

FACULTY OF COMPUTER SCIENCE & IT

SYLLABUS

of

**Bachelor of Computer Applications (Honours)
(offered under 4-Year UG Degree Programme)**

(Semester III-VI)

(Under Credit Based Continuous Evaluation Grading System)

Under NEP 3030

Session: 2026-27



The Heritage Institution

**KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)**

PROGRAMME SPECIFIC OUTCOMES

Bachelor of Computer Applications (Session 2026-27)

Program Specific Outcomes

PSO1: Apply skills for development of software and websites for providing efficient solution to IT based problems

PSO2: Comprehend development process in IT industry through ethical, defined and innovative techniques.

PSO3: Achieve leadership role and team player role to be able to work in multidisciplinary areas at various job roles.

PSO4: Identify and demonstrate the implementation of various tools and technologies involved in the field of Information Technology.

PSO5: Demonstrate proficiency in the field of Programming, Web development and IT enabled services.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE/FOUR YEAR DEGREE
PROGRAMME

Bachelor of Computer Applications ((Three Year Degree Programme)
Bachelor of Computer Applications (Honours) (Four Year Degree Programme)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Session 2026-27)

Bachelor of Computer Applications /Bachelor of Computer Applications (Honours) Semester - III										
Course Code	Course Title	Course Type	Hours per week	Credit		Marks				Examination Time (in Hours)
			L-T-P	L-T-P	Total	Total	Ext.		CA	
							L	P		
BCAL-3111	Advanced Database Management System	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-3112	Computational Problem Solving	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-3113	Numerical Methods and Statistical Techniques	Minor	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-3114	Management Information System	MDC	4-0-0	4-0-0	4	100	70	-	30	3
BCAP-3115	Lab on Computational Problem Solving	DSC	0-0-4	0-0-2	2	50	-	35	15	3
BCAP-3116	Lab on Advanced Database Management System	DSC	0-0-4	0-0-2	2	50	-	35	15	3
BCAI-3117	Internship	C	0-0-4	0-0-2	2	50	-	50	-	-
BCAM-3110	Data Analysis using Spreadsheet and Tableau	SEC	2-0-2	2-0-1	3	100	40	30	30	3+3
VACE-3221	* Environmental Studies	VAC	2-0-0	2-0-0	2	50	35	-	15	3
	Total				27	700				

Note:

C – Compulsory, DSC – Discipline Specific Course, SEC – Skill Enhancement Course

MDC – Multi-Disciplinary Course, VAC – Value Added Course

***Credits/Grades Points of these courses will not be included in the SGPA/CGPA of Semester / Program, only grades will be provided.**

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE/FOUR YEAR DEGREE PROGRAMME

Bachelor of Computer Applications ((Three Year Degree Programme) Bachelor of Computer Applications (Honours) (Four Year Degree Programme) Credit Based Continuous Evaluation Grading System (CBCEGS) (Session 2026-27)

Bachelor of Computer Applications /Bachelor of Computer Applications (Honours) Semester - IV										
Course Code	Course Title	Course Type	Hours per week	Credit		Marks				Examination Time (in Hours)
			L-T-P	L-T-P	Total	Total	Ext.		CA	
							L	P		
BCAL-4111	Data Structures	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-4112	Computer Networks	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-4113	Web Designing and Development	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-4114	Applied and Discrete Mathematics	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BCAM-4105	Effective Soft Skills	AEC	2-0-4	2-0-2	4	100	40	30	30	3+3
BCAP-4116	Lab on Data Structures	DSC	0-0-4	0-0-2	2	50	-	35	15	3
BCAP-4117	Lab on Web Designing and Development	DSC	0-0-4	0-0-2	2	50	-	35	15	3
VACP-4511	*Personality Development and Gender Sensitization	VAAC	2-0-0	2-0-0	2	50	35	-	15	3
	Total				26	650				

Note:

C – Compulsory, DSC – Discipline Specific Course, SEC – Skill Enhancement Course

AEC – Ability Enhancement Course, VAAC – Value Added Audit Course

Note:

***Credits/Grades Points of these courses will not be included in the SGPA/CGPA of Semester / Program, only grades will be provided.**

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE/FOUR YEAR DEGREE PROGRAMME

