

2. BCA Honours with Research Semester - VII Syllabus

BCA Honours with Research Semester- VII (Fourth Year)

Subject Title : Data Analytics

Subject Code : CAM401-4C

Subject Type : Major

Rationale:

The Data Analytics course is designed to develop data-driven thinking and analytical skills among students. With the exponential growth of digital data across various domains, the ability to analyze and interpret data has become essential. This course introduces fundamental concepts of data collection, pre-processing, analysis, and visualization. It emphasizes hands-on learning and real-world problem solving to enhance practical competencies. The course bridges theoretical knowledge with industry-relevant applications. It also supports employability and multidisciplinary learning by preparing students for data-oriented roles. Overall, the course contributes to skill development, critical thinking, and lifelong learning.

Learning Outcomes:

The Students will be able to:

- Understand data analytics, types, lifecycle, applications, and ethical considerations.
- Collect, clean, preprocess structured, semi-structured, unstructured data efficiently.
- Perform exploratory data analysis, summarize distributions, and interpret descriptive statistics.
- Create visualizations and dashboards using Python and Power BI.
- Apply correlation, regression, classification, clustering, basic predictive analytics techniques.

Teaching and Evaluation Scheme:

Credits	Duration in Hours		Maximum Marks		Total
	Theory	Practical	CCE(Formative)	SEE(Summative)	
4	30	60	50	50	100

Course Content:

Unit I

[Weightage=25%approx., Lectures=7, Practicals=14]

Introduction to Data Analytics: Introduction to Data, Information, and Knowledge, Types of Data: Structured, Semi-Structured, and Unstructured, Data Analytics vs. Data Science vs. Business Analytics, Evolution of Data Analytics, Data Analytics Lifecycle: Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize Types of Analytics: Descriptive, Diagnostic, Predictive, Prescriptive, Role of Data Analytics in Decision Making Applications of Data Analytics in Education, Healthcare, Business, Government, and Industry Challenges and Ethical Issues in Data Analytics.


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Unit II [Weightage=25%approx., Lectures=7, Practicals=14]

Data Collection and Data Pre-processing: Data Sources: Primary and Secondary Data Sources, Internal and External Data Sources, Data Collection Techniques, Data Quality Issues, and Data Cleaning: Noise Removal, Duplicate Handling, and Handling Missing Data: Deletion, Mean/Median/Mode Imputation, Data Integration and Data Reduction, Data Transformation: Normalization, Aggregation, Discretization, Data Encoding Techniques, Introduction to Data Pre-processing Tools.

Unit III [Weightage=25%approx., Lectures=8, Practicals=16]

Exploratory Data Analysis and Visualization: Introduction to Exploratory Data Analysis (EDA), Importance of EDA in Data Analytics, Descriptive Statistics: Mean, Median, Mode, Variance, Standard Deviation, Data Distribution and Frequency Analysis, Data Summarization Techniques, Data Visualization Principles, Types of Charts: Bar Chart, Line Chart, Pie Chart, Histogram, Box Plot and Scatter Plot, Introduction to Dashboards and Reports, Interpretation of Visual Data.

Unit IV [Weightage=25%approx., Lectures=8, Practicals=16]

Basic Analytical and Predictive Techniques: Introduction to Analytical Modelling, Correlation Analysis and its Applications, Regression Analysis: Simple Linear, Regression (Concept Only), Classification Techniques: Overview of Decision Tree and K-NN, Clustering Overview: K-Means Concept, Introduction to Predictive Analytics, Model Evaluation Basics, Use Cases of Predictive Analytics, and Limitations of Basic Analytics Models.

Text Book:

Data Analytics Anil Maheshwari, Second Edition McGraw-Hill Education.

