructure and promoting green IT practices, such as efficient resource utilization and energy savings.

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)

Programme Code : BBACA

Class : T.Y. BBA (C.A)

Semester : V

Course Type : Major Mandatory (Theory)

Course Code : BBACA-304-MJM

Course Title : Cyber Security

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To acquire the fundamental principles, concepts, and constructs of networking and cybersecurity.
2. To develop competency in understanding communication systems, transmission media, and network topologies.
3. To understand the TCP/IP protocol stack, wireless networks, and the functioning of the internet.
4. To learn the principles of information security, types of attacks, and goals for securing systems.
5. To analyze e-commerce security, computer forensics, and advanced techniques like steganography.
6. To identify and mitigate security threats, vulnerabilities, and malicious activities in networks.
7. To understand the impact of cybercrime, cyberterrorism, and information warfare on global security.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Understand and explain the fundamental principles of communication systems, transmission media, and network topologies.

CO2. Illustrate and describe the TCP/IP protocol stack, wireless networks, and the functioning of the internet.

CO3. Analyze and explain the goals of information security, types of attacks, and e-commerce security challenges.

CO4. Identify and mitigate common security threats, vulnerabilities, and malicious activities in networks.

CO5. Apply advanced techniques such as computer forensics and steganography to secure Information systems.

CO6. Develop strategies to address cybercrime, cyberterrorism, and information warfare in a global context.

CO7. Evaluate and implement secure network designs and protocols to protect against evolving cybersecurity threats.

Topics and Learning Points

Unit 1 Overview of Foundations of Networking and Cybersecurity 07

1.1 Basics of Communication Systems

1.2. Transmission Media

1.3. Topology and Types of Networks

1.4. TCP/IP Protocol Stacks

1.5. Wireless Networks

1.6. The Internet

Unit 2 Information Security Concepts 11

2.1. Information Security Overview: Background and Current Scenario

2.2. Types of Attacks

2.3. Goals for Security

2.4. E-commerce Security

2.5. Computer Forensics

2.6. Steganography

Unit 3 Security Threats and Vulnerabilities 12

3.1. Overview of Security threats

3.2. Weak / Strong Passwords and Password Cracking

3.3. Insecure Network connections

3.4. Malicious Code

3.5. Programming Bugs

3.6. Cyber-crime and Cyber terrorism

3.7. Information Warfare and Surveillance

References:

Reference Books:

1. "Computer Networks: Principles, Protocols, and Practice" by S. Keshav and Olivier Bonaventure, 2nd Edition, Pearson Education.
2. "Cryptography and Network Security: Principles and Practice" by William Stallings and Atul Kahate, 7th Edition, Pearson Education.
3. "Introduction to Cybersecurity: Concepts and Practices" by Sunit Belapure, Nina Godbole, and William Stallings, 1st Edition, Wiley India.
4. "Network Security: Private Communication in a Public World" by Charlie Kaufman, Radia Perlman, and Mike Speciner, 2nd Edition, Pearson Education.
5. "Ethical Hacking and Penetration Testing" by Mohit Kumar and Georgia Weidman, 1st Edition, BPB Publications.

Website Reference Link

1. https://www.netacad.com
2. https://owasp.org
3. https://www.nist.gov/cyberframework
4. https://www.khanacademy.org
5. https://www.cybrary.it

Choice Based Credit System Syllabus (2024 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: T.Y. BBA (C.A) **Subject: BBA (C.A)**

Course Type: Cyber Security **Course Code:** BBACA-304-MJE (A)

Weightage: 1=weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

Programme Outcomes (POs)															
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3														
CO2	3			2											
CO3	3			2								3			
CO4		3	3	2	3	2				3	2	3		3	
CO5		3	3		3	2				3	2	3		3	
CO6		3	3		3	2				3	2	3		3	
CO7		3	3		3	2				3	2	3		3	

PO1: Fundamental Knowledge and Coherent Understanding

CO1, CO2, CO3 are strongly mapped as they develop core knowledge of networking, cybersecurity principles, and foundational concepts like communication systems, TCP/IP, and information security goals.

PO2: Procedural Knowledge for Skill Enhancement

CO4, CO5, CO6, CO7 are strongly mapped as they involve procedural knowledge in identifying threats, applying forensic techniques, and designing secure networks.

PO3: Critical Thinking and Problem-Solving Skills

CO4, CO5, CO6, CO7 are strongly mapped because they emphasize problem-solving through threat mitigation, forensic analysis, and addressing cybercrime and cyberterrorism.

PO4: Communication Skills

CO2, CO3, CO4 are moderately mapped as they require logical explanations, presentations, and discussions of network protocols, security goals, and threat analysis.

PO5: Analytical Reasoning Skills

CO4, CO5, CO6, CO7 are strongly mapped as they require students to evaluate security threats, vulnerabilities, and solutions analytically.

PO6: Innovation, Employability, and Entrepreneurial Skills

CO4, CO5, CO6, CO7 are moderately mapped as they build skills essential for employability in cybersecurity roles and innovation in secure system design.

PO10: Design and Development of System

CO4, CO5, CO6, CO7 are strongly mapped as they focus on designing secure systems, implementing forensic techniques, and addressing cyber threats.

PO11: Ethical and Social Responsibility

CO4, CO5, CO6, CO7 are moderately mapped as students learn ethical practices in cybersecurity, such as handling sensitive data and preventing cybercrime.

PO12: Research-Related Skills

CO3, CO4, CO5, CO6, CO7 are strongly mapped as they involve designing solutions for security challenges, analyzing threats, and researching emerging cybersecurity trends.

PO14: Area Specific Expertise

CO4, CO5, CO6, CO7 are strongly mapped as they ensure expertise in cybersecurity, including threat mitigation, forensic analysis, and secure network design.

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)
Programme Code : BBACA
Class : T.Y. BBA (C.A)
Semester : V
Course Type : Major Mandatory (Practical)
Course Code : BBACA-305-MJM
Course Title : Practical Lab on Data Analytics Using Python
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives:

1. Gain knowledge of Python's syntax, data types, and control structures.
2. Learn how to process, analyze, and manipulate data using libraries like NumPy and Pandas.
3. Understand statistical concepts such as probability, correlation, regression, and their applications in data science.
4. Learn to visualize data using Matplotlib and other visualization tools.
5. Explore fundamental concepts of machine learning, including supervised and unsupervised learning techniques.
6. Work with structured datasets, handle missing data, and perform data preprocessing techniques.
7. Implement machine learning models using scikit-learn and evaluate their performance for real-world applications.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Demonstrate an ability to write, debug, and execute Python scripts for various applications.

CO2. Efficiently handle and manipulate large datasets using Python libraries such as Pandas and NumPy.

CO3. Apply statistical methods to analyze and interpret data for decision-making.

CO4. Create meaningful visualizations to represent data trends and insights.

CO5. Implement basic machine learning algorithms to classify, predict, and cluster data.

CO6. Handle structured and unstructured data efficiently, including data cleaning and transformation.

CO7. Develop a complete data science project, from data acquisition to model deployment.

