Bharatiya Vidya Bhavan

Bhavan's Vivekananda College

of Science, Humanities and Commerce

Sainikpuri, Secunderabad
(Reaccredited with 'A' Grade by NAAC)
Autonomous College – Affiliated to Osmania University

Department of Computer Science

BCA III SEMESTER

CBCS (Choice Based Credit System) w.e.f. 2025-2026

Scheme of Instruction and Examination

Sl.No.	*Code*	*Paper Title*	*Course Type*	*PPW*		*Max. Marks*		*Max. Marks*		*Credits*
				TH	*PR*	*TH*	*TH-CIA*	*PR*	*PR-CIA*	
1	BCA341	Fundamentals of Probability and Statistics	BSC	4		70	30			4
2	BCA342	Java Programming	PCC	4		70	30			4
3	BCA343	Environmental Science	MC	4		70	30			4
4	BCA344	Operating System Concepts	PCC	4		70	30			4
5	BCA345	Database Design	PCC	4		70	30			4
6	BCA342P	Java Programming Lab	LCC		4			50	25	2
7	BCA344P	Operating System Concepts Lab	LCC		4			50	25	2
8	BCA345P	Database Design Lab	LCC		4			50	25	2
9	BCA346	MOOCs Course (NPTEL)		2		75	25			2
		Total		*22*	*12*	*425*	*175*	*150*	*75*	*28*

BSC : Basic Science Course

PCC : Professional Core Course

MC: Managerial Course

LCC : Laboratory Core Course

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Department of Computer Science

BCA IV SEMESTER

CBCS (Choice Based Credit System) w.e.f. 2025-2026

Scheme of Instruction and Examination

Sl. No.	*Code*	*Paper Title*	*Course Type*	*PPW*		*Max. Marks*		*Max. Marks*		*Credits*
				TH	*PR*	*TH*	*TH-CIA*	*PR*	*PR-CIA*	
1	BCA441	Distributed and Cloud Computing	PCC	4		70	30			4
2	BCA442	Network Security	PCC	4		70	30			4
3	BCA443	Software Engineering	PCC	4		70	30			4
4	BCA444	Data Science using Python	PCC	4		70	30			4
5	BCA445	Artificial Intelligence	PCC	4		70	30			4
6	BCA442P	Network Security Lab	LCC		4			50	25	2
7	BCA444P	Data Science using Python Lab	LCC		4			50	25	2
8	BCA446	Technical Seminar	SEC		2				50	2
		Total		*20*	*10*	*350*	*150*	*100*	*100*	*26*

PCC: Professional Core Course
LCC : Laboratory Core Course
SEC: Skill Enhancement Course

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: FUNDAMENTALS OF PROBABILITY AND STATISTICS
(w.e.f. 2025-26)

PAPER CODE: BCA341 | **PPW: 4**
YEAR/SEMESTER: II/III | **NO. OF CREDITS: 4**

COURSE OBJECTIVE: Students will gain the knowledge in basic statistics and learn to apply for real life data analysis. They will also acquire the knowledge to give the proper inference about the data.

UNIT-WISE COURSE OBJECTIVES:

COb1: To perceive the basic concepts in Statistics.

COb2: Calculate and interpret the various descriptive measures of centrality and dispersion.

COb3: Basic concepts of probability theory and apply concepts of various discrete and continuous probability distributions to various problems.

COb4: To explain the concepts of Random variable and Probability Distributions.

COb5: The concept of association between two variables and forecast future values by regression equations.

UNIT-I

Introduction: Importance of Statistics, Concepts of Statistics, Population and a Sample; Quantitative and Qualitative Data; Collection of Primary and Secondary Data; Classification and Tabulation of Data. Construction of Univariate and Bivariate Frequency Distribution; Diagrammatic and Graphical Representation of Data.
(Book 1 – Chapters - 1, 2, 14)

UNIT-II

Descriptive Statistics: Measures of Central Tendency: Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean; **Measures of Dispersion:** Range, Quartile Deviation, Mean Deviation, Standard Deviation.
Definition of Moments; **Measures of Skewness:** Karl Pearson's Coefficient of Skewness, Bowley's Coefficient of Skewness; Kurtosis.
(Book 1 – Chapter - 2)

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UNIT-III

Probability: Basic Terminology, Mathematical Probability, Statistical Probability, Axiomatic Approach to Probability, Theorems on Probability.

Conditional Probability, Multiplication Theorem of Probability, Independent Events, Pairwise/Mutually Independent Events, Bayes' Theorem.

(Book 1 – Chapters - 3, 4)

UNIT-IV

Random variable: Definition of a Random Variable, Discrete and Continuous Random Variables, Functions of Random Variables, Probability Mass Function, Probability Density Function, Mathematical Expectation of a Random Variable, and Properties of Expectation.

Probability Distributions: Binomial, Poisson and Normal Distribution.

(Book 1 – Chapters - 5, 6, 8, 9)

UNIT-V

Correlation and Regression Analysis: Definition of Correlation, Scatter Diagram, Karl Pearson's Coefficient of Correlation; Partial and Multiple Correlation Coefficients (for three variables); Definition of Regression, Simple Linear Regression (for 2 variables).

Small Sample Tests: Basic Definitions of Testing of Hypothesis; **t-Test:** t-test for Single Mean, t-test for Difference of Means, Paired t-test. **F-Test:** F-test for Equality of Two Population Variances.

CHI-SQUARE Test: Test for Single Variance (Population Variance) and Test of Independence of Attributes.

(Book 1 – Chapters – 10, 11, 12, 15, 16)

Suggested Readings:

1. S.C. Gupta and V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 12th Edition, 2020.
2. A.M. Gun, M.K. Gupta, B.Dasgupta, "Fundamentals of Statistics", Vol-1, the world press Pvt. Ltd., Kolakota.
3. William Mendenhall, Robert J. Beaver, Barbara M. Beaver, "Introduction to Probability and Statistics", Thomson Brooks / Cole, Eleventh Edition, 2003.
4. Richard A. Johnson, "Probability and Statistics for Engineers", Prentice Hall of India, Seventh Edition, 2005.

COURSE OUTCOMES: At the end of the course students will be able to:

BCA341 CO1: Develop skills in presenting quantitative and qualitative data using appropriate diagrams, tabulations and construction of frequency distributions.

BCA341 CO2: Acquire knowledge of various types of data, their organisation and evaluation of summary measures such as measures of central tendency and dispersion.

BCA341 CO3: Calculate probabilities by applying probability laws and theoretical results, knowledge of important discrete and continuous distributions, their interrelations with real time applications.

BCA341 CO4: Acquire knowledge on random variable and probability distributions.

BCA341 CO5: Compute and interpret Correlation Analysis, regression lines and multiple regression analysis with applications.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: JAVA PROGRAMMING
(w.e.f. 2025-26)

COURSE CODE: BCA342 | **PPW: 4**
YEAR/SEMESTER: II/III | **NO. OF CREDITS: 4**

COURSE OBJECTIVE: To familiarize the students with Java programming.