Reference Books:

- Jiawei Han, Micheline Kamber, Jian Pei Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann.
- Wes McKinney Python for Data Analysis, 3rd Edition, O'Reilly Media.
- Seema Acharya & Subhashini Chellappan Big Data and Analytics, Wiley India.
- Vijay Kotu & Bala Deshpande, Predictive Analytics and Data Mining, Morgan Kaufmann.
- Andy Kriebel & Avi Singh Storytelling with Data, Wiley.

Reference Links:

- <https://www.geeksforgeeks.org/complete-data-analytics-training-program/>
- <https://www.aspirecomputer.in/syllabus/data-analytics-course-syllabus.html>
- <https://learn.microsoft.com/hi-in/training/modules/understand-concepts-of-data-analytics/>
- <https://learn.microsoft.com/hi-in/training/modules/explore-analyze-data-with-python/>
- <https://learn.microsoft.com/hi-in/training/courses/pl-300t00>

Practical List:

- **Study of Data Analytics Concepts-** Understand data, information, knowledge, types of analytics, analytics lifecycle, and applications through case studies.

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- **Dataset Collection and Understanding**- Identify data sources, collect datasets from for data interpretation.
- **Power CSV/Excel**, and study data attributes, size, and quality issues.
- **Python Environment Setup**- Install Anaconda, launch Jupyter Notebook, and execute basic Python commands for data analytics.
- **Data Loading and Exploration using Pandas**- Load datasets using Pandas and perform basic exploration using head(), tail(), info(), and describe().
- **Data cleaning and Pre-processing**- Handle missing values, remove duplicates, and apply basic transformations using Pandas.
- **Exploratory Data Analysis (EDA)**- Perform descriptive statistical analysis and frequency distribution on datasets using Python.
- **Data Visualization using Python**- Create bar charts, line charts, histograms, and scatter plots using Matplotlib.
- **BI Data Import and Visualization** -Import Excel/CSV data into Power BI and create basic visualizations such as bar, column, and pie charts.
- **Dashboard Creation in Power BI**- Design a simple interactive dashboard using filters and slicers to analyse trends and comparisons.
- **Basic Predictive Analysis**
Perform correlation analysis and simple linear regression using Python; interpret results and visualize outcomes.
- **Classification using K-Nearest Neighbors (K-NN)**
Implement a basic K-NN classification model using Python (Scikit-learn) on a given dataset and analyse the classification results.
- **Clustering using K-Means Algorithm**
Apply K-Means clustering on a dataset using Python, visualize clusters, and interpret the clustering outcome.


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BCA HONOURS WITH RESEARCH SEMESTER : VII
SUBJECT CODE : CAM401-4C
SUBJECT TITLE : DATA ANALYTICS

COs	Course Outcome	POs/ PSOs	CL Cognitive Level	KC Knowledge Category	Class Sessions	Lab Sessions
CO1	Understand fundamental concepts, processes, and applications of Data Analytics in various domains.	PO1, PO2, PO3, PO5, PSO2	U	C	7	6
CO2	Apply data collection and data pre-processing techniques to prepare datasets for analysis.	PO2, PO3, PO4, PO7, PSO1, PSO2	Ap	P	5	10
CO3	Perform exploratory data analysis using basic statistical methods to identify patterns and trends.	PO2, PO3, PO5, PO9, PSO2	An	A	5	10
CO4	Use appropriate tools and programming techniques to analyze and interpret data effectively.	PO3, PO4, PO7, PO9, PO10, PSO1, PSO2	Ap /An	P	4	12
CO5	Create meaningful data visualizations to communicate analytical insights clearly and accurately.	PO4, PO6, PO7, PSO2, PSO3	AP	A	4	12
CO6	Demonstrate data-driven problem-solving skills by analyzing real-world datasets and presenting conclusions.	PO1, PO2, PO8, PO9, PO10, PSO2, PSO3	An	M	5	10