Topics

1) **Assignment on Array, Dictionary, Set**

1) Write a Python Code to Create a Dictionary & perform the following operation-
   a) Updating Dictionary Element
   b) Delete Dictionary Element
   c) Check Presence of key in Dictionary or Not
   d) Print all keys & Values
2) Write a Python Code to accept the number of student data in a dictionary like Name of Student, Roll Number, and Marks and perform following operations
   a) Display all student information
   b) By Entering Mark find the Name of Student
3) Write a Python code to create a Simple array of one dimension to perform following array operations-
   a) Display all individual element in array
   b) Make Sum of all Elements in Array
4) Write a Python code to create Two Simple one dimensional array and make addition of both array elements into third array.
5) Write a Python code to find Minimum and Maximum value in an Array.
6) Write a Python code to create an ndarray to perform the following operations

i) To find Dimensions of Array

ii) Display Data Type of Element

iii) Find Shape and Size of Array

iv) Delete Array Elements

7) Write a Python Code to create TWO ndarray and concatenate that both array.

8) Write a Python Code to perform addition of all elements of ndarray.

9) Write a python program to find minimum and maximum value in ndarray.

10) Write a Python program to perform array broadcasting in two ndarray.

2) **Assignment on Series, DataFrame**

1) Write a Python Code to create a Series by-
   i) From Array
   ii) From Dictionary
   iii) From Scalar

2) Write a Python Code to create a DataFrame and perform the following column operations (Use Following DataSet)

	name	age	city	Maths	science
0	sachin	18	pune	85	87
1	kartik	22	solapur	87	90
2	piyush	21	kolhapur	88	91
3	Mahesh	20	Banglore	85	90

   i) Column Selection in DataFrame
   ii) Addition of Two Column Values
   iii) Deletion of Column

3) Write a Python code to Create DataFrame to perform following Row Operations (Use Following DataSet)

	name	age	city	Maths	science
0	sachin	18	pune	85	87
1	kartik	22	solapur	87	90
2	piyush	21	kolhapur	88	91
3	Mahesh	20	Banglore	85	90

	name	age	city	Maths	science
n	Smith	18	pune	85	92

   i) Selection of row
   ii) Insertion of new row
   iii) Deletion of any row

4) Write a python code to perform various indexing operation (Use Following DataSet)

i) Label Based Indexing(.loc)

	name	age	city	Maths	science
a	sachin	18	pune	85	87
b	kartik	22	solapur	87	90
c	piyush	21	kolhapur	88	91
d	Mahesh	20	Banglore	85	90

ii) Integer Based Indexing (.iloc)

	name	age	city	Maths	science
0	sachin	18	pune	85	87
1	kartik	22	solapur	87	90
2	piyush	21	kolhapur	88	91
3	Mahesh	20	Banglore	85	90

5) Write a Python Code to perform Following Boolean Indexing Operations (Use Following DataSet)

	name	age	degree	Score
True	Aparna	18	BCA	85
False	Pankaj	22	MBA	87
True	piyush	21	BBA	88
False	Geeta	20	BTECH	85

i) Accessing Dataframe by .loc()
ii) Apply Boolean Mask to Dataframe

6) Write a Python code to create a DataFrame to perform the following operations

	name	age	degree	Score
True	Aparna	18	BCA	85
False	Pankaj	22	MBA	87
True	piyush	21	BBA	88
False	Geeta	20	BTECH	85

i) Masking Data Based on Column Value
ii) Masking Data Based on Index Value

7) Write a Python code to create Two DataFrame & Merge that DataFrame by Unique Key Combination in both list (i.e. by on='key')

	name	age	degree
0	Aparna	18	BCA
1	Pankaj	22	MBA
2	piyush	21	BCA
3	Geeta	20	BTECH

	name	city	score
0	Aparna	Pune	85
1	Pankaj	Solapur	87
2	piyush	Kolhapur	88
3	Geeta	Nashik	85

8) Write a Python code to Create a Two DataFrame & Merge that

DataFrame by how in an arguments by following ways-

```
     name  age degree
0  Aparna   18    BCA
1  Pranav   22    MBA
2  piyush   21    BCA
3   Geeta   20  BTECH
      name       city  score
0   Aparna       Pune     85
1   Pankaj   Solapur      87
2   piyush  Kolhapur     88
3  Pranita    Nashik     85
```

i) Left Outer Join
ii) Right Outer Join
iii) Outer Join
iv) Inner Join

9) Write a Python code to create a Two DataFrame and perform following operations

```
     name  age degree
a  Aparna   18    BCA
b  Pranav   22    MBA
c  piyush   21    BCA
d   Geeta   20  BTECH
        city  score
a       Pune     85
b    Solapur     87
c   Kolhapur     88
d     Nashik     85
```

i) Joining of DataFrame
ii) Concatenate DataFrame by Both Vertical & Horizontal Ways

10) write a Python Code to Create a DataFrame to perform –

```
     name  age      city  science  maths  phy
0  Aparna   18      Pune       85     90   87
1  Pranav   22   Solapur       87     92   85
2  piyush   21  Kolhapur       88     87   90
3   Geeta   20    Nashik       85     93   82
```

i) Sorting Dataframe by column in Ascending Order
ii) Sorting Dataframe by column in Descending Order
iii) Sorting Dataframe by Multiple Columns

3) **Assignment on Visualizations**

1) Create an Array in the range 1 to 20 with values 1.25 apart. Another array contains the log values of the elements in first array.
   a) Simply plot the two arrays first vs second in a line chart
   b) Change the x-axis label as "Random Values" & Y-axis as "Logarithmic values"
   c) create a third array that shows the cos values of first array and plot that with first array. The Cos line should be plotted with a dashdotted line.

2) T.C.College celebrated volunteering week where each section of class TY dedicated a day for collecting amount for charity being supported by the college. Section A volunteered on Monday, B on Tuesday, C on Wednesday and so on.There are six section in class TY. Amount collected by sections A to F are 8000, 12000,9800,11200,15500,7300.

   A) Create a bar chart showing collection of amount.
   B) Plot the collected amount vs days using a bar chart.
   C) Plot the collected amount vs Sections using bar chart.

3) Write to create a pie for sequence con=[23.4,17.8,25,34,40] for zones = ['East','West','North','South','Central'].
A) Show North Zone's Value Exploded
B) Show % Contribution for each zone
C) The Pie Chart should be Circular

4) Create a multiline line charts on common plot where three data ranges are plotted on same chart. The data ranges to be plotted is –
Data= [[5.0, 25.0, 45.0, 20.0],[8.0,13.0,29.0,27.0],[9.0,29.0,27.0,39.0]]

5) Create a Scatter Plot Chart having two array as follows. [5,7,8,7,2,17,2,9,4,11,12,9,6] [99,86,87,88,111,86,103,87,94,78,77,85,86]
a) Show simple scatter plot.
b) Set your own color of the Markers.

6) Write a Python Code to create Tree by using Bigtree library of python the output display should be in following form

```
a [age=90]
├── b [age=65]
└── c [age=60]
```

7) Write a Python Code to create Tree by using Bigtree library of python the output display should be in following form

```
Language
├── Python
│   ├── Pandas
│   └── Django
└──         └── java
```

4) **Assignment on Data Preprocessing**

1) Write a Python code to perform the following operations use following dataset
    a. Check empty or missing data in all dataset
    b. Check empty or missing data in column 'Postcode'
    c. Display total count of missing data in each column
    d. Drop rows that are having missing values

2) Write a Python code to perform the following operations use following dataset
    a. Display unique value in column 'Price'
    b. Display total number (Count) unique value
    c. Display duplicate rows in dataset
    d. Display total count of all duplicates

3) Write a Python code to perform the following operations use following dataset
    a. Find the total marks of column Maths
    b. Find the Mean & standard deviation of marks in column Science
    c. Find minimum marks in Physics & Maximum marks in Maths
    d. Find minimum marks all Subjects

4) Write a Python code to perform the following operations use following dataset
    a. Use groupby function to create a group of "Course"
    b. Display first row Group "Course"
    c. Display all rows in a Group "Course"
    d. Create a group "Maths" & display its mean

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (SEM V) **Subject**: BBA (C.A)
Course: Practical Lab on Data Analytics Using Python **Course Code**: BBACA-305-MJM

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)														
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3	3	2		2					2				3	
CO2	3	3	3		3					3		2		3	
CO3	2	3	3		3	2				2		2		3	
CO4	1	2	3	3	3					2				2	
CO5	3	3	2		2					2				3	
CO6	2	3	3		3					3		2		3	
CO7	3	3	3	2	3	2				3	2	3	2	3	

PO1: A Fundamental Knowledge and Coherent Understanding:

CO1, CO2, CO5, CO7 are strongly mapped and others moderately mapped as enable students to build a strong foundation in Python programming and data analytics across various business domains.