UNIT-WISE COURSE OBJECTIVES:

COb1: To discuss Object-Oriented programming concepts in Java.

COb2: To acquire knowledge on Arrays, Strings, Inheritance, Interfaces, Packages and Inner Classes in Java.

COb3: To illustrate the importance of Exception Handling and Multithreading in Java.

COb4: To demonstrate the concepts of GUI Design & Event Handling.

COb5: To impart knowledge on File Handling and Collections Framework.

UNIT-I

Introduction to Java: Java History – Features of Java, The Birth of Modern Programming: C, C++: The Next Step, The Creation of Java, Java Primitive Types, Basic Operators, Control Statements.

Defining Classes: Adding Instance Fields and Methods, Constructors, Access Modifiers (Visibility Modes), Object Creation Examples, Method Overloading and Constructor Overloading, Use of Static and Final Keywords, Objects as Parameters, The Scope and Life Time of Variables, Introduction to Object Class, How to Read User Input(from Keyboard).

(Book 1 – Chapters: 1, 3, 4, 5, 6, 7, 8, 9, 13)

UNIT-II

Arrays, Strings in Java: How to Create and Define Arrays, Introduction to java.util.Array Class, Difference between String & StringBuffer Classes, StringTokenizer Class, Wrapper Classes and Conversion between Objects & Primitives.

Inheritance, Interfaces and Packages in Java: Defining Super/Sub Classes, Abstract Classes, Method Overriding, Interfaces, Creating and Defining Packages.

Inner Classes in Java: Types of Inner Classes.

(Book 1 – Chapters: 3, 17, 15, 18, 16, 8, 9)

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UNIT-III

Exception Handling in Java: What are Exceptions, Writing your own Exception Classes, Try, Catch, Throw, Throws Clauses, Difference between Checked Vs Unchecked Exceptions, Errors Vs Exception.

Multithreading in Java: Thread and its Life Cycle, How to Create Threads, Thread Class in Java, Use of Synchronized Keyword, How to Avoid Deadlock.

(Book 1 – Chapters: 10, 11)

UNIT-IV

GUI Design & Event Handling: Component, Container, Color, GUI Controls, Layout Managers, Introduction to Swings, Events, Listeners, Writing GUI Based Applications, Applets, Running Applets.

(Book 1 - Chapters : 24, 25, 30, 23, 22)

UNIT-V

File Handling: Stream Classes, Reader and Writer Classes, File and Directory Class.

Generics and Frameworks: Generics, Collections Framework, Collection Interfaces and Classes, ArrayList, LinkedList, Vector.

(Book 1 – Chapters: 19, 20, 17)

Suggested Readings:

1. Herbert Schildt : "Java : The Complete Reference Java", 8th Edition,Tata McGraw Hill Publications, 2011.
2. E.Balaguruswamy, Programming with Java, A primer 5th Edition, Tata McGraw-Hill, 2014
3. John R. Hubbard, Programming with Java, Second Edition, Schaum's outline Series, Tata McGraw-Hill, 2007.
4. Timothy Budd, Understanding Object Oriented Programming with Java, Pearson Education, 2007.

COURSE OUTCOMES: At the end of the course students will be able to:

BCA342 CO1: Comprehend Object-Oriented programming concepts in Java.

BCA342 CO2: Implement the concepts of Arrays, Strings, Inheritance, Interfaces, Packages and Inner Classes in Java.

BCA342 CO3: Employ the concepts of Exception Handling and Multithreading in Java.

BCA342 CO4: Apply the concepts of GUI Design & Event Handling.

BCA342 CO5: Develop applications using File Handling and Collections Framework.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: JAVA PROGRAMMING LAB
(w.e.f. 2025-26)

PAPER CODE: BCA342P **YEAR/SEMESTER: II/III**

COURSE OBJECTIVE: Enable students to apply Object-Oriented Concepts and GUI Programming.

Cob1: To demonstrate the concepts of Control statements, Object-Oriented Concepts, packages, Exception Handling and Multithreading using Java Programming.

Cob2: To illustrate the concepts of AWT, Applets, GUI Design and Event Handling.

1. Programs on if-else, if-else-if.
2. Program on switch.
3. Program on while.
4. Program on for loop.
5. Program on do-while.
6. Program to demonstrate class concept.
7. Program to demonstrate methods.
8. Program to demonstrate method overloading.
9. Program to demonstrate constructors.
10. Program to demonstrate constructor overloading.
11. Program to demonstrate an Array.
12. Program to demonstrate multidimensional array.
13. Program to demonstrate Strings.
14. Program to demonstrate inheritance.
15. Program to demonstrate method overriding.
16. Program to demonstrate abstract class.
17. Program to demonstrate reading console input.
18. Program to demonstrate interfaces.
19. Program to demonstrate packages.
20. Program to demonstrate exceptional handling.
21. Program to demonstrate creating a thread by extending Thread class.
22. Program to demonstrate creating a thread by implementing Runnable interface.

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23. Program to demonstrate AWT controls.
24. Program to demonstrate Layout Manager.
25. Program to demonstrate Events.
26. Program to demonstrate applets.

COURSE OUTCOMES: At the end of the course students will be able to:

BCA342P CO1: Apply Control Statements, Object-Oriented Programming concepts, Packages, Exception Handling and Multithreading.

BCA342P CO2: Implement AWT, Applets, GUI design and Event Handling.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: ENVIRONMENTAL SCIENCE
(w.e.f. 2025-26)

PAPER CODE: BCA343 | **PPW: 4**
YEAR/SEMESTER: II/III | **NO. OF CREDITS: 4**

COURSE OBJECTIVE: To instill social responsibility among students to protect the environment and to promote judicious use of natural resources.

UNIT-WISE COURSE OBJECTIVES:

COb1: To introduce students to the scope and importance of environmental studies; to senstise students about the misuse of water resources and ill effects of modern agricultural practices.

COb2: To gain knowledge about the various ecosystems, and to promote optimal use of land and energy resources.

COb3: To appreciate the need to protect the endangered species and to conserve the rich biodiversity on earth.

COb4: To understand the harmful effects of all kinds of pollution and to study their control measures and environmental legislation.

COb5: To sensitise the students about the major environmental challenges like climate change, global warming, ozone depletion and the steps to be taken towards effective disaster management.

UNIT-I

Environmental Studies: Definition, Scope and Importance, Need for Public Awareness. **Natural Resources:** Water Resources; Use and Over-Utilization of Surface and Ground Water, Floods, Drought, Conflicts Over Water, Dams: Benefits and Problems. Effects of Modern Agriculture, Fertilizer- Pesticide Problems, Water Logging and Salinity.