Mapping of COs with POs & PSOs

Course CAM401-4C	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CO1	3	3	3	-	2	-	-	-	-	-	-	3	-
CO2	-	3	3	2	-	-	3	-	-	-	3	3	-
CO3	-	3	3	-	2	-	-	-	3	-	-	3	-
CO4	-	-	3	2	-	-	3	-	3	3	3	3	-
CO5	-	-	-	2	-	3	3	-	-	-	-	3	3
CO6	3	3	-	-	-	-	-	3	3	3	-	3	3

3: High, 2: Medium, 1: Low


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BCA Honours with Research Semester – VII

(Fourth Year)

Subject Title : Artificial Intelligence

Subject Code : CAM402- 4C

Subject Type : Major

Rationale:

This course introduces students to the fundamental concepts and techniques of Artificial Intelligence, enabling them to understand how intelligent systems are designed and implemented. It provides a strong foundation in problem solving, search strategies, knowledge representation, reasoning, and basic artificial intelligence. By learning both theoretical principles and practical algorithms, students become capable of analyzing problems, selecting suitable AI techniques, and developing simple intelligent applications using AI.

Learning Outcomes:

Students will be able to:

- Understand the fundamental concepts, history, and applications of Artificial Intelligence. Model real-world problems using state-space representation, agents, and production systems.
- Apply uninformed and informed search techniques, including A*, Hill Climbing, and game-playing strategies.
- Represent knowledge using logic, semantic networks, frames, and rule-based systems.
- Perform reasoning through forward chaining, backward chaining, unification, and resolution.
- Implement basic machine learning, robotics, and vision concepts using Python.

Teaching and Evaluation Scheme:

Credits	Duration in Hours		Maximum Marks		Total
	Theory	Practical	CCE (Formative)	SEE (Summative)	
4	30	60	50	50	100

Course Content:

Unit I

[Weightage=25% approx., Lectures=7, Practicals= 14]

Introduction to Artificial Intelligence: Introduction to Artificial Intelligence, History of AI, Strong AI and Weak AI, Foundations and Applications of AI, PEAS representation, Rational Agents, Components of AI (Knowledge, Reasoning, Learning), Problem Formulation, State Space Representation, Problem Characteristics, Production Systems, Generate-and-Test Method, Means–Ends Analysis, and Introduction to Hill Climbing.


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Unit II [Weightage=25% approx., Lectures=7, Practicals= 14]

Search Techniques and Game Playing: Uninformed Search Methods: Breadth-First Search (BFS), Depth-First Search (DFS), Depth-Limited Search, Uniform Cost Search.

Informed Search Methods: Greedy Best-First Search, A* Search, Heuristic Functions, Hill Climbing, AO* Algorithm.

Game Playing: Minimax Strategy, Alpha–Beta Pruning, and Simple Evaluation Functions.

Unit III [Weightage=25% approx., Lectures=8, Practicals= 16]

Knowledge Representation and Reasoning: Propositional Logic, Predicate Logic (First-Order Logic), Unification, Resolution, Semantic Networks, Frames, Scripts, Conceptual Dependency, Rule-Based Knowledge Representation, Forward Chaining, Backward Chaining, Inference Mechanisms, and Introduction to Expert Systems including Knowledge Base and Inference Engine.

Unit IV [Weightage=25% approx., Lectures=8, Practicals= 16]

Machine Learning Fundamentals, Robotics and Vision: Fuzzy Sets: Notion of Fuzziness, Membership Functions, Fuzzification and Defuzzification, Operations on Fuzzy Sets, Fuzzy Functions and Linguistic Variables; Fuzzy Relations, Fuzzy Rules and Fuzzy Inference; Fuzzy Control System and Fuzzy Rule Based Systems. Foundations of Machine Learning and types of learning (Supervised, Unsupervised, Reinforcement), Concept Learning, Decision Trees, Regression (basic idea), Artificial Neural Networks and Perceptron Model, Basic Robotics Concepts including Sensors and Actuators, Path Planning Introduction, Computer Vision Basics including Edge Detection and Feature Extraction, and Applications of Artificial Intelligence in real-world domains.