PO2: Procedural Knowledge for Skill Enhancement:

CO1 to CO7 are strongly and moderately mapped which involve hands-on skill development with Python, NumPy, and Pandas, building solid procedural knowledge in data analysis and visualization.

PO3: Critical Thinking and Problem-Solving Skills:

CO2, CO3, CO4, CO6, CO7 strongly mapped and other moderately mapped as develop the ability to analyze problems using data and implement effective Python-based solutions.

PO4: Communication Skills:

CO4 and CO7 strengthen the ability to communicate insights clearly using visualization tools, contributing to data storytelling and presentation.

PO5: Analytical Reasoning Skills:

CO2, CO3, CO4, CO6, CO7 are strongly and other moderately mapped as enhance data interpretation and decision-making through analysis and logical reasoning.

PO6: Innovation, Employability and Entrepreneurial Skills:

CO3 and CO7 are moderately mapped as develop employable skills and foster an innovative approach to data science, aligning with business intelligence and analytics roles.

PO10: Design and Development of System:

CO2, CO6, CO7 are strongly and others are moderately mapped which support the creation of scalable data models and visual systems aligned with business and social needs.

PO11: Ethical and Social Responsibility:

CO7 promotes responsible data handling and ethical implementation of data models, aligning with societal responsibilities.

PO12: Research-Related Skills:

CO2, CO3, CO6, CO7 are strongly and moderately mapped as support the foundation for conducting data-driven research, from hypothesis to analysis and conclusion.

PO13: Teamwork:

CO7 includes collaborative development of data models and group problem-solving, building team and project-based skills.

PO14: Area-Specific Expertise:

CO1 to CO7 all strongly and moderately mapped as directly develop expertise in analytics, programming, and decision-making across business and tech domains.

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)
Programme Code : BBACA
Class : T.Y. BBA (C.A)
Semester : V
Course Type : Major Elective (MJE)
Course Code : BBACA-306-MJE (A)
Course Title : Software Project Management
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. To understand the fundamentals of Software Project Management
2. To investigate software project planning and management tools
3. To learn software project scheduling and tracking
4. To discuss the principles and practices of agile project management
5. To know the importance of people management in software projects
6. To develop skills for quality assurance and configuration management
7. To evaluate project performance and ensure successful project delivery

Course Outcomes:

By the end of the course, students will be able to:

CO1: Comprehend fundamental project management concepts
CO2: Use various tools of software project management
CO3: Schedule and manage activities in software projects
CO4: Track project progress and handle changes
CO5: Apply Agile methodologies in project management
CO6: Analyze staffing and team-building processes in software projects
CO7: Make informed decisions in software project planning and execution

Topics and Learning Points		
Unit 1	**Introduction to Software Project Management**	07
	1.1 Project Definition and Difference Between Project and Flow-Type Work	
	1.2 Project Lifecycle and Its Phases	
	1.3 Processes and Knowledge Areas in Project Management (PM)	
	1.4 Build or Buy Decision in Project Planning	
	1.5 Work Breakdown Structure (WBS) and Its Types	
	1.6 Introduction to PMBOK (Project Management Body of Knowledge)	
	1.7 Overview of Program and Portfolio Management	
Unit 2	**Project Planning and Project Management Tools**	07
	2.1 Steps Involved in Project Planning	
	2.2 PERT and Gantt Charts for Project Scheduling	
	2.3 Tools: Gantt Project, Microsoft Project, and Primavera	
	2.4 Objectives and Importance of Activity Planning	
	2.5 Project Schedules: Definition and Components	
	2.6 Activities: Sequencing and Scheduling Techniques	
	2.7 Network Planning Models and Formulating Network	
Unit 3	**Activity based Scheduling**	06
	3.1 Introduction and objectives of activity planning	
	3.2 Introduction and objectives of activity planning	
	3.3 Project schedules and their significance in project management	
	3.4 Activity sequencing and scheduling methods	

3.5 Network planning models and formulation of network diagrams

3.6 Activity relationships: FS (Finish to Start), SF (Start to Finish), SS (Start to Start), FF (Finish to Finish)

3.7 Forward Pass and Backward Pass techniques for time estimation

Unit 4 Project Tracking and Control 05

4.1 Introduction, Collection of Project data

4.2 Visualizing progress, Cost monitoring

4.3 Earned Value Analysis, Project tracking

4.4 Change Control, Software Configuration Management

4.5 Managing contracts, Contract Management.

Unit 5 Agile Project Management 06

5.1 Predictive versus Empirical Management

5.2 Comparison between Non-Agile and Agile Project

5.3 Three stages of Agile Project

5.4 Estimation, Scope Management

5.5 Roles and Responsibilities

5.6 Scheduling and Tracking.

References:

Reference Books:

1. Ken Schwaber, “Agile Project Management”, Microsoft Press, 2004

2. Walker Royce, “Software Project Management”, Addison-Wesley, 1998.

3. Jalote Pankaj, “Software Project Management in Practice”, Addison-Wesley Professional, 2002

PMBOK Guide

Text Books:

1. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", Sixth Edition, Tata McGraw Hill, New Delhi, 2017.

2. Robert K. Wysocki, "Effective Software Project Management", Wiley Publication, 2011

Website Links:

1. https://www.kornev-online.net/ITIL/Mcgraw.Hill.Software_Project_Management_2nd_ Edition.pdf
2. http://library.lol/main/B96E3B122326F8D2C6FBD35A5E978422
3. https://onlinecourses.nptel.ac.in/noc19_cs70/preview

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (SEM V) **Subject:** BBA (C.A)

Course: Software Project Management **Course Code:** BBACA-306-MJE (A)

Weightage: = weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)														
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3										1	1	1	3	1
CO2	2	3								3	1	2	2	2	1
CO3	2	3	3		3					3	2	1	3	2	1
CO4	2	3	3		3					3	2	1	3	2	1
CO5	2	3	3		3	3				3	2	1	3	2	1
CO6	1			3							3	1	3	1	1
CO7	2	3	3		3	3				3	2	2	3	2	1

PO1: A Fundamental Knowledge and Coherent Understanding:

Strongly mapped with CO1 (project management fundamentals) and moderately with CO2 to CO7 as they require basic knowledge in management and computing.

PO2: Procedural Knowledge for Skill Enhancement:

Strongly mapped with CO2-CO5 & CO7 as they involve deep procedural understanding of project management tools and techniques.

PO3: Critical Thinking and Problem-Solving Skills:

CO3, CO4, CO5 & CO7 Strongly mapped them require analytical decision-making in project scenarios.

PO4: Communication Skills:

CO6 Strongly mapped with (team-building) as it involves interpersonal communication.

PO5: Analytical Reasoning Skills:

CO3, CO4, CO5 & CO7 are strongly mapped involve logical project scheduling and tracking.