Bachelor of Computer Applications ((Three Year Degree Programme) Bachelor of Computer Applications (Honours) (Four Year Degree Programme) Credit Based Continuous Evaluation Grading System (CBCEGS) Session 2026-27

Bachelor of Computer Applications Semester V										
Course Code	Course Title	Course Type	Hours per week	Credit		Marks				Examination Time (in Hours)
			L-T-P	L-T-P	Total	Total	Ext.		CA	
							L	P		
BCAL-5111	Object Oriented Programming -II	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-5112	Web Development (Full Stack Development)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-5113	Operating System	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-5114	Machine Learning	AEC	4-0-0	4-0-0	4	100	70	-	30	3
BCAP-5115	Lab on Object Oriented Programming- II	DSC	0-0-4	0-0-2	2	50	-	35	15	3
BCAP-5116	Lab on Full Stack Development	DSC	0-0-4	0-0-2	2	50	-	35	15	3
BCAI-5117	Internship	C	0-0-4	0-0-2	2	50	-	50	-	3
BCAM-5110	Server-Side Programing	SEC	2-0-2	2-0-1	3	100	40	30	30	3+3
VACJ-5551	*Job Readiness Course	VAAC	2-0-0	2-0-0	2	50	35	-	15	1
	Total				27	700				

Note:

C – Compulsory, VAAC – Value Added Audit Course, DSC – Discipline Specific Course, SEC – Skill Enhancement Course

***Credits/Grades Points of these courses will not be included in the SGPA/CGPA of Semester / Program, only grades will be provided.**

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE/FOUR YEAR DEGREE PROGRAMME

Bachelor of Computer Applications ((Three Year Degree Programme) Bachelor of Computer Applications (Honours) (Four Year Degree Programme) Credit Based Continuous Evaluation Grading System (CBCEGS) Session 2026-27

Bachelor of Computer Applications Semester VI										
Course Code	Course Title	Course Type	Hours per week	Credit		Marks				Examination Time (in Hours)
			L-T-P	L-T-P	Total	Total	Ext.		CA	
							L	P		
BCAL-6111	Information Security and Threats	MDC	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-6112	Software Engineering	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BCAL-6113	Computer Graphics	Minor	4-0-0	4-0-0	4	100	70	-	30	3
BCAP-6114	Lab on Graphics Designing	DSC	0-0-4	0-0-2	2	50	-	35	15	3
BCAD-6115	Project	DSC	0-0-16	0-0-8	8	200	-	140	60	3
VACH-6401	Human Rights and Constitutional Rights	VAC	2-0-0	2-0-0	2	50	35	-	15	3
	Total				24	600				

Note:

C-Compulsory, DSC – Discipline Specific Course, VAC – Value Added Course

MDC – Multi Disciplinary Course

Bachelor of Computer Applications (Honours) Semester – III
(Session 2026-27)
COURSE CODE: BCAL-3111
ADVANCED DATABASE MANAGEMENT SYSTEM

Course Outcomes:

After passing course the student will be able to:

CO1: Gain knowledge of transaction management and Concurrency control.

CO2: Create, manage and access database using PL/SQL.

CO3: Create and manage database using NoSQL

CO4: Comprehend the implementation of queries using MongoDB

Bachelor of Computer Applications (Honours) Semester – III
(Session 2026-27)

COURSE CODE: BCAL-3111

ADVANCED DATABASE MANAGEMENT SYSTEM

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

SQL: Join methods & sub query, Union, Intersection, Minus, Indexes, Views.

Transaction Management-ACID Properties, Concurrency Control, Security amongst users.

UNIT-II

PL/SQL: Introduction, advantages and limitations, block structure, constant and variables, input and output, control statements, data-types. Triggers, functions and procedures, cursors, packages, exceptions.

Big Data: Meaning, Characteristics, Benefits, CAP Theorem

UNIT III

NoSQL: Overview, Need of NoSQL, Structured Data Vs. Unstructured Data, Types of Database in NoSQL, Features of NoSQL, Advantages of NoSQL, Eventual Consistency, ACID vs BASE Properties.

MongoDB: Overview, Install MongoDB server, Environment, Create Database, Data Model, Collection (Creation and Deletion), Data types in MongoDB, CRUD: Create, Update, Delete And Query Database.