Text Book:

Artificial Intelligence, Elaine Rich, Kevin Knight, Shivashankar B. Nair, 3rd Edition, McGraw Hill.

Reference Book:

Artificial Intelligence-A modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Pearson Education.

Reference Links:

- <https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/>
- <https://www.geeksforgeeks.org/history-of-artificial-intelligence/>
- <https://www.geeksforgeeks.org/strong-ai-vs-weak-ai/>
- <https://www.geeksforgeeks.org/intelligent-agents-in-artificial-intelligence/>
- <https://www.geeksforgeeks.org/problem-formulation-in-artificial-intelligence/>
- <https://www.geeksforgeeks.org/production-system-in-artificial-intelligence/>
- <https://www.geeksforgeeks.org/introduction-hill-climbing-artificial-intelligence/>

Practical List:

- PEAS Representation for real-world problems (Vacuum Cleaner, Self-driving Car)
- Design of Simple Reflex/Rational Agent (Vacuum Cleaner Problem)
- Water Jug Problem using basic state-space approach


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- 8-Puzzle Problem (basic state representation and moves)
- Breadth First Search (BFS) implementation
- Depth First Search (DFS) implementation
- A* Search algorithm (basic heuristic-based search)
- Hill Climbing algorithm (simple optimization problem)
- Propositional Logic operations (AND, OR, NOT, implication)
- Fuzzy Set operations and simple Fuzzy Inference System
- Decision Tree algorithm for classification
- Simple Perceptron model (AND/OR gate implementation)


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BCA HONOURS WITH RESEARCH SEMESTER : VII

SUBJECT CODE : CAM402-4C

SUBJECT TITLE : ARTIFICIAL INTELLIGENCE

COs	Course Outcome	POs/PSOs	CL Cognitive Level	KC Knowledge Category	Class Sessions	Lab Sessions
CO1	Explain the fundamental concepts, history, foundations, and applications of Artificial Intelligence.	PO1, PO2	U	C	4	4
CO2	Model real-world problems using agents, PEAS representation, state-space representation, and production systems.	PO1, PO2, PO3	Ap	C	4	8
CO3	Apply uninformed and informed search techniques and game-playing strategies to solve AI problems.	PO2, PO3, PO4	Ap	P	6	14
CO4	Represent knowledge and perform reasoning using logic, semantic networks, frames, and rule-based systems.	PO2, PO3, PO4	An	C,P	7	13
CO5	Apply fuzzy logic, machine learning, and neural network concepts to simple problem domains.	PO2, PO3, PO4, PSO1	Ap	P	6	12
CO6	Design and implement basic AI applications such as search algorithms, expert systems, and learning models using Python.	PO3, PO4, PO5, PSO1, PSO2	C	P,M	3	9

Mapping of COs with POs & PSOs

Course CAM402-4C	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CO1	3	3	—	—	—	—	—	—	—	—	—	—	—
CO2	3	3	3	—	—	—	—	—	—	—	—	—	—
CO3	—	3	3	3	—	—	—	—	—	—	—	—	—
CO4	—	3	3	3	—	—	—	—	—	—	—	—	—
CO5	—	3	3	3	—	—	—	—	—	—	3	—	—
CO6	—	—	3	3	2	—	—	—	—	—	3	3	—

3: High, 2: Medium, 1: Low

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BCA Honours with Research Semester –VII

(Fourth Year)

Subject Title : Web Content Management System

Subject Code : CAM403-4C

Subject Type : Major

Rationale:

WordPress is a popular open-source Content Management System (CMS) that powers over 40% of all websites on the internet. It is a versatile and powerful CMS that offers users the ability to create and manage a wide range of websites, from simple blogs to complex e-commerce sites. Its ease of use, customizability, SEO-friendliness, security, and supportive community make it an excellent choice for anyone looking to create a website. This course is a 120-hour fully practical module designed to provide technical awareness about the structure and functionality of a CMS using professional engineering frameworks.