UNIT- II

Ecosystems: Concept of an Ecosystem, Structure and Function of an Ecosystem, Producers, Consumers and Decomposers, Energy Flow in Ecosystem, Food Chains, Ecological Pyramids, Aquatic Ecosystem (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries).

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Energy Resources: Growing Energy Needs, Renewable And Non-Renewable Energy Sources. Land Resources, Land as a Resource, Land Degradation, Soil Erosion and Desertification.

UNIT- III

Biodiversity: Genetic Species and Ecosystem Diversity, Bio-Geographical Classification of India. Value of Biodiversity, Threats to Biodiversity, Endangered and Endemic Species of India, Conservation of Biodiversity.

UNIT-IV

Environmental Pollution: Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution; solid and liquid waste management.

Environment Protection Act: Air, water, forest and wild life Acts, enforcement of environmental legislation.

UNIT-V

Social Issues and the Environment: Water Conservation, Watershed Management, and Environmental Ethics. Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion. **Environmental Disaster Management:** Types of Disasters, Impact of Disasters on Environment, Infrastructure, and Development. Basic Principles of Disaster Mitigation, Disaster Management, and Methodology. Disaster Management Cycle, and Disaster Management in India.

Suggested Readings:

1. A.K. De, Environmental Chemistry, Wiley Eastern Ltd.
2. E.P. Odum, Fundamentals of Ecology, W.B. Sunders Co., USA.
3. M.N. Rao and A.K. Datta , Waste Water Treatment, Oxford and IBK Publications.
4. Benny Joseph, Environmental Studies, Tata McGraw Hill, 2005.
5. V.K. Sharma, Disaster Management, National Centre for Disaster Management, IIPE,1999.
6. Green Building Council of India, Teri Document.

COURSE OUTCOMES: At the end of the course, the student will be able:

BCA343 CO1: Assess the importance of environmental studies and develop sustainable practices for water management and agriculture.

BCA343 CO2: Examine the function of ecosystems and integrate them with judicious use of land and energy resources.

BCA343 CO3: Demonstrate appreciation for biodiversity and express concern for endangered species.

BCA343 CO4: Discuss the different types of pollution and relate them to the control measures in the light of environmental legislation.

BCA343 CO5: Evaluate the role of social and environmental ethics to overcome environmental challenges and to apply them in the area of disaster management.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: OPERATING SYSTEM CONCEPTS
(w.e.f. 2025-26)

PAPER CODE: BCA344 | **PPW: 4**
YEAR/SEMESTER: II/III | **NO. OF CREDITS: 4**

COURSE OBJECTIVE: To enable students, acquire knowledge on Operating System Services and Functions, Processes, Memory Management, Disk Management, Security and Protective Measures.

UNIT-WISE COURSE OBJECTIVES:

COb1: To impart the basic concepts of Operating System Services.

COb2: To explain Process Synchronization Methods and Deadlocks.

COb3: To describe the Main Memory Management.

COb4: To outline File System Interface Concepts.

COb5: To comprehend the concepts of Protection and Security.

UNIT-I

Introduction: Definition of Operating System, Computer System Architecture- Single Processor System, Multi-Processor System, Clustered System,
Operating System Structures: Operating System Services, System Calls.
Process: Process Concept-The Process, Process State, Process Control Block, Thread; Process Scheduling- Scheduling Queues, Schedulers, Context Switch; Inter process Communication (Only Definition) **Threads:** Overview- Motivation, Benefits.
CPU Scheduling: Basic Concepts: CPU-I/O Burst Cycle, CPU Scheduler, Preemptive Scheduling, Scheduling Criteria, Scheduling Algorithms - FCFS, SJF, Priority Scheduling, Round Robin Scheduling.
(Book 1 - Chapters: 1, 2, 3, 6)

UNIT-II

Process Synchronization: Background, The Critical-Section Problem, Peterson's Solutions, Semaphores- Semaphore Usage, Classic Problems of Synchronization- The Bounded-Buffer Problem, The Reader's Writer's problem, The Dining Philosophers' Problem, Monitors- Monitor Usage.

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Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance (Introduction), Deadlock Detection (Introduction), Recovery from Deadlock- Process Termination, Process Preemption.
(Book 1 - Chapters: 5,7)

UNIT-III

Main Memory: Swapping- Standard Swapping, Swapping on Mobile Systems, Contiguous Memory Allocation- Memory Protection, Memory allocation, Fragmentation; Segmentation- Basic Method, Segmentation hardware, Paging- Basic Method, Structure of the Page Table- Hierarchical.

Virtual Memory: Background, Demand Paging - Basic Concepts, Page Replacement- Basic Page Replacement, FIFO Page Replacement, Optimal Page Replacement, LRU page Replacement, Thrashing-Cause of Thrashing.

Mass-Storage Structure: Overview of Mass Storage Structure - Magnetic Disks, Solid State Disk, Magnetic Tapes. Disk Structure, Disk Scheduling – FCFS Scheduling, SSTF Scheduling, SCAN Scheduling, C-SCAN Scheduling. Disk Management, RAID Structure (level 0, level 1, level 1+0).
(Book 1 - Chapters: 8,9,10)

UNIT-IV

File-System Interface: File Concept - File Attributes, File Operations. Access Methods, Directory and Disk Structure- Storage Structure, Directory Overview, Single Level Directory, Two-level Directory, Protection.

File-System Implementation: File-System Structure, Directory Implementation- Linear Lists, Hash Table. Allocation Methods - Contiguous Allocation, Linked Allocation, Indexed Allocation, Performance. Efficiency and Performance- Efficiency, Performance.

I/O Systems: Overview, Kernel I/O Subsystem- I/O Scheduling, Buffering, Caching. Transforming I/O Requests to Hardware Operations.
(Book 1 - Chapters: 11, 12, 13)

UNIT-V

Protection: Goals of Protection, Principles of Protection, Domain of Protection-Domain Structure. Access Matrix, Access Control, Revocation of Access Rights.

Security: The Security Problem, Program Threats-Trojan, Horse, Trap Door, Logic Bomb, Stack and Buffer Overflow, Viruses. System and Network Threats-Worms, Port Scanning, Denial of Service. User Authentication-Passwords, Password Vulnerabilities, Securing Passwords, One Time Password, Biometrics.
(Book 1 - Chapters: 14, 15)

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Suggested Readings :

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, "Operating System Concepts", 9th Edition, John wiley and sons publication, 2013.

2. A.Tanenbaum,"Modern Operation Systems", 5th Edition, Pearson Education, 2024..
3. William Stallings, "Operating Systems", 9th Edition, Pearson Education, 2019.
4. Ida M.Flynn, "Understanding Operating Systems", 7th Edition, Cengage, 2013.
5. D.M.Dhamdhere,"Operating systems a concept based approach", 3rd Edition, McGraw-Hill, 2017

COURSE OUTCOMES: At the end of the course, the student will be able:

BCA344 CO1: To paraphrase operating system services and how these services are implemented.