UNIT IV

SQL to MongoDB Mapping, Projection. Sorting, Limiting and Counting records. Indexes in MongoDB: Creation of Index, Options, Dropping and fetching of Index. Analyze Query performance, Plan and Profiler. MongoDB Aggregation Query: Aggregate Framework (sum,

avg, min, max, push, first, etc). Replication and Sharding, MapReduce Function. Creating database backup.

Reference/ Textbooks:

1. C.J. Date, An Introduction to Database Systems, Pearson Education 3000.
2. H. F. Korth&Silverschatz, A., Database System Concepts, Tata McGraw Hill, 3010.
3. Elmasri&Navathe, Fundamentals of Database Systems, Addison-Wesley, 3011.
4. Hoffer, Prescott, Mcfadden, Modern Database Management, Paperback International, 3012.
5. Adam Fowler, “NoSQL For Dummies”, Wiley, First Edition, 3015.
6. Gerardus Blokdyk, “NoSQL A Complete Guide”, 5STARCOoks, Second Edition, 3021.

Note: The latest editions of the books should be followed.

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAL–3112
COMPUTATIONAL PROBLEM SOLVING

Course Outcomes:

After passing course the student will be able to:

CO1: Comprehend basics of Python programming like operators, data types, control structures, etc.

CO2: Apply list and dictionaries for handling and accessing data through iterations.

CO3: Implement various built-in and user defined function, libraries to solve mathematical problems

CO4: Comprehend Object Oriented Programming and modules in Python.

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAL–3112
COMPUTATIONAL PROBLEM SOLVING

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section

UNIT-I

Introduction to Python: Process of Computational Problem Solving, Introduction to Artificial Intelligence, Basics of Machine Learning, Generative AI Overview, Python Programming Language Data and Expressions: Literals, Variables and Identifiers, Operators, Expressions, Statements and Data Types, Control Structures

UNIT-II

Lists: List Structures, Lists (Sequences) in Python, Iterating Over Lists (Sequences) in Python Dictionaries: Dictionaries and Files, Looping and dictionaries, advanced text parsing Iteration: While statement, definite loops using For, Loop Patterns, Recursive Functions, Recursive Problem Solving, Iteration vs. Recursion

UNIT-III

Functions: Fundamental Concepts, Program Routines, Flow of Execution, Parameters & Arguments Files: Opening Files, Using Text Files, String Processing, Exception Handling, Introduction to Libraries: NumPy, Pandas, Matplotlib, Reading CSV Files, Data Cleaning, Data Visualization

UNIT-IV

Objects and Their Use: Introduction to Object Oriented Programming Modular Design: Modules, Top-Down Design, Python Modules Using Databases and SQL: Database Concepts, SQLite Manager Firefox Add-on, SQL basics summary, basic Data Modelling, Programming with multiple tables

References/Textbooks:

1. Charles Severance, Python for Informatics, Version 0.0.7.
2. Charles Dierbach, Introduction to Computer Science Using Python: A Computational Problem-Solving Focus, Wiley Publications, 2012.
3. Guttag John V, Introduction To Computation And Programming Using Python, PHI, 2014.
4. Jeeva Jose and Sojan P. Lal, Introduction to Computing & Problem Solving Through Python, Khanna Publishers, 2015.
5. Mark J. Guzdial, Introduction to Computing and Programming in Python, Pearson Education, 2015.
6. Kenneth Lambert, Fundamentals of Python, Course Technology, Cengage Learning, 2015
7. Mark Lutz, Learning Python, O'Reilly Media, 2013

Note: The latest editions of the books should be followed.

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAL–3113
NUMERICAL METHODS AND STATISTICAL TECHNIQUES

Course Outcomes:

After the completion of this course, the student will be able to:

CO1: Solve non-linear and linear equations using different methods.

CO2: Comprehend interpolation and numerical integration.

CO3: Calculate different means and deviations using statistical techniques.

CO4: Comprehend correlation and regression for finding solutions to various statistical problems

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAL–3113
NUMERICAL METHODS AND STATISTICAL TECHNIQUES

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section. Students can use non-storage and non-programmable scientific calculator.