Learning Outcomes:

Students will be able to:

- Explain the fundamentals of Content Management Systems and WordPress architecture.
- Install, configure, and manage WordPress in local and live environments.
- Design, customize, and deploy responsive WordPress websites using themes and plugins.
- Create, manage, and optimize content using WordPress posts, pages, and media.
- Apply SEO, security, and performance optimization techniques to WordPress websites.
- Develop a complete professional WordPress-based project integrating real-world requirements.

Teaching and Evaluation Scheme:

Credits	Duration in Hours		Maximum Marks		Total
	Theory	Practical	CCE (Formative)	SEE (Summative)	
4	-	120	50	50	100

Course Content:

Unit I

[Weightage=25% approx., Practicals=30]

Introduction to WordPress: Content Management System (CMS). Features, Advantages, and Disadvantages. Installation Process: System Requirements for WordPress. Downloading WordPress, Step-by-Step WordPress Installation. Database Engineering: Creating Store Database and User. Dashboard Mechanics: Understanding the Dashboard Menu, Screen Options, Site Customization, Quick Draft, News, and Activity.


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Unit II

[Weightage=25% approx., Practicals=30]

WordPress Themes: WordPress Themes Overview, Installing and Activating a Theme, Manual Theme Upload and Activation, Deleting a Theme.

Customization: Appearance Customization. Site Identity including Logo, Title, and Tagline. Adding a Site Icon (Favicon). Header and Color Customization.

Content Scaffolding: Template Layout Modification.

Post and Page Engineering: Creating a New Blog Post using the Visual Editor. Formatting Headings, Bulleted and Numbered Lists, Quotes, and Revisions. Publishing, Deleting, and Restoring Posts.

Linking Strategy: Adding the Read More Tag. Internal and External Linking. Opening Links in a New Tab.

Unit III

[Weightage=25% approx., Practicals=30]

WordPress Media Library: Media Library Overview, adding Images to a Post or Page.

Asset Management: Manual Image Resizing, Cropping, and Rotating. Media Settings for Thumbnail, Medium, and Large Sizes, adding a featured Image, Media Library Cleanup. Advanced Media: Creating Image Galleries and Embedding YouTube Videos.

WordPress Plugins: Plugin Overview, Installing and Updating Plugins, Recommended WordPress Plugins including SEO, WooCommerce, and Security.

Mobile Engineering: Developing Responsive and Mobile-Friendly Websites using WordPress.

Unit IV

[Weightage=25% approx., Practicals=30]

Deploying WordPress Website: Importance of Data Backup and Different Backup Methods. Site Monitoring for Security Issues. Hosting and Launch Concepts: Concept of Web Hosting, Server Types, and WordPress Deployment Overview.

Performance Optimization: Configuring Security Measures and Optimizing Site Speed. Advanced Troubleshooting: Understanding Common Error Codes and Screen Color/Layout Issues.

Security Management: Installing Security Plugins to Prevent Unauthorized Access and Recover Websites. Comprehensive Mini Project: Applying All Knowledge to Create a Professional Blog, Portfolio, or E-commerce Store.

Text Book:

K. Król, WordPress 5 Complete – Seventh Edition, Birmingham, UK: Packt Publishing, 2020.

Reference Books:

- WordPress: The Ultimate Guide, ShoutMeLoud, BPB Publications.
- Professional WordPress: Design and Development, Brad Williams, David Damstra, and Hal Stern, Wrox Press.
- WordPress Plugin Development: Beginner's Guide, Vladimir Prelovac, Packt Publishing.
- WordPress: The Missing Manual, Matthew MacDonald, O'Reilly Media.
- WordPress For Dummies, Lisa Sabin-Wilson, John Wiley & Sons.