PO6: Innovation, Employability and Entrepreneurial Skills:

CO5 & CO7 (Agile methodologies & decision-making) strongly mapped with as they enhance employability.

PO10: Design and Development of System:

CO2, CO3, CO4, CO5 & CO7 Strongly mapped with they involve designing project workflows.

PO11: Ethical and Social Responsibility:

Strongly mapped with CO6 (team-building ethics) and moderately with CO3-CO5.

PO13: Teamwork

Strongly mapped with CO6 (team-building) and CO3, CO4, CO5 (collaborative project management).

PO14: Area Specific Expertise

Strongly mapped with CO1 (fundamentals) and moderately with CO2-CO7 (applied project management).

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2024 Pattern)

Name of the Programme : BBA (Computer Application)

Programme Code : BBACA

Class : T.Y. BBA (C.A)

Semester : V

Course Type : Major Elective (MJE)

Course Code : BBACA-306-MJE (B)

Course Title : Block Chain

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To study the fundamentals of blockchain technology.
2. To analyze the architecture and components of blockchain systems.
3. To study various consensus algorithms and mechanisms.
4. To analyze real-world blockchain platforms and applications.
5. To study practical approaches to blockchain application development.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Understand basic concepts and structure of blockchain.

CO2: Explain components of distributed ledger systems.

CO3: Analyze different blockchain consensus mechanisms.

CO4: Explore platforms like Bitcoin and Ethereum.

CO5: Develop smart contracts using blockchain tools.

CO6: Apply blockchain to real-world applications.

CO7: Evaluate security and scalability in blockchain systems.

Topics and Learning Points	Teaching Hours

Unit 1 Introduction to Blockchain 06

1.1 Foundational Computing Concepts: Client-Server vs Peer-to-Peer Systems, Types of Networks

1.2 Evolution of Blockchain and its Generations

1.3 Blockchain vs Traditional Databases, Benefits and Challenges of Blockchain

1.4 Types of Blockchain and Layered Architecture of Blockchain Ecosystem

1.5 Core Components of Blockchain and Overview of Consensus Mechanisms

1.6 Introduction to Cryptocurrency, Bitcoin, Ethereum, Smart Contracts, and Use Cases of Blockchain

Unit 2 Cryptography 08

2.1 Definition, importance, and historical overview of cryptography

2.2 Introduction to modern cryptography and symmetric key Algorithms

2.3 Block ciphers: DES, AES and their applications

2.4 Stream ciphers and their working principles

2.5 Public-key cryptography: RSA and ECC basics

2.6 Cryptographic hash functions: SHA256, properties, and applications

2.7 Digital signatures: concept, structure, and authentication use cases

2.8 Cryptanalysis techniques: brute-force, frequency analysis, and other attacks

Unit 3 Working of Blockchain 05

3.1 Understanding SHA256 Hash and Immutable Ledger

3.2 Distributed Peer-to-Peer (P2P) Network in Blockchain

3.3 Mining Process: Nonce, Cryptographic Puzzle, and Block Creation

3.4 Byzantine Fault Tolerance and Its Role in Blockchain Security

3.5 Consensus Protocols: Proof of Work, Proof of Stake, Defense Against Attacks, and Competing ChainsImage degradation models

Unit 4 Smart Contracts 06

4.1 Overview of Ethereum Network and Smart Contracts

4.2 Ethereum Virtual Machine (EVM), Ether, and Gas Concept

4.3 Decentralized Applications (DApps) and Their Use Cases

4.4 Decentralized Autonomous Organizations (DAO)

4.5 Hard Forks, Soft Forks, and Network Upgrades

4.6 Initial Coin Offerings (ICO) and Smart Contract Demonstration

Unit 5 Programming Assignment 05

Teachers should demonstrate various programs mentioned below in the classroom or laboratory, at their convenience.

- Assignment 1 –Demonstration of Blockchain https://andersbrownworth.com/blockchain
- Assignment 2 – Write a Simple Python program to create a Block class that contains index, timestamp, and previous hash. Connect the blocks to create a Blockchain.
- Assignment 3 – Write a Simple Python program to create a Block class that contains an index, timestamp, and previous hash. Connect the blocks to create a Blockchain.

- Assignment 4 –Demo of Remix-Ethereum IDE https://remix.ethereum.org and

Test Networks

- Assignment5–1. Write a Simple Smart Contract for Bank with withdraw and deposit functionality.
- Assignment 6 – 2. Write a Smart Contract for storing and retrieving information of Degree Certificates.

References:

Reference Books:

1. Mastering Blockchain by Imran Bashir, Third Edition, Packt Publication
2. Waterhole, The Science of the Blockchain
3. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
4. Mastering Ethereum: Building Smart Contracts and DAPPS, by Andreas Antonopoulos, Dr. Gavid Wood, Oreilly Publication

TextBook:

1. Beginning Blockchain : A Beginner's Guide to Building Blockchain Solutions By Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress Media

Website Reference Link

1. https://www.investopedia.com/terms/b/blockchain.asp

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (SEM V) **Subject:** BBA (C.A)
Course: Block Chain **Course Code:** BBACA-306-MJE (B)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes (POs)															
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3								2			2		3	
CO2	3	3							2			2		3	
CO3	3	3	3		3				2		2	2		3	
CO4	2				3				2			2		2	
CO5	2	3	3	2	3	3			2	3	2	2	2	3	
CO6	2	3	3	2	3	3	3		2	3	2	2	2	3	
CO7	2		3		3	3			2	3	2	2	2	3	

PO1: A Fundamental Knowledge and Coherent Understanding:

CO1, CO2, and CO3 are strongly mapped with foundational understanding of blockchain, which is essential for all other outcomes. CO4, CO5, CO5, and CO7 are moderately mapped as Explore knowledge platforms like Bitcoin and ethereum, blockchain tools.

PO2: Procedural Knowledge for Skill Enhancement:

CO2, CO3, CO5, CO6 strongly mapped with smart contracts, real-world applications, and tools require procedural expertise.

PO3: Critical Thinking and Problem-Solving Skills:

CO3, CO5 to CO7 strongly mapped for analyzing consensus, designing contracts, and evaluating systems all need critical thinking.

PO4: Communication Skills:

CO5 and CO6 moderately mapped.it presenting and documenting blockchain projects involve communication, though not a major focus.

PO5: Analytical Reasoning Skills:

CO3 to CO7 strongly mapped. these involve detailed evaluation and analysis of systems and technologies.

PO6: Innovation, Employability and Entrepreneurial Skills:

CO5 to CO7 strongly mapped for practical skills in modern blockchain tools enhance job readiness and innovation.

PO7: Multidisciplinary Competence:

CO6 strongly mapped blockchain spans multiple industries, so interdisciplinary knowledge is useful.

PO9: Traditional Knowledge to Modern Application:

All CO's moderately mapped – blockchain represents a modern application domain, but may link to traditional systems in certain contexts.

PO10: Design and Development of System:

CO5 to CO7 strongly mapped. Students design smart contracts and decentralized apps.

PO11: Ethical and Social Responsibility:

CO3, CO5 to CO7 moderately mapped with topics like security, transparency, and data protection reflect ethical concerns.

PO12: Research-Related Skills:

CO1to CO7 moderately mapped. Many outcomes involve problem analysis and systematic evaluation relevant for research.

PO13: Teamwork:

CO5 to CO7 moderately mapped although often implemented individually, collaborative projects are possible.

PO14: Area-Specific Expertise:

All CO's are strongly mapped – the course builds blockchain-specific skills and expertise.