UNIT-I

Introduction: Numerical Methods, Numerical methods versus numerical analysis, Types of Error, Errors and Measures of Errors.

Non-linear Equations: Bisection Method and Newton Raphson's Method

Linear Equations: Gauss Elimination Method, Gauss Jordan Method.

UNIT-II

Interpolation: Newton's Methods: Forward Difference Method, Backward Difference Method, and Divided Difference Method.

Numerical Integration: Trapezoidal Rule, Simpson's 1/3 method and Simpson's 3/8 Method

UNIT-III

Statistical Techniques:

Measure of Central Tendency: Arithmetic mean, Median, Mode.

Measures of dispersion: Range, Quartile Deviation, Mean deviation, Standard deviation, Co-efficient of variation.

UNIT –IV

Correlation: Introduction, Karl Pearson's Coefficient of Correlation, Rank Correlation method

Regression: Regression line and regression equations, Regression Coefficient

References / Textbooks:

1. Amrinder Pal Singh, Jaspal Singh, Anshuman Sharma, Fundamentals Of Numerical Methods And Statistical Techniques, Lakhanpal Publishers, 4th edition.
2. Kandasamy P.& et Al., Numerical Methods, S. Chand & Company (3006), Reprint Edn. 3006 Edition.
3. B.S. Grewal, Numerical Methods in Engineering & Science, Khanna Publishers (3013), 11th Edition.
4. E. Balagurusamy, Numerical Methods, Tata McGraw Hill Education (3017)
5. H.S.G. Rao, Numerical Methods, IK International Publishing House (3011)
6. S.S. Sastry, Introductory methods of Numerical Analysis, PHI (3012), 5th Edition

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAL–3114
MANAGEMENT INFORMATION SYSTEM

Course Outcomes:

After passing course the student will be able to:

CO1: Identify the importance of Management Information System.

CO2: Comprehend development life cycle of information systems.

CO3: Identify the decision-making process and role of DSS and EIS.

CO4: Comprehend the role of Expert System and case studies of HR and ERP.

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAL–3114
MANAGEMENT INFORMATION SYSTEM

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section

UNIT - I

Basic Concepts: Data, Information, Knowledge, Meaning of Information System, Organization structure, Role of information systems, Components of Information System.

Management Information System - Need, Components and Functions of MIS. Planning of MIS, Implementation and Controlling.

UNIT - II

Planning Information systems: System Analysis and System Design, System Development Life Cycle - various phases including Planning, Analysis – Analysis Tools, Requirement determination, Methodologies and Best Practices, Design & development, Implementation and Maintenance. Rapid Application Development.

UNIT - III

Decision Making Process: Structured, Semi structured and unstructured decisions, Decision Support Systems - Characteristics, Types, Components and Approaches of DSS,. Executive Support Systems – Components of EIS, Benefits of using EIS, Difference between DSS and EIS.

UNIT - IV

Expert Systems: Meaning, Types of Expert Systems, Case Studies of Expert Systems using Artificial Intelligence for HR and ERP.

References / Textbooks:

1. Mohammad Azam, Management Information Systems, Tata McGraw Hill Education (3012).
2. James A. O'Brein, Management Information Systems, Tata McGraw-Hill.
3. Effy OZ, Management Information Systems, Thomson Learning/Vikas Publications
4. Nagpal D.P., Textbook on Management Information System, S.Chand& Company (3011).
5. R. Kelly, Rainer and Casey G. Cegielski, Introduction to Information Systems, Wiley (3015), 4th Edition
6. C. Laudon Kenneth and P. Laudon Jane, Management Information System, Pearson Education (3018), 15th Edition.
7. David Kroenke, Management Information System, Tata Mc Graw Hill Publication.
8. Brien, Marakas and Behl, Management Information Systems, McGraw Hill Education (3017), 10th Edition
9. W.S Jawadekar, Management Information System, Tata Mc Graw Hill Publication
10. Kenneth C. Landon, Jane P. Landon, MIS: Managing the digital firm, Pearson Education

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAP-3115
LAB ON COMPUTATIONAL PROBLEM SOLVING

L-T-P: 0-0-2
Credits: 2

Max. Marks: 50
Practical: 35
CA: 15

Lab based on Computational Problem Solving.