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Reference Links:

- <https://wordpress.org/documentation/>
- <https://learn.wordpress.org/>
- <https://developer.wordpress.org/themes/>
- <https://developer.wordpress.org/plugins/>
- <https://www.wpbeginner.com/>
- <https://darrelwilson.com/best-wordpress-resources/>
- <https://www.hostinger.com/tutorials/wordpress>

Practical List:

- **Install WordPress** on your local machine or on a web server.
- **Theme Customization:** Choose a WordPress theme that you like and customize it to fit your needs.
- **Page Architecture:** Create some pages for your website, such as an "About Us" page or a "Contact Us" page.
- **Plugin Management:** Install some plugins that you find useful or interesting and configure them.
- **Blog Engineering:** Create a blog post and publish it on your website.
- **Navigation Design:** Create a custom menu for your website and add pages and categories.
- **Rich Content:** Use the built-in WordPress editor to create content like a photo gallery or video.
- **Global Settings:** Configure website settings such as the site title, tagline, and homepage settings.
- **Template Hierarchy:** Create a custom template for a specific page or post using the hierarchy.
- **Advanced Customizer:** Use the WordPress Customizer to customize colors, fonts, and layout.
- **Mini Project:** Design a full-featured website integrating all components (E-commerce, SEO, and Security).


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BCA HONOURS WITH RESEARCH SEMESTER : VII**SUBJECT CODE : CAM403-4C****SUBJECT NAME : WEB CONTENT MANAGEMENT SYSTEM**

COs	Course Outcome	POs/PSOs	CL Cognitive Level	KC Knowledge Category	Lab Sessions
CO1	Understand about WordPress, its features, and creation logic.	PO1, PO2, PSO2	U	C	20
CO2	Navigate the dashboard and manage posts, pages, and media.	PO2, PO3, PSO1	Ap	P	25
CO3	Customize themes using the Customizer and basic HTML/CSS.	PO3, PO4, PSO1	Ap	P	25
CO4	Search, install, and manage Security and SEO plugins.	PO4, PO7, PSO1, PSO2	An	A	25
CO5	Create their own website applying practical learned skills.	PO9, PO10, PSO3	C	M	25

Mapping of COs with POs & PSOs

Course CAM403-4C	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	3	-	-	-	-	-	-	-	3	-	-
CO3	-	-	3	3	-	-	-	-	-	-	3	-	-
CO4	-	-	-	3	-	-	3	-	-	-	3	3	-
CO5	-	-	-	-	-	-	-	-	2	2	-	-	3

3: High, 2: Medium, 1: Low


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BCA Honours with Research Semester – VII

(Fourth Year)

Subject Title : Cloud Computing
Subject Code : CAE401- 4C
Subject Type : Minor

Rationale:

The proposed syllabus introduces students to the fundamentals of cloud computing using open-source tools, enabling understanding of scalable and distributed systems without requiring prior cloud experience. The course emphasizes conceptual clarity, virtualization basics, containerization, and simple deployment practices, ensuring accessibility for beginners while maintaining industry relevance. Students will gain hands-on exposure to simulated cloud environments using lightweight tools suitable for academic infrastructure.

Learning Outcomes:

Students will be able to:

- Explain basic concepts and service models of cloud computing.
- Understand virtualization and container-based environments.
- Deploy simple applications using open-source tools.
- Perform basic monitoring, storage, and backup operations.
- Identify fundamental security practices in cloud environments.

Teaching and Evaluation Scheme:

Credits	Duration in Hours		Maximum Marks		Total
	Theory	Practical	CCE (Formative)	SEE (Summative)	
4	30	60	50	50	100

Course Content:

Unit I [Weightage=25% approx., Lectures=7, Practicals= 14]

Introduction to Cloud Computing: Definition and evolution of cloud computing, basic terminologies: server, client, internet.

Essential characteristics: on-demand service, scalability, elasticity, Overview of service models (IaaS, PaaS, SaaS) and deployment models (Public, Private, Hybrid), Advantages and limitations of cloud computing, Comparison with traditional IT systems.