BCA344 CO2: To summarize how a process is synchronized and scheduled.

BCA344 CO3: To infer different approaches of memory management.

BCA344 CO4: To illustrate the structure and organization of file system.

BCA344 CO5: To correlate the different Security and Protection measures of a system.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: OPERATING SYSTEM CONCEPTS LAB
(w.e.f 2025-2026)

COURSE CODE: BCA344P **YEAR/SEMESTER: II/III**

COURSE OBJECTIVE: To enable students with knowledge in selecting CPU scheduling and page replacement algorithms.

COb1: To familiarize the Unix shell commands.

COb2: To demonstrate the implementation of CPU Scheduling and Page Replacement Algorithms.

I: Unix Shell Commands- mkdir, cfinger, d, ls, cat, touch, rmdir, man, pwd, mv, cp, rm, cut, cal, date, factor, who, who am i, finger, wc, sort, grep, head, tail , ps, more, banner, mail, write, wall, ps, kill, nice.

II: System Calls, CPU Scheduling and Page Replacement Algorithms:
1. Process System Calls
2. IO System Calls
3. IPC using Pipe Processing
4. First Come First Serve Scheduling
5. Shortest job first Scheduling
6. Priority Scheduling
7. Round Robin Scheduling
8. Simulate Page Replacement Algorithms FIFO
9. Simulate Page Replacement Algorithms LRU
10. Simulate Page Replacement Algorithms OPTIMAL

COURSE OUTCOMES: At the end of the course, the student will be able to:

BCA344P CO1: Apply the Unix shell commands.

BCA344P CO2: Implement the CPU Scheduling and Page Replacement algorithms

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: DATABASE DESIGN
(w.e.f. 2025-26)

PAPER CODE: BCA345 **PPW: 4**
YEAR/SEMESTER: II/III **NO. OF CREDITS: 4**

COURSE OBJECTIVE: Enable students to acquire knowledge on Database Models, Normalization, File Organization, Transaction Management and Concurrency Control.

UNIT-WISE COURSE OBJECTIVES:

COb1: To impart knowledge on the basic concepts of database.

COb2: To explain Entity-Relation approach of data modeling.

COb3: To describe the relational model and Normalization.

COb4: To outline Transaction Management concepts.

COb5: To comprehend the concepts of recovery and security in databases.

UNIT-I

Introduction to Databases: Database Environment – Concepts and Definitions, Traditional File Processing Systems, Database Approach, Range of Database Applications, Advantages, Costs and Risks, Components, SDLC, Three Schema Architecture.
(Book 1 - Chapters: 1, 2)

UNIT-II

Database Analysis - E-R Model – Entities, Attributes, Relationships, Degree and Cardinality - Case Studies.
Enhanced E-R Model - Super Type, Sub Type, Specialization and Generalization, Constraints, Disjointness, Subtype Discriminator, Super Type /Subtype Hierarchies.
(Book 1 - Chapter: 7)

UNIT-III

Relational Model – Definitions, Integrity Constraints, Transforming EER Diagrams into Relations, Normalization - Normal Forms, Merging Relations, Case Study.
Overview of Storage and Indexing: File Organizations and Indexing- Clustered Indexes Primary and Secondary Indexes, Index Data Structures, RAID- Level 1, Level 0, Level 1+0.
(Book 1 - Chapter: 7, Book 2 - Chapter: -8)

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UNIT-IV

Tree-Structured Indexing: Indexed Sequential Access Method (ISAM)- Overflow Pages, Locking Considerations, B+ Trees: A Dynamic Index Structure - Format of a Node. Search, Insert, Delete, Construction of B+ Tree.

Hash-Based Indexing: Static Hashing – Notation and Conventions, Extendible Hashing, Linear Hashing, Extendible Vs Linear Hashing.

(Book 2 - Chapters: 10, 11)

UNIT-V

Transaction Management: ACID Properties- Consistency and Isolation, Atomicity and Durability, Transactions and Schedules. Concurrent Execution of Transactions- Motivation for Concurrent Execution, Serializability. Lock-Based Concurrency Control- Strict 2-Phase Locking, Deadlocks.

Concurrency Control: 2PL, Serializability and Recoverability- View Serializability. Introduction to Lock Management- Implementing Lock and Unlock Requests- Atomicity of Locking and Unlocking. Dealing with Deadlock – Deadlock Prevention.

(Book 2 - Chapters: 16, 17)

Suggested Readings:

1. Fred R Me Fadden. Jeffrey A Hoffer, Mary B Prescott - Modern Database Management, 5th Edition. Addition Wesly 2016.
2. Raghu Ramakrishnan, Johannes Gehrke, "*Database Management Systems*", 3rd Edition, McGraw Hill, 2014.
3. Abraham Silberschatz, Henry F Korth, S Sudharshan, "*Database System Concepts*", 7th Edition, McGraw-Hill International Edition, 2021

COURSE OUTCOMES: At the end of the course, the student will be able to:

BCA345 CO1: Acquire knowledge on the basic concepts of Database.

BCA345 CO2: Familiarize the Entity-Relation approach of Data Modeling.

BCA345 CO3: Paraphrase the Relational Model and Normalization.

BCA345 CO4: Summarize Transaction Management concepts.

BCA345 CO5: Acquire knowledge on the concepts of recovery and security in databases.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: DATABASE DESIGN LAB
(w.e.f. 2025-26)

PAPER CODE: BCA345P **YEAR/SEMESTER: II/III**

COURSE OBJECTIVE: Enable students to acquire knowledge on SQL Commands, Clauses, Stored Procedures and Triggers.

COb1: To impart the basic concepts of SQL commands and Clauses.

COb2: To program the SQL commands through Stored Procedures and Triggers.

1. Create command for creating a table using primary key
2. Alter command for altering the column name and datatype of a column in the table
3. Alter command to add new column to the existing table
4. Alter command to modify the existing name of the column in the table
5. Drop command of the table
6. Truncate command for the table
7. Insert command for storing the records in the database table
8. Update command for updating a particular record by using where clause
9. Delete command for removing a particular record from the table
10. Select command for selecting data from the table
11. Select command for selecting the specific data from the data by using where clause and select distinct statement
12. Select command for selecting the records by using ORDER BY clause ASC
13. Select command for selecting the records by using ORDER BY clause DESC
14. SQL Built in functions (MIN. MAX, COUNT, AVG, SUM)
15. SQL Query to perform AND Operator and OR Operator
16. SQL Query to perform GROUPBY Clause
17. SQL Query to perform HAVING Clause
18. SQL l Queries to perform integrity constraints
19. SQL Query to perform SQL BETWEEN Operator
20. Joins – Equi Join, Non-Equi Join, Outer Join and Self Join
21. Stored Procedures
22. Triggers

COURSE OUTCOMES: At the end of the course, the student will be able to:

BCA345P CO1: Query the database with appropriate commands and clauses.