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAP-3116
LAB ON ADVANCED DATABASE MANAGEMENT SYSTEM

L-T-P: 0-0-2
Credits: 2

Max. Marks: 50
Practical: 35
CA: 15

Lab based on Advanced Database Management System.

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAI - 3117
INTERNSHIP

L-T-P: 0-0-2
Credits: 2

Max. Marks: 50

Internship with Local / Public / Private Industry / Business organization / MOOCs / Online Internship / Certifications from the recognized organization.

Important points to be considered:

- MOOCs tenure should not be less than 8 weeks.
- The tenure of the Online Certification must be more than 60 hours.
- Online / Offline Internship tenure should be from 6-8 weeks.
- The requisite certificate and Internship report to be submitted to HOD in print form by the third week of November.

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAM-3110
DATA ANALYSIS USING SPREADSHEET AND TABLEAU

Course Outcomes:

After the completion of this course, the student will be able to:

CO1: Understand the scope of data analysis with Spreadsheet

CO2: To enable students to create applications and tools to deal with complex.

CO3: To comprehend hands-on experience with Spreadsheet and Tableau

CO4: To enable the students to create a Tableau dashboard.

Bachelor of Computer Applications Semester – III
(Session 2026-27)
COURSE CODE: BCAM-3110
DATA ANALYSIS USING SPREADSHEET AND TABLEAU

L-T-P: 2-0-1

Credits: 3

Examination Time: 3+3 Hours

Max. Marks: 100

Theory: 40

Practical: 30

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (8 marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section. Students can use non-storage and non-programmable scientific calculator.

UNIT - I

Spreadsheet: Font Formatting, changing the Color of a cell, Currency symbols in Spreadsheet, Merging cells, Using Auto fill, using paste special, adding comment to a cell.

Templates: Introduction, creating basic spreadsheet template. Data Validation.

Advanced Spreadsheet Formulas: Logical Functions – IF, AND, OR, NOT, Nested IF, Nested IF vs IFS, LOOKUP Functions, VLOOKUP with Match, INDEX Function, INDEX+MATCH function, Text Functions, MID Function, DATE & TIME Function

UNIT - II

Introduction to Time series, Analysis of Time Series Data: Forecasting/Data Relationship Tools –Graphical Analysis.

Advanced Data Management & Visualization: Named Ranges in Spreadsheet, Structured referencing in Table, Advanced Charting – Sparklines, WHAT-IF Analysis, Error Handling.

Advanced Functions: Power Query, Power Pivot, DAX Functions, Macros.

UNIT – III

Tableau: Introduction, Installation, Architecture, File Types & Extensions.

Tableau Basics: Connecting Tableau to a Data File – CSV File, Navigating Tableau, Creating calculated Fields, Adding Colors, Adding Labels and Formatting, Exporting worksheet, Working with Data extracts in Tableau, Working with Time Series, Understanding Aggregation, Granularity and level of Detail.

Combining Data: Basics Data Modeling, Logical & Physical Layers, Joins, Union, Relationships, Data Blending

Filtering & Sorting Data: Understand Tableau Filters, steps to Create Filters, Customizing Filters

UNIT – IV

Tableau Calculations: Number Functions, String Functions, Date Functions, Null Functions, Logical Functions, Aggregate Functions, Attribute Function ATTR(), Fixed, Exclude, Include

Tableau Chart Types: Relationship vs Joins, Joining Data in Tableau, Creating and area chart, creating a map and working with Hierarchies, Creating a scatterplot, Applying Filters to multiple Worksheets, Using Line Chart, Using Heat Maps, Using Histograms, Using Pie Charts.

Tableau Dashboard: Build Interactive Dashboards, Best practices for creating effective dashboards, creating a Dashboard and Importing Sheets, Use of Running Actions, Using Dashboard Actions.

References / Textbooks:

1. Joyce Cox, Joan Lambert and Curtis Frye, Microsoft office Professional 3010 Step by Step, Microsoft Press, 3010.
2. V. Rajaraman, Neeharika Adabala, Fundamentals of Computers, PHI Learning, 3015.
3. P.K. Sinha, Computer Fundamentals, BPB Publications, 3004
4. Jumpstart Tableau: A Step-By-Step Guide To Better Data Visualization, Apress Publication

Bachelor of Computer Applications Semester – IV
(Session 2026-27)
COURSE CODE: BCAL-4111
DATA STRUCTURES

Course Outcomes:

After passing course the student will be able to:

CO1: Analyse complexity of algorithms to determine their efficiency.