Unit II [Weightage=25% approx., Lectures=8, Practicals= 16]

Virtualization and Cloud Environment: Introduction to cloud architecture (basic layered view), Virtualization concepts: hypervisors (basic idea), virtual machines, Containers and introduction to containerization, Comparison of Virtual Machines and Containers, Basic concepts of scalability and resource sharing, Overview of cloud providers like Amazon Web Services, Microsoft Azure, and Google Cloud Platform.

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Unit III [Weightage=25% approx., Lectures=7, Practicals= 14]
Cloud Services and Operations: Basic understanding of compute, storage, and networking, Introduction to object storage concepts, Static website hosting concept, Basic monitoring and performance observation, Introduction to backup and recovery, Basic cloud security concepts (users, authentication), Introduction to Infrastructure as Code concept.

Unit IV [Weightage=25% approx., Lectures=8, Practicals= 16]
Cloud Management, Security, and Trends: Basic security practices: user roles, data protection introduction. Backup and disaster recovery concepts. Introduction to container-based deployment, Basic idea of load balancing (conceptual), Cloud applications in real life, Emerging trends: AI, Edge Computing overview.

Text Books:

- Thomas Erl, Cloud Computing: Concepts, Technology & Architecture, Pearson Education.
- Velte, Velte & Elsenpeter, Cloud Computing: A Practical Approach, McGraw Hill.

Reference Books:

- Barrie Sosinsky, Cloud Computing Bible, Wiley.
- AWS Certified Cloud Practitioner Official Study Guide, Wiley.
- NPTEL Online Course – Cloud Computing (IIT Kharagpur).
- Google Cloud Skills Boost – Free Labs & Quests.
- AWS Educate and Cloud Foundations Modules.

Reference Links:

- <https://www.geeksforgeeks.org/cloud-computing/cloud-computing-tutorial/>
- https://www.tutorialspoint.com/cloud_computing/index.htm
- <https://nvlpubs.nist.gov/nistpubs/legacy/sp/nistspecialpublication800-145.pdf>
- https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4914169

Practical List:

- Install VirtualBox
- Create and configure a Linux Virtual Machine
- Modify VM resources (CPU/RAM)
- Take snapshot and restore VM
- Install Docker
- Run basic Docker container
- Deploy simple web server using Docker
- Compare VM and container performance
- Install MinIO
- Create storage buckets and manage files
- Configure access permissions
- Host static website using Nginx
- Monitor system using Linux commands
- Create and manage Linux users
- Implement basic file permissions
- Perform backup and restore operations


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BCA HONOURS WITH RESEARCH SEMESTER : VII

SUBJECT CODE : CAE401-4C

SUBJECT TITLE : CLOUD COMPUTING

COs	Course Outcome	POs/PSOs	CL Cognitive Level	KC Knowledge Category	Class Sessions	Lab Sessions
CO1	Explain the fundamental concepts of cloud computing, including evolution, characteristics, service models, and deployment models.	PO1, PO2, PO5, PSO2	U	C	5	10
CO2	Describe virtualization, cloud architecture, and compare virtual machines with containerization technologies.	PO1, PO2, PO3, PSO2	U	C	5	10
CO3	Apply basic cloud services such as compute, storage, and networking for simple cloud-based operations.	PO2, PO3, PO7, PSO1, PSO2	Ap	P	5	10
CO4	Analyze cloud operations including monitoring, backup, recovery, and Infrastructure as Code concepts.	PO2, PO3, PO9, PSO2	An	A	5	10
CO5	Evaluate cloud security practices including authentication, data protection, and disaster recovery mechanisms.	PO1, PO5, PO8, PSO3	E	V	5	10
CO6	Apply cloud technologies and emerging trends (AI, Edge Computing, container deployment) in real-world scenarios.	PO2, PO3, PO7, PO9, PSO1, PSO2	Ap	P	5	10