BCA345P CO2: Apply stored procedures and triggers on the database.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: DISTRIBUTED AND CLOUD COMPUTING
(w.e.f. 2025-26)

PAPER CODE: BCA441 **PPW: 4**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 4**

COURSE OBJECTIVE: To impart knowledge in students with the concepts of Distributed Systems and Cloud Computing

UNIT-WISE COURSE OBJECTIVES:

COb1: To introduce Distributed Systems and Inter process Communication.

COb2: To impart knowledge on Remote Method Invocation and Publish-Subscribe systems.

COb3: To explain the concepts of cloud computing, system models, types of clouds, features, principles of cloud computing and its challenges and risks.

COb4: To discuss the concepts of Virtual Machines and Virtualization Clusters and Data Centers.

COb5: To describe the concepts of Cloud computing architectures over Virtualized Data Centers.

UNIT-I

Examples of Distributed Systems, Trends in Distributed Systems: Pervasive Networking and The Modern Internet, Mobile and Ubiquitous Computing, Distributed Multimedia Systems, Distributed Computing as a Utility. Focus on Resource Sharing.
Challenges: Heterogeneity, Openness, Security, Scalability, Failure Handling, Concurrency, Transparency, Quality of Service.
System Model: Physical Models, Architectural Models-Architectural Elements, Fundamental Models - Interaction Models, Failure Models.
Inter Process Communication: Introduction, The API for Internet Protocols-The Characteristics of Inter Process Communication.
(Book 1 - Chapters: 1.2, 1.3, 1.4, 1.5, 2.2, 2.3, 2.4, 4.1, 4.2)

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UNIT-II

Network virtualization: Overlay Networks, Case Study-MPI Remote Method Invocation and Objects.

Remote Invocation – Introduction, The Request-Reply Protocols.

Remote Procedure Call- Design Issues for RPC, Implementation of RPC.

Remote Method Invocation: Introduction.

Group Communication: The Programming Model, Process Groups and Object Groups, Implementation Issues, Group Membership Management.

Publish-Subscribe Systems: Applications of Publish-Subscribe Systems, Characteristics of Publish-Subscribe Systems.

Message Queues: The Programming Model.

Shared Memory Approaches: Distributed Shared Memory, Tuple Space Communication, Implementation Issues.

Distributed Objects and Components-Distributed Objects.

(Book 1 - Chapters: 4.5, 4.6, 5.1, 5.2, 5.3, 5.4, 6.2, 6.3, 6.4, 6.5, 8.2)

UNIT-III

Introduction to Cloud Computing: Cloud Computing in a Nutshell.

Roots Of Cloud Computing: From Mainframes to Clouds, SOA, Web Services, Web 2.0, and Mashups, Grid Computing, Utility Computing, Hardware Virtualization, Virtual Appliances and The Open Virtualization Format, Autonomic Computing.

Layers and Types of Clouds: Infrastructure as a Service, Platform as a Service, Software as a Service.

Deployment Models: Public, Private, Community, Hybrid Clouds. Desired Features of a Cloud.

Challenges and Risks: Security, Privacy, and Trust, Data Lock-In and Standardization, Availability, Fault-Tolerance, and Disaster Recovery, Resource Management and Energy-Efficiency.

(Book 2 - Chapters: 1.1, 1.2, 1.3, 1.4, 1.8)

UNIT-IV

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation level of Virtualization-Levels of Virtualization implementation, Virtualization Support at the OS Level.

Virtualization Structures Tools and Mechanisms: Hypervisor, Full Virtualization, Para-Virtualization.

Virtualization of CPU, Memory and I/O Devices-Hardware Support for Virtualization, CPU Virtualization, Memory Virtualization, I/O Virtualization.

Virtual Clusters and Resource Management - Physical versus Virtual Clusters.

Migration of Memory, Files and Network Resources: Memory Migration, File System Migration, Network Migration.

Virtualization Data-Center Automation: Server Consolidation in Data Centers, Virtual Storage Management, Cloud OS for Virtualization Data Centers.

(Book 3- Chapters: 3-3.1, 3.2, 3.3, 3.4, 3.5)

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UNIT-V

Cloud Computing Architectures over Virtualized Data Centers: Data-Center Design and Interconnection Networks-Warehouse-Scale Data-Center Design,
Data-Center Interconnection Networks, Modular Data – Center in Shipping Containers, Interconnection of Modular Data Centers, Data-Center Management Issues.

Architectural Design Of Compute And Storage Clouds: A Generic Cloud Architecture Design-Cloud Platform Design Goals, Enabling Technologies for Clouds, A Generic Cloud Architecture.

Public Cloud Platforms, GAE, AWS, Azure: Public Clouds and Services Offerings, Google App Engine, Amazon Web Services, Microsoft Windows Azure.

Inter-Cloud Resource Management: Extended Cloud Computing Services.

(Book 3– Chapters: 4-4.2, 4.3, 4.4, 4.5.1)

Suggested Readings:

1. Distributed System Concepts & Design - George Colouries, Jean Dollimore, Tim Kindberg, Gordon Blair, 5th Edition- Pearson Education. 2012.
2. RajkumarBuyya, James Broberg and Andrzej M. Goscinski," Cloud Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing), WileyPublishing ©2011
3. Kai Hwang. Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing FromParallelProcessing to the Internet of Things", Elsevier, 2012.
4. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hallof India, 2007.
5. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
6. John W. Rittinghouse, "Cloud Computing: Implementation, Management, and Security ". James F.Ransome, CRC Press 2009.

COURSE OUTCOMES: At the end of the course students will be able to:

BCA441 CO1: Outline Distributed Systems and Inter-Process Communication.

BCA441 CO2: Comprehend Remote Method Invocation and Publish- Subscribe Systems.

BCA441 CO3: Acquire Knowledge on Distributed and Cloud Computing

BCA441 CO4: Paraphrase Virtualization Concepts.

BCA441 CO5: Interpret the concepts of Cloud computing architectures over Virtualized Data Centers.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: NETWORK SECURITY
(w.e.f. 2025-26)

PAPER CODE: BCA442 **PPW: 4**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 4**

COURSE OBJECTIVE: Enable students to acquire knowledge on various techniques of encryption and decryption.

UNIT-WISE COURSE OBJECTIVES:

Cob1: To understand cryptographic principles, techniques, and protocols to ensure secure communication, data protection, and authentication in various digital environments.

COb2: To demonstrate the concepts of the intermediate, advanced and esoteric protocols.

COb3: To inculcate knowledge on key management, algorithm types and modes.

COb4: To illustrate the concepts of Mathematical Background, DES and Pseudo-Random Sequence Generators.

Cob5: To apply hash, public- key algorithms and implementations.

UNIT-I

Foundations-Cryptography Terminology, Steganography, Substitution Ciphers, One-Time Pads.