CO2: Comprehend various hashing method, sorting and searching algorithms.

CO3: Comprehend various operations of stack and queue along with different scenarios.

CO4: Comprehend advanced data structures such as tree and graph.

Bachelor of Computer Applications Semester – IV
(Session 2026-27)
COURSE CODE: BCAL-4111
DATA STRUCTURES

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section

UNIT-I

Data Structure: Introduction, Common Operations on Data Structures, Algorithm Complexity, Big O Notation, Time – Space tradeoff between Algorithms.

Arrays: Array Defined, Representing Arrays in Memory, Operations (Traversing, Inserting, Deleting), Bubble Sort, Linear Search, Binary Search, Selection Sort, Insertion Sort, Merge Sort.

UNIT-II

Hashing: Hash Functions: Division Method, Mid-Square Method & Folding Method and Collision Resolution methods.

Linked Lists: Introduction, Types of Linked Lists, Representing Linked Lists in Memory using Array and Linked List, Advantages of using Linked Lists over Arrays, Various Operations on Linked Lists.

UNIT-III

Stacks: Description of STACK structure, Implementation of Stack in memory, Applications of Stacks – Converting Arithmetic expression from infix notation to reverse polish and their subsequent evaluation and Quicksort method.

Queues: Description of queue structure, Implementation of queue in memory, Priority Queue, Dequeues.

UNIT-IV

Trees: Description of Tree Structure and its Terminology, Binary Trees, B Tree, AVL Tree, Binary Search Trees and their representation in Memory and Heapsort.

Graphs: Description of Graph Structure, Implement Graphs in Memory using Adjacency Matrix, Adjacency List, Operations (Find, Insert, Delete), Path Matrix and Graph traversal techniques - DFS, BFS, Dijkstra Algorithm and Bellman Ford Algorithm.

References / Textbooks:

1. Seymour Lipschutz, Data Structures with C (Schaum's Outline Series), McGraw Hill Education (2017), 1st Edition
2. Reema Thareja, Data Structures Using C, Oxford Publication (2014), 2nd Edition
3. Sahni Horowitz, Fundamentals of Data Structures in C (2008), 2nd Edition
4. Narasimha Karumanchi, Data Structures and Algorithms made easy, Careermonk Publications (2014), 5th Edition
5. S.K. Srivastava and Deepali Srivastava, Data Structures through C, BPB Publications (2004)
6. YedidyahLangsam, Augestein and Tanenbaum, Data Structures using C and C++, Pearson Education India (2015), 2nd Edition

Bachelor of Computer Applications Semester – IV
(Session 2026-27)
COURSE CODE: BCAL-4112
COMPUTER NETWORKS

Course Outcomes:

After passing course the student will be able to:

CO1: Describe the functions of each layer in OSI and TCP/IP model.

CO2: Identify various network devices and the layers on which it operates.

CO3: Describe the Data Link layer and Network layer design issues.

CO4: Comprehend the functioning of Transport layer and Application layer protocols.

Bachelor of Computer Applications Semester – IV
(Session 2026-27)
COURSE CODE: BCAL-4112
COMPUTER NETWORKS

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT – I

Introduction: Basic concepts of Computer Networks, Basic Components of a Network, Network types and topologies.

Models: OSI Reference Model, TCP/IP Model, Comparison between TCP/IP and OSI model

Transmission Media: Coaxial Cable, Twisted Pair Cable, Fiber Optics & Satellites.

UNIT – II

Network Devices: Hub, Switch, Repeaters, Bridges, Routers, Gateways.

Introduction to Analog and Digital Transmission: Introduction to Analog and Digital Signals, Modems, Types of modems, pulse code modulation. Multiplexing and its types, Circuit Switching, Packet Switching, Message Switching.

Data Link Layer Design Issues: Error Control, Flow Control, Error Detection & Correction

UNIT - III

Media Access Protocols: CSMA, CSMA/CD, CSMA/CA.