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)
Programme Code : BBACA
Class : T.Y. BBA (C.A)
Semester : V
Course Type : Major Elective (Theory)
Course Code : BBACA-306-MJE(C)
Course Title : Digital Image Processing
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. To introduce the fundamental concepts and methodologies of digital image processing.
2. To understand image enhancement techniques in both spatial and frequency domains.
3. To study image restoration, compression, and segmentation methods.
4. To explore morphological image processing techniques.
5. To apply image processing algorithms to real-world problems.
6. To understand various feature extraction methods to identify and extract key features from images, including introduction to object recognition processes.
7. To explore a wide range of real-world applications of image processing, such as medical imaging, satellite imaging, computer vision, and pattern recognition.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Understand the basics of digital image representation and processing.

CO2: Apply image enhancement techniques in spatial and frequency domains.

CO3: Implement image restoration and compression algorithms.

CO4: Perform image segmentation and feature extraction.

CO5: Utilize morphological operations for image analysis.

CO6: Develop solutions for practical problems using image processing techniques.

CO7: Evaluate the performance of various image processing algorithms.

Topics and Learning Points		
Unit 1	**Introduction to Digital Image Processing**	07
	1.1 Digital image fundamentals 1.2 Elements of visual perception 1.3 Image sampling and quantization 1.4 Basic relationships between pixels 1.5 Imaging geometry 1.6 Applications of digital image processing	
Unit 2	**Image Enhancement Techniques**	05
	2.1 Point processing techniques 2.2 Histogram processing 2.3 Spatial filtering (smoothing and sharpening filters) 2.4 Frequency domain filtering	
Unit 3	**Image Restoration and Compression**	07
	3.1 Image degradation models 3.2 Noise models 3.3 Restoration using inverse filtering 3.4 Wiener filtering 3.5 Fundamentals of image compression 3.6 Lossless and lossy compression techniques	
Unit 4	**Image Segmentation and Feature Extraction**	05
	4.1Detection of discontinuities (point, line, edge) 4.2Edge linking and boundary detection	

4.3Thresholding techniques

4.4Region-based segmentation

4.5Feature extraction techniques

4.6Introduction to object recognition

Unit 5 Morphological Image Processing and Applications 06

5.1Dilation and erosion

5.2Opening and closing

5.3Hit-or-miss transform

5.4Basic morphological algorithms

5.5 Applications in pattern recognition and computer vision

References:

1. "Digital Image Processing" – Rafael C. Gonzalez and Richard E. Woods, Pearson Education.
2. "Fundamentals of Digital Image Processing" – Anil K. Jain, Prentice Hall.
3. "Digital Image Processing Using MATLAB" – Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins.

Website Reference Link

1. Digital Image Processing Course - Stanford University – https://stanford.edu/class/ee368/
2. OpenCV Official Documentation – https://docs.opencv.org/
3. MATLAB Image Processing Toolbox – https://www.mathworks.com/products/image.html

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (SEM V) **Subject:** BBA (C.A)
Course: Digital Image Processing **Course Code:** BBACA-306-MJE(C)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes (POs)															
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3	2	2		2	2				2		2		2	
CO2	2	3	2		3	3	2			3		2		3	
CO3	2	3	3		3	3	2			3		3		3	
CO4	2	3	3	2	3	2	2			3		3		3	
CO5	2	2	2		3	2				3		2		2	
CO6	2	2	3	2	3	3	2			3		3	2	3	
CO7	2	2	3	2	3	2	2			2		3	2	3	

PO1: A Fundamental Knowledge and Coherent Understanding:

CO1 is strongly mapped to Introduces foundational concepts of digital image processing. CO2 to CO7 are moderately mapped to Build upon the basic concepts but focus more on application and analysis.

PO2: Procedural Knowledge for Skill Enhancement:

CO2, CO3, and CO4 are strongly mapped for outcomes involving step-by-step application of enhancement, restoration, and segmentation techniques. CO1 and CO5 to CO7 are moderately mapped to use procedures and tools to a lesser extent.

PO3: Critical Thinking and Problem-Solving Skills:

CO3, CO4, CO6, and CO7 are strongly mapped to demand design, evaluation, and optimization of image algorithms. CO1, CO2, and CO5 are moderately mapped to involve decision-making in applying concepts.

PO4: Communication Skills:

CO4, CO6, CO7 are moderately mapped require reporting, documentation, or team-based project discussion.

PO5: Analytical Reasoning Skills:

CO2 to CO7 are strongly mapped. Image enhancement, segmentation, and evaluation require logical analysis and data interpretation. CO1 is moderately mapped. Conceptual understanding involves some reasoning.

PO6: Innovation, Employability and Entrepreneurial Skills:

CO2, CO3, CO6 are strongly mapped with Creative use of algorithms and implementation boosts employability. Others CO's moderately mapped for **p**ractical relevance adds moderate impact.

PO7: Multidisciplinary Competence

CO2 to CO7 are moderately mapped. Concepts overlap with AI, vision, hardware, and medical fields.

PO10: Design and Development of System:

CO2 to CO6 are strongly mapped to involve developing or simulating image processing systems. CO1, CO7 are moderately mapped. Aid system understanding or evaluation.

PO12: Research-Related Skills:

CO3, CO4, CO6, CO7 are strongly mapped. It support research through experimentation, optimization, and evaluation. CO1, CO2, CO5 are moderately mapped. Contribute through understanding and exploration.

PO13: Teamwork:

CO6 and CO7 are moderately mapped often implemented as collaborative mini-projects.

PO14: Area-Specific Expertise:

CO2 to CO7 are strongly mapped. Specialized image processing tools and techniques are covered.

CO1 is moderately mapped. Establishes a base but not expert-level.

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)
Programme Code : BBACA
Class : T.Y. BBA (C.A)
Semester : V
Course Type : Major Mandatory (Theory)
Course Code : BBACA-311-MN
Course Title : Digital Marketing
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. To introduce the fundamental concepts of Internet and Digital marketing and its evolution from traditional marketing.
2. To develop an understanding of digital marketing channels, tools, and strategies including SEO, SEM, and email marketing.
3. To enable students to create and manage digital content that aligns with web design principles and audience targeting.
4. To familiarize learners with social media marketing tools and platforms like Facebook, Instagram, LinkedIn, and YouTube.
5. To provide knowledge of budgeting, cost estimation, and analytics in planning and executing digital marketing campaigns.
6. To build skills in customer relationship management (CRM) and its role in digital marketing.
7. To equip students with practical exposure and strategic planning skills for real-world digital marketing scenarios.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Understand the core principles of Internet and digital marketing and how they differ from traditional methods.

CO2. Apply SEO and SEM techniques to optimize website visibility and drive online traffic.

CO3. Design digital marketing content and webpages using appropriate tools and strategies.

CO4. Analyze and segment target groups and apply content strategies accordingly.

CO5. Create and implement effective social media marketing plans across multiple platforms using relevant tools.

CO6. Use web and campaign analytics tools to evaluate performance and make data-driven marketing decisions.

CO7. Estimate and manage digital marketing budgets**,** including cost control and resource planning for campaigns.