Cryptographic Protocols-Introduction to Protocols, Communications using Symmetric Cryptography, One-Way Hash Functions, Communication using Public-Key Cryptography, Digital Signatures, Digital Signatures with Encryption, Random and Pseudo-Random-Sequence Generation.

Basic Protocols- Key Exchange, Authentication and Key Exchange, Formal Analysis of Authentication and Key-Exchange Protocols, Secret Splitting, Secret Sharing, Cryptographic Protection of Databases.

(Book 1 - Chapters: 1, 2, 3)

UNIT-II

Intermediate Protocols-Timestamping Services, Subliminal Channel, Signatures-Undeniable Digital Signatures, Designated Confirmer Signatures, Proxy Signatures, Group Signatures, Fail-Stop Digital Signatures, Bit Commitment, Fair Coin Flips, Key Escrow.

Advanced Protocols-Zero Knowledge Proofs, Blind Signatures, Identity-Based Public-Key Cryptography, Oblivious Transfer, Simultaneous Contract Signing, Digital Certified Mail,

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Simultaneous Exchange of Secrets.
Esoteric Protocols-Secure Elections, Secure Multiparty Computation, Anonymous Message Broadcast Digital Cash.
(Book 1 - Chapters: 4, 5, 6)

UNIT-III
Key Length - Symmetric Key Length, Public-Key Length.
Key Management - Generating Keys, Transferring Keys, Verifying Keys, Storing Keys, Backup Keys, Lifetime of Keys, Destroying Keys, Public-Key Key Management.
Algorithm Types and Modes-Electronic Codebook Mode, Block Replay, Cipher Block Chaining Mode, Stream Ciphers, Self–Synchronizing Stream Ciphers, Cipher-Feedback Mode, Synchronous Stream Ciphers, Output-Feedback Mode, Choosing A Cipher Mode.
Using Algorithms - Choosing an Algorithm, Public Key versus Symmetric Encrypting and Communication Channels. Encrypting Data for Storage Hardware Encryption versus Software Encryption.
(Book 1 - Chapters: 7, 8, 9, 10)

UNIT-IV
Mathematical Background - Information Theory, Complexity Theory, Number Theory, Factoring, Prime Number Generation.
Data Encryption Standard (DES) - Background, Description of DES, Security of DES, Differential and Linear Cryptanalysis.
Pseudo-Random Sequence Generators and Stream Ciphers - Linear Congruential Generators, Linear Feedback Shift Registers, Design and Analysis of Stream Ciphers, Stream Cipher Using LFSRs.
(Book 3 - Chapters: 11, 12, 16)

UNIT-V
One- way hash functions-Background, MD5, SHA
Public-key Algorithms- Digital Signature Algorithm (DSA).
Key-Exchange Algorithms–Diffie-Hellman algorithm for Key Exchange
Example Implementation -IBM Secret-Key Management Protocol, ISDN, Kerberos, ISO Authentication Framework, PEM, PKCS, UEPS
(Book 1 - Chapters: 18, 20, 22, 24)

Suggested Readings:

1. Bruce Schneier, "Applied Cryptography", Standard Edition, Wiley 2015.
2. William Stallings, "Cryptography and Network Security", 7th Edition, Pearson, 2017.
3. Douglas Stinson, "Cryptography: Theory and Practice", CRC Press, 4th Edition, 2018.
4. Introduction to Cryptography with Coding Theory by Lawrence C. Washington and Wade Trappe, Pearson Publications., 3rd Edition, 2020.

COURSE OUTCOMES: At the end of the course students will be able to:

BCA442 CO1: Outline the Cryptographic Principles, Techniques, and Protocols to ensure Secure Communication, Data Protection, and Authentication in various Digital Environments.

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BCA442 CO2: Comprehend the concepts of the Intermediate, Advanced and Esoteric protocols.

BCA442 CO3: Acquire Knowledge on Key Management, Algorithm Types and Modes.

BCA442 CO4: Comprehend Mathematical Background, DES and Pseudo-Random Sequence Generators.

BCA442 CO5: Apply Hash, Public-Key algorithms and implementations.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: NETWORK SECURITY LAB
(w.e.f 2025-2026)

PAPER CODE: BCA442P **YEAR/SEMESTER: II/IV**

COURSE OBJECTIVE: To inculcate knowledge in the implementation of different levels of security issues.

COb1: To introduce Encryption and Decryption Algorithms.

COb2: To illustrate the use of Hashing Algorithms.

1. Write a program to generate cipher text and recover the plaintext using a) Caesar-Cipher text algorithm b) Product Cipher.
2. Write a program to generate cipher text and recover the plaintext using Hill cipher.
3. Write a program to generate random numbers using pseudo random number generation Algorithm.
4. Write a program to implement Poly-Alphabetic Cipher.
5. Write a program to implement Transposition Cipher and Rail Fence Technique.
6. Write a program to implement single DES-Encrypt method.
7. Write a program to implement single DES-Decrypt method.
8. Write a program to implement triple DES-Encrypt method.
9. Write a program to implement triple DES-Decrypt method.
10. Write a program to implement hash functions (MD5 and SHA-1) for Password Hashing.
11. Write a program to implement Digital signature using RSA Public Key Encryption Algorithm.
12. Write a program to implement Diffie- Helman Key Exchange Algorithm.
13. Write a program to implement SHA-I Algorithm.
14. Generation of Public Key and Private Key.
15. Write a program to implement MD5 Algorithm.
16. Write a program to implement the Signature Scheme Digital Signature Standard.
17. Write a program to encrypt and decrypt a sample message using DES, RSA, AES algorithms and measure the time taken for encryption and decryption by each algorithm.
18. Write a program to implement your own pseudo-random number generator and stream cipher.
19. Demonstrate Intrusion Detection System using Snort Tool
20. Download the N-Stalker Vulnerability Assessment Tool and explore its features.

Note: Recommended to use the C/C++/Java (without using collection framework) language on Linux systems.

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COURSE OUTCOMES: At the end of the course students will be able to:

BCA442P CO1: Implement Encryption and Decryption for different applications.

BCA442P CO2: Apply different Hashing Algorithms.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: SOFTWARE ENGINEERING
(w.e.f. 2025-26)

PAPER CODE: BCA443 | **PPW: 4**
YEAR/SEMESTER: II/IV | **NO. OF CREDITS: 4**

COURSE OBJECTIVE: To enable students, improve logical thinking and systematic approach in Software Engineering.

UNIT WISE OBJECTIVES:

COb1: To impart knowledge of generic process models in software engineering.

COb2: To analyze requirement engineering principles and requirement specifications.

COb3: To discuss about architectural styles.

COb4: To inculcate knowledge in building UML models.

COb5: To infer about Software Testing techniques.

UNIT-I

Software Engineering– Introduction, Program Versus Software (Definition Only), Software Engineering (Definition Only), Software Development Process and its Stages, Generic Software Development Process Models (Waterfall Model, V Model, Iterative Software Process Model, Spiral Model), Code of Ethics and Professional Practice, Software Development and Maintenance Cost Breakup.