Mapping of COs with POs & PSOs

Course CAE401-4C	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CO1	3	2	-	-	2	-	-	-	-	-	-	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	-	3	2	-	-	-	3	-	2	-	3	3	-
CO4	-	3	2	-	-	-	2	-	3	-	-	3	-
CO5	3	-	-	-	2	-	-	3	-	-	-	-	3
CO6	-	3	2	-	-	-	3	-	3	-	3	3	-

3: High, 2: Medium, 1: Low

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BCA Honours with Research Semester – VII

(Fourth Year)

Subject Title : Research Project

Subject Code : RP401-4C

Subject Type : RP

Rationale:

This course is designed to develop research aptitude and problem-solving skills in various computing domains. It enables students to identify, analyze, and formulate real-world research problems and apply both theoretical and practical knowledge to design appropriate computing-based solutions. The course also introduces learners to research ethics, documentation, and academic writing practices. It encourages innovation, critical thinking, and independent learning, thereby preparing students for higher studies, research careers, and industry-oriented roles.

Learning Outcomes:

Upon completion of this course, the students should be able to:

- Identify and formulate research problems in computing domains.
- Apply appropriate research methodologies to analyze and solve problems.
- Design and develop computing-based solutions using theoretical and practical knowledge.
- Demonstrate understanding of research ethics, documentation, and academic writing.
- Analyze and interpret research results effectively.
- Present research findings clearly through reports and presentations

Teaching and Evaluation Scheme:

Credit	Duration in Hours		Maximum Marks		
	Theory	Practical	CCE (Formative)	SEE (Summative)	Total
6	-	180	75	75	150

Course Content:

- Research Project should be conducted in the area of Major discipline.
- Research Project should be conducted in house laboratories under university recognized guide.
- The research project contributes to the total 180 credits required for the Honors with Research degree.

Please Note: The Research Project Work shall be submitted as a Research Project work Dissertation /Presentation / Report / Project Demonstration.

Rupel
Dear 25/05/2026

Faculty of Computer Science
Kadi Sarva Vishwavidyalaya
Gandhinagar

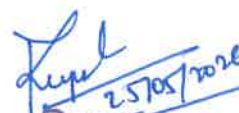
BCA HONOURS WITH RESEARCH SEMESTER : VII
SUBJECT CODE : RP401-4C
SUBJECT TITLE : RESEARCH PROJECT

CO No.	Course Outcome (CO)	PO(s) / PSO(s)	CL Cognitive Level	KC Knowledge Category	Lab Sessions
CO1	Identify, define, and formulate relevant research problems in computing domains.	PO1, PO2, PO5, PO9, PSO2	U, An	C	30
CO2	Conduct a systematic and critical literature review using appropriate academic sources.	PO1, PO5, PO9, PSO3	U, An	F	30
CO3	Design a suitable research methodology and develop an effective solution approach.	PO2, PO3, PO9, PO10, PSO1, PSO2	An, Ap	M	30
CO4	Implement, test, and validate the proposed research or software-based solution.	PO2, PO3, PO7, PO9, PO10, PSO1	Ap	M	30
CO5	Analyze, interpret, and evaluate research findings using appropriate techniques.	PO2, PO5, PO9, PSO2	An	C	30
CO6	Document, present, and defend the research work effectively while adhering to ethical standards.	PO6, PO8, PO9, PO10, PSO3	U, Ap	F	30

Mapping of COs with POs & PSOs

Course RP401-4C	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CO1	2	3	-	-	3	-	-	-	3	-	-	3	-
CO2	2	-	3	-	3	-	-	-	3	-	-	-	2
CO3	-	3	3	-	-	-	-	-	3	3	2	3	-
CO4	-	3	3	-	-	-	1	-	3	3	2	-	-
CO5	-	3	-	-	3	-	-	-	3	-	-	3	-
CO6	-	-	-	-	-	-	-	1	3	3	-	-	2

3: High, 2: Medium, 1: Low


 25/05/2026
 Dean
 Faculty of Computer Science
 Kadi Sarva Vishwavidyalaya
 Gandhinagar