Topics and Learning Points

Unit 1: Foundations of Internet Marketing **06**

1.1 Understanding Internet Marketing
1.2 Search Engine Optimization
1.3 Search Engine Marketing
1.4 Email Marketing
1.5 Digital Display Marketing

Unit2: Essentials of Digital Marketing **06**

2.1 Introduction to Digital Marketing
2.2 Traditional vs. Digital
2.3 Digital Marketing Channels
2.4 Types of Digital Marketing
2.5 Introduction to CRM

Unit3:	**Strategic Content & Website Management**	**06**

3.1 Content Management & SEO
3.2 SWOT Analysis
3.3 Target Group Analysis
3.4 Web Design Principles
3.5 Website Creation.

Unit4:	**Social Media & Performance Marketing**	**06**

4.1 Introduction to Social Media Marketing
4.2 Facebook Marketing
4.3 Instagram & LinkedIn
4.4 YouTube & Email Marketing
4.5 Social Media Tools
4.6 Social Media Plan

Unit5:	**Budgeting and Analytics in Digital Marketing**	**6**

5.1 Web Analytics
5.2 Resource Planning
5.3 Cost Estimation
5.4 Cost Budgeting
5.5 Cost Control

References:

1. Digital Marketing: Strategy, Implementation & Practice by Dave Chaffey and Fiona Ellis-Chadwick, 7th Edition
2. Digital Marketing: Strategy, Implementation and Practice by Dave Chaffey & Fiona Ellis-Chadwick, Publisher Pearson
3. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation by Damian Ryan
4. Digital Marketing for Dummies by Ryan Deiss & Russ Henneberry
5. Social Media Marketing: A Strategic Approach **by** Melissa Barker, Donald Barker, Nicholas Bormann

Website Reference Link:

1. https://digitalgarage.withgoogle.com
2. https://moz.com/beginners-guide-to-seo
3. https://contentmarketinginstitute.com/
4. https://sproutsocial.com/insights/social-media-marketing-strategy/

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (SEM V) **Subject:** BBA (C.A)
Course: Digital Marketing **Course Code:** BBACA-311-MN

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes (POs)															
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3			3		2	2		2		2			3	1
CO2	2	3	3		3	3	2		2	3		2		3	2
CO3	2			3		3	2			3				3	2
CO4	2		3	3	3	3	2	2		3		2		3	2
CO5	2	3		3		3	2	2		3	2		2	3	2
CO6	2	3	3		3	3	2			3		2		3	2
CO7	2	3	3		3	3	2			3	2	2	2	3	2

PO1: A Fundamental Knowledge and Coherent Understanding:

CO1 is strongly mapped to build foundational understanding of internet and digital marketing; CO2–CO7 are moderately mapped to enhance technical knowledge across platforms and tools.

PO2: Procedural Knowledge for Skill Enhancement:

CO2, CO5, CO6, and CO7 are strongly involved in applied skill sets like SEO, campaign execution, social media tool usage, and analytics, which enhance procedural mastery.

PO3: Critical Thinking and Problem-Solving Skills:

CO2, CO4, CO6, and CO7 are strongly focused on applying strategies, analyzing campaigns, and using insights to make informed decisions.

PO4: Communication Skills:

CO1, CO3, CO4, and CO5 strongly foster communication through content creation, marketing message delivery, and platform interaction.

PO5: Analytical Reasoning Skills:

CO2, CO4, CO6, and CO7 strongly require evaluation of data, segmenting audiences, and drawing conclusions from performance reports.

PO6: Innovation, Employability and Entrepreneurial Skills:

All COs, especially CO5 to CO7, enable students to gain practical, industry-relevant skills needed in modern digital marketing roles or startups.

PO7: Multidisciplinary Competence:

CO1–CO7 apply knowledge from marketing, business strategy, and IT, reflecting a multidisciplinary approach.

PO8: Value Inculcation through Community Engagement:

CO4 and CO5 encourage responsible marketing and ethical communication with different communities.

PO9: Traditional Knowledge into Modern Application:

CO1 and CO3 are moderately connect conventional marketing concepts to current digital practices.

PO10: Design and Development of System:

All COs are strongly emphasize on designing content, user-centric strategies, and campaign architecture.

PO11: Ethical and Social Responsibility:

CO1, CO5, and CO7 include emphasis on ethical campaign design, privacy in marketing, and social media usage ethics.

PO12: Research-Related Skills:

CO2, CO4, CO6, and CO7 involve analyzing trends, evaluating analytics, and assessing target audiences using data-driven approaches.

PO13: Teamwork:

CO5 and CO7 may involve collaborative group assignments or campaign planning.

PO14: Area-Specific Expertise:

All COs directly relate to digital marketing, which is a core skill in modern computer applications and business environments.

PO15: Environmental Awareness:

Digital marketing encourages paperless, resource-efficient outreach strategies; CO5–CO7 promote eco-friendly digital communication.

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)

Programme Code : BBACA

Class : T.Y. BBA (C.A)

Semester : V

Course Type : Major Mandatory (Practical)

Course Code : BBACA-312-MN

Course Title : Practical Lab on Digital Marketing

No. of Credits : 02

No. of Teaching Hours : 60

Course Objectives:

1. To provide hands-on experience in designing and developing digital marketing strategies for real-life business scenarios using online tools and platforms.
2. To enable students to create and manage a basic digital marketing website, integrating SEO best practices to enhance online visibility.
3. To develop the ability to analyze and interpret website traffic data using Google Analytics, aiding in data-driven marketing decisions.
4. To train students in creating visually appealing marketing materials, such as banners and promotional creatives, using tools like Canva.
5. To provide practical knowledge of managing social media campaigns, including Facebook, Twitter, Instagram, and YouTube, for brand promotion and customer engagement.
6. To introduce students to the fundamentals of email marketing, including the design, automation, and performance analysis of email campaigns.
7. To cultivate the skills required to build and manage digital content, implement targeted promotions, and evaluate the success of various digital marketing channels

Course Outcomes:

By the end of the course, students will be able to:

CO1: Demonstrate the ability to design and implement effective digital marketing strategies for business scenarios using various online tools.

CO2: Develop and optimize a digital marketing website, incorporating SEO best practices to improve visibility and user engagement.

CO3: Analyze website traffic and user behavior using Google Analytics to derive actionable marketing insights.

CO4: Create professional promotional banners and visual content using Canva for use across multiple digital platforms.

CO5: Plan, execute, and manage social media marketing campaigns on platforms such as Facebook, Instagram, Twitter, and YouTube.

CO6: Design and implement targeted email marketing campaigns, including performance analysis based on open and click-through rates.

CO7: Evaluate the effectiveness of various digital marketing channels and tools, and apply optimization techniques based on performance data.

Topics and Learning Points

1. Assignments on Digital Marketing Implementation in Business Scenario
2. Assignments on Create the Digital Marketing Webpage
3. Assignments on Using Google Analytics to analyse website performance
4. Assignments on Creating Promotional banner through Canvas
5. Assignments on Facebook Promotion using banners
6. Assignments on Creating YouTube Channel for Marketing
7. Assignments on Twitter Marketing
8. Assignments on Instagram Marketing
9. Assignments on Email Marketing

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (SEM V) **Subject:** BBA (C.A)
Course: Practical Lab on Digital Marketing **Course Code:** BBACA-312-MN

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes (POs)															
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3	3	3			3			3	3				3	
CO2	3	3				3				3				3	
CO3	2	3	3		3	2				3		3	3	3	
CO4		2		3		3	3			2			3	2	
CO5	3	3		3		3	3	3		3	3		3	2	
CO6		3		3		3			3	2	3			2	
CO7		3	3		3	3				3		3		3	

PO1: A Fundamental Knowledge and Coherent Understanding:

This PO is addressed through CO1**,** CO2, and CO5. Students gain multidisciplinary knowledge by designing and implementing digital marketing strategies (CO1), developing SEO-based websites (CO2), and managing social media campaigns (CO5). These outcomes collectively ensure that students understand digital marketing concepts in the broader context of commerce, management, and computer applications.