Requirement Engineering Processes– Requirement Engineering Process, Feasibility Study, Cost and Benefit Analysis.

(Book 1 - Chapters: 1, 2)

UNIT-II

Requirement Specification (Functional Requirement Specification, Requirement Elicitation Analysis), Characteristics of aGood Requirement and Validation Techniques, Requirements Management Planning (Definition Only), Process of Requirement Change Management.

Software Requirement Specifications– Introduction, Stakeholder Analysis, Software Requirements Document, IEEE Standard of Software Requirement Specifications (Table 3.2), Organizing Functional Requirements (Functional Requirements Shown Class Wise), Traceability and Validation of Specifications.

(Book 1 - Chapters: 2, 3)

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UNIT-III

Architectural Styles– Introduction, Architecture Styles (Client-Server Architecture, Layered Architecture), Object Oriented Architecture, Computing Architecture Style, Core, Configurable and Customizable Architecture, Architectural Design Principles.

Object Oriented System Analysis– Introduction, Object Oriented Design, Object Oriented Design Models, Object Oriented Analysis.

(Book 1 - Chapters: 4, 5)

UNIT-IV

Object-Oriented Design Using UML– Introduction, Sequence Diagram, State Machine Diagram, Timing Diagram, Decision Tree and Decision Table, Composite Structure Diagram, Generating Test Cases, Structured Methods.

Software Development– Introduction, Good Coding Practices, Code Reuse, Design Pattern, Component Based Software Engineering, Agile Methods (Extreme Programming, XP Programming Practices, Principles of Pair Programming, Prototyping).

(Book 1 - Chapters: 6, 7)

UNIT-V

Verification, Validation and Software Testing– Introduction, Software Verification and Validation Process (Definition Only), Software Testing (Unit Testing, White Box Testing, Integration Testing, Regression Testing), Black Box Testing, System Testing, Artof Debugging.

Measurement and Metrics for Assessing Software Quality– Introduction, ISO 9126 Quality Standards, Quality Management Models (ISO 9001, CMM for Process Improvement), Ways to Build Quality in Software, Software Quality Control and Metrics, Class Coupling Metric-Coupling Between Objects (Definitions Only), Monitoring Dynamic Quality Attributes (Visible Externally) of aSoftware.

(Book 1 - Chapters: 8, 9)

Suggested Readings:

1. Rajesh Narang, Software Engineering: Principles and Practices 1st edition 2015
2. Ian Sommerville, Software Engineering 9 edition 2011.
3. R. Mall, Fundamentals of Software Engineering, 2018.
4. PankajJalote, An Integrated Approach to Software Engineering, 3rd Edition 2005.
5. Frank Tsui, Orlando Karam, Barbara Bernal, Essentials of Software Engineering,4th Edition 2016.
6. Roger S Pressman, B R Maxim, Software Engineering – A Practitioner's Approach,8th Edition 2015.
7. Grady Booch, The Unified Modeling Language User Guide,2nd Edition 2005.

COURSE OUTCOMES: At the end of the course students will be able to:

BCA443 CO1: Use generic process models in software engineering.

BCA443 CO2: Comprehend Requirement Engineering principles and requirement specifications.

BCA443 CO3: Acquire knowledge about architectural styles which can be implemented in present scenario.

BCA443 CO4: Design UML Models.

BCA443 CO5: Acquire knowledge on Software Testing techniques.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: DATA SCIENCE USING PYTHON
(w.e.f. 2025-26)

PAPER CODE: BCA444 | **PPW: 4**
YEAR/SEMESTER: II/IV | **NO. OF CREDITS: 4**

COURSE OBJECTIVE: To inculcate knowledge in students with the concepts of Data Science using Python Programming.

UNIT-WISE COURSE OBJECTIVES:

COb1: To introduce Data Science, Data Analysis and Python Programming.

COb2: To demonstrate the usage of functions and conditional Statements in Python Programming.

COb3: To demonstrate the usage of Strings, Lists, Tuples and Dictionaries.

COb4: To illustrate the concepts of Numpy.

COb5: To exhibit the usage of Pandas for data manipulation.

UNIT-I

Introduction To Data Science – Introduction to Data Science, Data Science Components, Data Science Process, Data Science Jobs Roles, Tools for Data Science, Difference Between Data Science with BI (Business Intelligence), Applications of Data Science, Challenges of Data Science Technology.

Data Analysis – Introduction to Data Analysis, Data Analysis Tools, Types of Data Analysis, Techniques and Methods, Data Analysis Process

Introduction to Python, Python Features, Python Interpreter, Modes of Python Interpreter, Values and Data Types, Variables, Keywords, Identifiers, Statements.

(Book 1 - Chapters: 1,2)

UNIT-II

Expressions, Input & Output, Comments, Lines & Indentation, Quotations, Tuple Assignment, Operators, Precedence of Operators.

Functions: Definition and Use, Types of Functions, Flow of Execution, Parameters and Arguments, Modules.

Conditionals: Conditional (if), Alternative (if-else), Chained Conditionals (if-elif-else), Nested Conditionals; **Iteration/Control Statements:** while, for, break, continue, pass; Fruitful Function Vs Void Function, Parameters/Arguments, Return Values, Variables Scope(Local, Global), Function Composition.

(Book 1 - Chapters: 2, 3, 5, 7, Book 3 - Chapters: 4, 6, 7)

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UNIT-III

Strings: Strings, String Slices, Immutability, String Functions & Methods, String Module; List as Array: Array, Methods of Array. **Lists:** List Operations, List Slices, List Methods, List Loops, Mutability, Aliasing, Cloning List, List Parameters.**Tuple:** Benefit of Tuple, Operations on Tuple, Tuple Methods, Tuple Assignment, Tuple as Return Value, Tuple as Argument.**Dictionaries:** Operations on Dictionary, Methods in Dictionary, Difference between List, Tuple and Dictionary.**Advanced List Processing:** List Comprehension, Nested List

(Book 1 - Chapters: 8, 10, 11, 12)

UNIT-IV

Introduction to Numpy – The Basics of Numpy Array, Computation on Numpy Arrays, Aggregations, Computations on Arrays, Comparisons, Masks and Boolean Logic, Fancy Indexing, Sorting Arrays, Structured Data.

(Book 2 - Chapter: 2)

UNIT-V

Data Manipulation with Pandas – Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets, Aggregation and Grouping

(Book 2 - Chapter: 3)

Suggested Readings:

1. Allen B Downey, "Think Python: How to think like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Jake VanderPlas, "Python Data Science Handbook – Essential Tools for Working with Data", 1st edition, O'Reilly Publishers, 2017.
3. Guido van Rossum and Fred L.DrakeJr, - An Introduction to Python - Revised and Updated for Python 3.2, Network Theory Ltd 2011.
4. Grus, Joel. Data science from scratch: first principles with python. O'Reilly Media, 2019.