IEEE standards 802: Token Ring, FDDI.

Design Issues of Network Layer: Routing Algorithm- Distance Vector Routing, Link state Routing and The Dijkstra Algorithm, IPv4: Notation, Classful addressing, Header Format, IPv6 addressing.

UNIT – IV

Design issues of Transport Layer: Introduction to TCP, TCP Services, features, TCP segment format, Introduction to UDP, User Datagram Format, UDP Operation

Network Security and Privacy: Introduction to Cryptography, types of Key.

References/Textbooks:

1. Tanenbaum , A.S., Computer Networks, Prentice Hall, 3010.
2. Stallings, W., Local Networks: An Introduction: Macmillan Publishing Co, 1990.
3. Stallings W., Data and Computer Communications, Prentice Hall, 3011.
4. Forouzan B., Data Communications and networking, McGraw Hill, 3007.

Note: The latest editions of the books should be followed.

Bachelor of Computer Applications Semester – IV
(Session 2026-27)
COURSE CODE: BCAL-4113
WEB DESIGNING AND DEVELOPMENT

Course Outcomes:

After passing course the student will be able to:

CO1: Comprehend basics of internet and email along with their effective use.

CO2: Apply HTML for development of static webpages.

CO3: Implement styling and behavior in webpages through the use of CSS.

CO4: Create and manage websites through the application of WordPress content management system.

Bachelor of Computer Applications Semester – IV
(Session 2026-27)
COURSE CODE: BCAL-4113
WEB DESIGNING AND DEVELOPMENT

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section

UNIT - I

Introduction to Web Design and Development: Overview of web technologies and the web development process, Understanding the difference between web design and development, Introduction to HTML, CSS, and JavaScript

HTML: The structure of a Webpage, Creating a full webpage, Header tags, Paragraph tags, Formatting tags, List, Image tags, Image map, Forms in HTML, Image as link, Tables, Nested Table, Links, HTML entities, Frames, iframe, embed audio and video in HTML, Forms, adding structure to the form

UNIT - II

CSS: What is CSS, Inline CSS, Internal CSS, Class and id, Div, Color, background, Floating, Positions, Margins, Padding, Borders, Font style, height and width, font, text properties, list properties, Styling links, FlexBox in CSS, Transformation, Animation effects, Difference between Div and Span.

UNIT III

JavaScript: Introduction to JavaScript, Data types, Operators, Control Statements, Arrays, Functions, Advanced Functions in JS, String, Data object, Call Back in JS, JS Promises.

DOM: Finding elements, node types, Traversing, DOM manipulation in JS, Events in JS, Client side Form Validation and its types.

UNIT IV

WordPress: Installation, Configuration, Management - Managing Posts, pages, categories, Plugins, Widgets, Tags, images, users, Import and export content.

Useful Plugins – MailChimp, Creating Gallery, Google Maps, Google Analytics.

References / Textbooks:

1. Anshuman Sharma, Fundamentals of Internet Applications, Lakhanpal Publications, 2014.
2. Ikvinderpal Singh, Internet Applications, Khanna Book Publishing Company, 1st Edition, 2011
3. P. Rizwan Ahmed, Internet & its Applications, Margham Publications, 2013.
4. Douglas E. Comer, Computer Networks and Internet with Internet Applications, Pearson, 4th Edition, 2008.
5. Satish Jain/Vineeta Pillai, Wireless Communication & Networking made Simple, BPB Publishers, 2007.
6. Laura Lerney, Rafe Colburn, Jennifer Kyrnin, Mastering HTML, CSS & Javascript Web Publishing, BPB Publishers, 1st Edition, 2014.
7. Lisa Sabin-Wilson, WordPress for Dummies, Wiley, 8th Edition, 2021.

Bachelor of Computer Applications Semester – IV
(Session 2026-27)
COURSE CODE: BCAL–4114
APPLIED AND DISCRETE MATHEMATICS

Course Outcomes:

After passing course the student will be able to:

CO1: Have knowledge of matrices, sets, relations, propositional logic.

CO2: Have knowledge of Boolean algebra.

CO3: represents world knowledge in symbolic notation through propositional calculus.

CO4: Apply discrete mathematical concepts to obtain analytical and numerical solutions.