PO2: Procedural Knowledge for Skill Enhancement:

All COs contribute significantly to this PO. Through hands-on practice in real-world digital tools and website development, students enhance procedural understanding of marketing operations and website optimization. They are also introduced to structured methods of campaign planning and execution, aligning well with the skill enhancement goals.

PO3: Critical Thinking and Problem-Solving Skills:

CO1, CO3, and CO7 support this PO by encouraging students to solve marketing-related problems through data analysis and strategy design. Students apply learned concepts in new contexts such as

evaluating traffic data (CO3) and selecting optimal digital channels (CO7), fostering their ability to deal with complex scenarios.

PO4: Communication Skills:

CO4, CO5, and CO6 directly contribute to improving communication skills. Students create promotional content (CO4), manage social media interactions (CO5), and design email campaigns (CO6), thereby strengthening their interpersonal, intrapersonal, and professional communication abilities in the digital context.

PO5: Analytical Reasoning Skills:

This PO is strongly aligned with CO3 and CO7, where students interpret user behavior through Google Analytics (CO3) and evaluate campaign effectiveness (CO7). These tasks require analyzing data, selecting appropriate tools, and taking action based on insights, thus developing strong analytical skills.

PO6: Innovation, Employability and Entrepreneurial Skills:

All course outcomes (CO1 to CO7) contribute to this PO, particularly CO1 (strategy design), CO2 (website development), CO5 (campaign execution), and CO6 (email marketing). Students develop digital skills that improve their employability and entrepreneurial capacity in digital marketing.

PO7: Multidisciplinary Competence:

CO4 and CO5 contribute here by combining knowledge of business, design, and IT. Students utilize tools like Canva (CO4) and implement social media strategies (CO5), integrating concepts from visual arts, marketing, and computer applications.

PO8: Value Inculcation through Community Engagement:

CO5 supports this outcome by allowing students to participate in social outreach through social media platforms. Campaigns may be designed for awareness and engagement, encouraging social responsibility and value-based communication.

PO9: Traditional Knowledge into Modern Application:

This PO is moderately supported by CO1 and CO6, where traditional marketing concepts (like promotions and customer communication) are implemented through modern tools such as email and online platforms.

PO10: Design and Development of System:

All course outcomes (CO1 to CO7) contribute to this PO, the primary contributor here, as students design and develop digital marketing websites and optimize them for real-world use. They ensure that systems meet user and business needs.

PO11: Ethical and Social Responsibility:

CO5 and CO6 relate to this PO as students manage public content, ensuring ethical practices in communication and promotion. Understanding responsible communication builds social awareness in digital interactions.

PO12: Research-Related Skills:

CO3 and CO7 contribute by training students to collect, analyze, and interpret web and marketing data. These tasks reflect basic research methodology, including observation, interpretation, and conclusion.

PO13: Teamwork:

Most practical assignments such as campaign management (CO5), content creation (CO4), and analytics (CO3) often require collaborative effort. Students learn to work in teams to deliver cohesive digital strategies.

PO14: Area-Specific Expertise:

This PO is thoroughly addressed across CO1 to CO7. Students gain domain-specific knowledge in marketing, website management, data analysis, and digital communication. It builds core expertise in areas like SEO, analytics, social media, and email marketing.

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)

Programme Code : BBACA

Class : T.Y. BBA (C.A)

Semester : V

Course Type : Vocational Skill Course (Practical)

Course Code : BBACA-321-VSC

Course Title : Practical Lab on.Net Framework

No. of Credits : 02

No. of Teaching Hours : 60

Course Objectives:

1. To understand the fundamentals of the .NET Framework and C# programming.
2. To develop Windows Forms applications with event-driven programming.
3. To implement database connectivity using ADO.NET.
4. To design and develop web applications using ASP.NET.
5. To generate Crystal Reports and deploy .NET applications.
6. To Implement Event-Driven Programming with Windows Forms.
7. To Integrate Learned Concepts in a Mini Project.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Demonstrate C# programming concepts, including OOP principles.

CO2: Develop Windows Forms applications using event-driven programming.

CO3: Implement database connectivity using ADO.NET.

CO4: Design dynamic web applications using ASP.NET.

CO5: Apply state management and authentication techniques in ASP.NET.

CO6: Generate and customize Crystal Reports for applications.

CO7: Deploy Windows and Web Applications efficiently.

Topics and Learning Points

Practical Assignment List

Assignment on Introduction to .NET & C# Programming

1. Write a C# program to check if a number is even or odd.
2. Write a C# program to calculate the factorial of a number using recursion.
3. Implement function overloading with different numbers of parameters.
4. Write a C# program to check if a given string is a palindrome.
5. Implement exception handling using try-catch-finally blocks.

Assignment on Windows Forms & Event-Driven Programming

6. Create a Windows Forms application with basic controls (Button, Label, TextBox).
7. Implement event handling for mouse clicks and key presses.
8. Design a simple calculator application using Windows Forms.
9. Implement multithreading to execute multiple tasks simultaneously.

Assignment on Database Programming with ADO.NET

10. Write a C# program to connect to a database using ADO.NET.
11. Implement CRUD (Create, Read, Update, Delete) operations on a Student database.
12. Display database records using DataReader and DataAdapter.
13. Implement data binding in a Windows Forms application to display database data.

Assignment on Web Development using ASP.NET

14. Create an ASP.NET Web Form to validate user input (e.g., email, phone number).
15. Implement ViewState, Session, and Cookies in an ASP.NET application.
16. Create a Master Page with navigation links and a consistent layout.
17. Develop a login authentication system using ASP.NET and database connectivity.

Assignment on Crystal Reports & Application Deployment

18. Generate a Crystal Report to display student marks from a database.
19. Deploy a Windows Forms application using ClickOnce deployment.
20. Publish an ASP.NET web application on IIS (Internet Information Services).
21. Develop a mini project integrating all concepts learned throughout the course.

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (SEM V) **Subject:** BBA (C.A)
Course: Practical Lab on.Net Framework **Course Code:** BBACA-321-VSC

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes (POs)															
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3	3	2	1	2					3	1	2		3	1
CO2	2	3	2	2	2					3	1	1		3	1
CO3	2	3	3	2	3					3	2	2		3	1
CO4	2	3	3	3	3	3				3	2	2		3	2
CO5	2	3	3	3	2	3				3	2	2		3	1
CO6	2	2	2	2	2					2	2	2		3	1
CO7	2	3	2	2	2	3				3	2	2	3	3	1

PO1: A Fundamental Knowledge and Coherent Understanding:

CO1 is strongly mapped, while CO2 through CO7 are moderately mapped. It offers both practical and theoretical understanding of .NET, C#, ASP.NET, database handling, and reporting tools—essential in the IT domain.

PO2: Procedural Knowledge for Skill Enhancement:

All COs are strongly mapped with building procedural skills through hands-on assignments on Windows Forms, ASP.NET, and database operations.

PO3: Critical Thinking and Problem-Solving Skills:

Students develop problem-solving skills via logical programming using CO1 and CO2 with moderately mapped CO3, CO4, and CO5, which are strongly mapped to error handling (CO5) and project implementation (CO7).

PO4: Communication Skills:

Students improve technical communication via documentation and reporting (CO6), and presentation of their mini-project (CO7).

PO5: Analytical Reasoning Skills:

The design of algorithms, use of ADO.NET for CRUD operations, and validations in ASP.NET applications (CO3, CO4, CO5) foster analytical thinking.