COURSE OUTCOMES: At the end of the course students will be able to:

BCA444 CO1: Acquire knowledge on Data Science, Data Analysis and basics of Python Programming.

BCA444 CO2: Develop applications by implementing functions and conditional statements using Python Programming.

BCA444 CO3: Develop applications using Strings, Lists, Tuples and Dictionaries.

BCA444 CO4: Apply the concepts of Numpy.

BCA444 CO5: Implement the concepts of Pandas for Data Manipulation.

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DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: DATA SCIENCE USING PYTHON LAB
(w.e.f 2025-2026)

PAPER CODE: BCA444P **YEAR/SEMESTER: II/IV**

COURSE OBJECTIVE: To enable students with the concepts of Python Programming, Numpy and Pandas to develop real-time applications.

COb1: To introduce Conditional Statements, Functions, Lists, Tuples and Dictionaries.
COb2: To illustrate the concepts of Numpy and Pandas.

Note: Datasets from Kaggle, UCI, Google, etc. can be used.

Python:
1. Write a program to demonstrate different numbers data types in python.
2. Write a python program to design simple calculator using functions.
3. Write a python program to check whether a given number is Armstrong number or not.
4. Write a python program to generate prime numbers between different intervals.
5. Write a python program to find factorial of a number using recursion.
6. Write a python program to check whether a string is palindrome or not.
7. Write a python program to count the number of characters present in a word.
8. Write a python program to create, append and remove lists.
9. Write a program to demonstrate working with tuples in python.
10. Write a program to demonstrate dictionaries in python.

Numpy:
11. Write a python program to demonstrate basic array characteristics.
12. Write a python program to demonstrate array creation techniques.
13. Write a python program to demonstrate indexing in numpy.
14. Write a python program to demonstrate basic operations on single array.
15. Write a python program to demonstrate unary operators in numpy.

Pandas:
16. Python code to make a Pandas DataFrame with two-dimensional list.
17. Python code to demonstrate creating DataFrame from dictionary of narray and lists.
18. Python code to demonstrate creating a Pandas Dataframe using list of tuples.
19. Python code to demonstrate how to iterate over rows in Pandas Dataframe.
20. Python code to demonstrate how to get column names in Pandas Dataframe.

COURSE OUTCOMES: At the end of the course students will be able to:
BCA444P CO1: Develop applications using Conditional Statements, Functions, Lists, Tuples and Dictionaries.

BCA444P CO2: Implement the concepts of Numpy and Pandas.

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BHAVAN'S VIVEKANANDA COLLEGE

OF SCIENCE, HUMANITIES AND COMMERCE
(Reaccredited with 'A' Grade by NAAC)
Autonomous College – Affiliated to Osmania University

DEPARTMENT OF COMPUTER SCIENCE
PROGRAM NAME: BCA
COURSE NAME: ARTIFICIAL INTELLIGENCE
(w.e.f. 2025-26)

PAPER CODE: BCA445 | **PPW: 4**
YEAR/SEMESTER: II/IV | **NO. OF CREDITS: 4**

COURSE OBJECTIVE: To enable students with the concepts of Artificial Intelligence.

UNIT-WISE COURSE OBJECTIVES:

COb1: To explain basics of Artificial Intelligence & Heuristic Techniques.

COb2: To inculcate knowledge on knowledge representation issues & game playing.

COb3: To outline uncertainty & reasoning techniques.

COb4: To describe the importance of Learning and Expert Systems.

COb5: To discuss about Natural Language Processing.

UNIT-I

What is Artificial Intelligence: AI problems, AI Technique-Introduction-Tic-Tac-Toe, Defining Problem as a State Space Search (A Water Jug Problem), Production Systems - Control Strategies - Breadth First Search Algorithm, Depth First Search Algorithm, Problem Characteristics, Production System Characteristics.
Heuristic Search Techniques: Generate – and – Test, Hill Climbing–Simple Hill Climbing, Steepest-Ascent Hill Climbing, Best – First Search - OR Graphs.
(Book 1 - Chapters: 1, 2, 3)

UNIT-II

Game Playing: Overview, Min-Max Search Procedure.
Knowledge Representation Issues: Representation and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation – Important Attributes, Relationship among Attributes, Frame Problem.
Using Predicate Logic: Representing Simple Facts in Logic, Representing Instance and ISA Relationships, Computable Functions and Predicates, Resolution- Introduction, Natural Deduction.
(Book 1 - Chapters: 12, 4, 5)

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UNIT-III

Symbolic Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Logics for Non-Monotonic Reasoning –Introduction. Implementation issues.

Statistical Reasoning: Probability and Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Networks, Dempster-Shafer Theory.

(Book 1 - Chapters: 7, 8)

UNIT-IV

Learning: What is Learning, Rote Learning, Learning by Taking Advice, Learning in Problem Solving - Learning by Parameter Adjustment, Learning from Examples: Induction-Winston's Learning Program, Decision Trees.

Expert Systems: Representing and Using Domain Knowledge, Expert Systems Shells, Explanation, Knowledge Acquisition.

(Book 1 - Chapters: 17, 20)

UNIT-V

Perception and Action: Real Time Search, Perception-Vision, Speech Recognition. ACTION-Navigation, Manipulation, Robot Architectures.

Natural Language Processing: Introduction, Syntactic Processing –Grammars and Parsers, Semantic Analysis –Introduction, Semantic Grammars Spell Checking.

(Book 1 - Chapters: 21, 15)

Suggested Readings:

1. Elaine Rich, Kevin Night, Shivashankar B.Nair," Artificial Intelligence", 3rd Edition.,2008.
2. Russell Norvig, "Artificial Intelligence-Modern Approach", 3 rd edition, 2009.
3. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012.

COURSE OUTCOMES: At the end of the course students will be able to:

BCA445 CO1: Acquire Knowledge in Artificial Intelligence and Heuristic Techniques.

BCA445 CO2: Comprehend knowledge representation issues and Game Playing.

BCA445 CO3: Apply uncertainty & reasoning techniques.

BCA445 CO4: Adopt different learning methods and concepts of Expert Systems

BCA445 CO5: Interpret the concepts of Natural Language Processing.

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YEAR/SEMESTER: II/IV | **NO. OF CREDITS: 2**

A **Technical Seminar** is a focused presentation or discussion session aimed at sharing knowledge, advancements, or research in a particular field of technology. It provides a platform for students to explore emerging trends, exchange ideas, and enhance their understanding of technical subjects.

The objective of a technical seminar is to:

- Foster awareness about the latest technological developments.
- Enhance the technical and presentation skills of participants.
- Promote collaborative learning and innovation.

These seminars often include the use of multimedia presentations, live demos, and case studies to make the session engaging and informative. They are valuable not only for academic enrichment but also for preparing students for future careers in technology-driven industries.

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