PO6: Innovation, Employability and Entrepreneurial Skills:

Application deployment CO4, CO5, and CO7 are strongly mapped to prepare students for entrepreneurship or job readiness in software development roles.

PO10: Design and Development of System:

All Cos are strongly mapped as students design and develop full-fledged desktop/web systems and components using .NET Framework and ASP.NET (CO2–CO7).

PO11: Ethical and Social Responsibility:

Through responsible software development, security implementations, and login/authentication mechanisms (CO5, CO7), students learn ethics.

PO12: Research-Related Skills:

All COs are moderately mapped as students use documentation, testing, analysis, and mini-project implementation, which form a base for research activities (CO6, CO7).

PO13: Teamwork:

Group project execution (CO7) fosters teamwork and collaborative programming.

PO14: Area-Specific Expertise:

All COs are strategically aligned to deliver technical expertise in web and desktop application development, database management, and reporting.

PO15: Environmental Awareness:

All COs are weakly mapped as indirectly contributing by encouraging digital solutions, which reduce paper-based systems (e.g., digital reports, web forms, etc.) (CO6, CO7).

CBCS Syllabus as per NEP 2020 for T.Y. BBA (Computer Application) (2023 Pattern)

Name of the Programme : BBA (Computer Application)

Programme Code : BBACA

Class : T.Y. BBA (C.A)

Semester : V

Course Type : Field Project (Practical)

Course Code : BBACA-335-FP

Course Title : Field Project

No. of Credits : 02

No. of Teaching Hours : 60

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Course Objectives:

1. To introduce students to field-based experiential learning.
2. To develop research, data collection, and analysis skills.
3. To enhance problem-solving and critical thinking abilities.
4. To improve communication and teamwork skills.
5. To encourage the application of theoretical knowledge in practical scenarios.
6. To exposure to industry practices, standards, and work environments, allowing them.
7. To manage projects, including planning, execution, time management, and resource allocation.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Identify and define a research problem relevant to real-world applications.

CO2: Design and develop an appropriate research methodology, including a questionnaire.

CO3: Conduct fieldwork and collect primary data systematically.

CO4: Analyze and interpret collected data using qualitative and quantitative methods.

CO5: Prepare a structured project report following academic guidelines.

CO6: Develop teamwork, ethical considerations, and professional communication skills.

CO7: Deliver an effective oral presentation, demonstrating clarity and confidence.

Topics and Learning Points

Time Allocation & Marks Distribution

Component	Hours Allocated	Marks
Topic Selection & Study Design	2.5 Hours	5 Marks
Survey Preparation & Fieldwork	12.5 Hours	20 Marks
Data Analysis	5 Hours	05 Marks
Report Writing	7.5 Hours	10 Marks
Oral Presentation	2.5 Hours	10 Marks
Total	**30 Hours**	**50 Marks**

Project Work Guidelines

1. **Topic Selection:**

   Each student/group (2-3 students per group) must select a real-world topic relevant to their field of study. A faculty guide will supervise the project.

2. **Survey Preparation & Fieldwork:**

   Prepare a structured questionnaire (20-30 questions) in Marathi or English**.** If the project does not require a survey**,** replace this step with relevant data collection methods. Conduct field visits to collect at least 25 responses or relevant data.

3. **Data Analysis:**

   Compile and analyze the collected data using statistical tools, charts, and graphs**.** Identify patterns and key insights.

4. **Report Writing:**

   The report should include Index, Chapters, Conclusion, and References**. Format:** 25 pages, Font Size 12, Line Spacing 1.5**.**

5. **Oral Presentation:**

   Each student/group must present their findings in front of two faculty examiners**.** Evaluation is based on clarity, confidence, and presentation quality**.**

6. **Evaluation Scheme**

   Evaluation will be done internally and externally by two faculty members. The Field Project is compulsory**,** and students must pass to complete their degree.

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: TYBBA (C.A) (Sem V) **Subject:** BBA (C.A)

Course: Field Project **Course Code:** BBACA-335-FP

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)														
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3	2	3		2	2		2	2	2	2	3		2	
CO2	2	3	2		2	2				3	2	3	2	2	
CO3		2	3		2	2	2	2		2	2	3	2	2	
CO4	2	2	3		3	2	2			3	2	3	2	2	
CO5	2	2	2	2	2					2	2	3	2	2	
CO6		2	2	3	2	3		2			3	2	3	2	
CO7		2	2	3		2				2	2		2		

PO1: A Fundamental Knowledge and Coherent Understanding

CO1 is strongly mapped; it involves identifying and defining a research problem using foundational knowledge. CO2, CO4, and CO5 are moderately mapped with required application of basic concepts to design methodology and analyze data. CO3, CO6, and CO7 are weakly mapped. Focus more on application and communication than core knowledge.

PO2: Procedural Knowledge for Skill Enhancement

CO2 is strongly mapped as Designing a methodology directly reflects procedural skill. CO1, CO3, CO4, CO5, CO6, and CO7 are moderately mapped: Apply structured approaches throughout the research process.

PO3: Critical Thinking and Problem-Solving Skills:

CO1, CO3, and CO4 are strongly mapped with each stage of research involving problem identification, data analysis, and evaluation. CO2, CO5, CO6, and CO7 are moderately mapped. Indirectly involve logical and strategic thinking in execution and reporting.

PO4: Communication Skills:

CO6 and CO7 are strongly mapped to an emphasis on verbal and written communication, especially for reporting and presentation. CO5 is moderately mapped, with academic writing requiring formal communication.

PO5: Analytical Reasoning Skills:

CO4 is strongly mapped. It directly involves interpreting data with analytical tools. CO1, CO2, CO3, CO5, and CO6 are moderately mapped. It engages with reasoning during problem identification, data collection, and ethics.

PO6: Innovation, Employability, and Entrepreneurial Skills

CO6 is strongly mapped. Enhances employability through professionalism and ethics. CO1, CO2, CO3, CO4, and CO7 are moderately mapped: Research and presentation skills foster innovation and applied learning.

PO7: Multidisciplinary Competence:

CO3 and CO4 are moderately mapped with Fieldwork and data analysis may involve multiple disciplines.

PO8: Value Inculcation through Community Engagement

CO1, CO3, and CO6 are moderately mapped, with Real-world research often involving community-focused problems and ethical practices.

PO9: Traditional Knowledge into Modern Application

CO1 and CO2 are moderately mapped with Research may integrate traditional issues or practices depending on the topic.

PO10: Design and Development of System

CO2 and CO4 are strongly mapped with Research design and data analysis mirrors system development principles. CO1, CO3, CO5, and CO7 are moderately mapped, which includes elements of structured design and planning.

PO11: Ethical and Social Responsibility

CO6 is strongly mapped with ethics and professionalism and is explicitly taught. CO1, CO2, CO3, CO4, CO5, and CO7 are moderately mapped: Indirectly involve ethics in research handling.

PO12: Research-Related skills:

CO1, CO2, CO3, CO4, and CO5 are strongly mapped for Central focus on research planning, execution, and reporting. CO6 is moderately mapped to apply to professional research practices.

PO13: Teamwork

CO6 is strongly mapped for promoting collaboration and team ethics. CO2, CO3, CO4, CO5, and CO7 are moderately mapped. Often carried out in group projects or peer-reviewed settings.

PO14: Area-Specific Expertise:

CO1, CO2, CO3, and CO4 are moderately mapped for Research builds domain knowledge. CO5 and CO6 are also moderately mapped via reporting and practice.