Bachelor of Computer Applications Semester – IV
(Session 2026-27)
COURSE CODE: BCAL–4114
APPLIED AND DISCRETE MATHEMATICS

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Logic and Propositional Calculus: Proposition and Compound Propositions, basic Logical Operations, Propositions and Truth Tables, Tautologies and Contradictions, Logical Equivalence, Laws of propositional logic, Algebra of propositions, Conditional and Bi conditional Statements, Arguments, Logical Implication, Propositional Functions, inference theory of proposition calculus, truth sets, Predicates and Quantifiers, Negation of Quantified Statements, Inference theory of the predicates calculus.

UNIT-II

Sets: Definition of sets, set representation, types of sets, operations on sets, Venn diagram, cardinality of sets (formulae), laws of set theory, Countable and uncountable sets, minset, maxset, normal forms, Partitions of sets, Cartesian products.

Relations: Basic definitions, domain and range of relations, representation of relations (arrow diagram). Types of relations, properties of relations, inverse of relation, closure of relation, equivalence classes, composition of relation.

UNIT-III

Functions: Basic definitions, domain, co-domain and range of functions, types of functions (Surjective, injective, bijective), inverse of a function, composition of function.

Matrices: Introduction, types of matrix, matrix addition, subtraction and scalar multiplication, multiplication of matrices, properties of matrix multiplication, transpose and its properties.

UNIT IV

Symmetric, skew-symmetric, nilpotent, unitary, orthogonal, Hermitian, skew-Hermitian, Identity matrix, involuntary matrix.

Determinant, minors and co-factors, adjoint of a matrix, Inverse of matrix, properties of determinant, rank of matrix, equation solving using Crammer's rule and matrix inversion method.

References/Textbooks:

1. Seymour Lipschutz, Marc Lars Lipson, Discrete Mathematics (Schaum's outlines Series), McGraw-Hill, 1997.
2. Bernard Kolman, Robert C. Busby, Discrete Mathematical structures for Computer Science, Prentice-Hall, 1984.
3. Alan Doerr, Kenneth Levasseur, Applied Discrete Structures for Computer Science, Galgotia Publications, 1989.
4. J.P.Tremblay. and R Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill, 1997.

Note: The latest editions of the books should be followed.

Bachelor of Computer Applications Semester – IV
(Session 2026-27)
COURSE CODE: BCAP-4116
LAB ON DATA STRUCTURES

L-T-P: 0-0-2
Credits: 2

Max. Marks: 50
Practical: 35
CA: 15

Lab Exercises based on Implementation of Data Structures using the C++ language:

1. Arrays and strings
2. Searching (binary search, linear search)
3. Linked list
5. Stacks (Using Arrays, linked lists)
6. Queues (Using Arrays, linked lists)
7. Trees – Traverse the BST, AVL Trees and B tree.
8. Sorting (selection sort, insertion sort, quick sort, merge sort, heap sort, bubble sort) ,
9. Graph-transversal, finding the shortest path

Bachelor of Computer Applications Semester – IV
(Session 2026-27)
COURSE CODE: BCAP-4117
LAB ON WEB DESIGNING AND DEVELOPMENT

L-T-P: 0-0-2
Credits: 2

Max. Marks: 50
Practical: 35
CA: 15

Lab Based on web designing and Development.

Bachelor of Computer Applications Semester – V

(Session 2026-27)

COURSE CODE: BCAL-5111

OBJECT ORIENTED PROGRAMMING - II

Course Outcomes:

After passing this course the student will be able to:

CO1: Understand the basic fundamentals of Object Oriented Programming using Java.

CO2: Identify the use of inheritance, interfaces and packages in Java.

CO3: Identify the utilization of multithreading and Exception handling.

CO4: Connect Java application with an existing database and access it through JDBC.

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAL-5111
OBJECT ORIENTED PROGRAMMING - II

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT - I

JAVA BASICS: Introduction to Java, Features of Java, Structure of a Java Program, primitive data types.

OOPS: Object oriented concepts Advantage of OOPs, Objects and Classes,

Strings: Declaring a string, Immutable string, string comparison, concatenation, substring, string tokenizer.

UNIT - II

Inheritance: what is inheritance, types of inheritance, static import, Method overloading, method overriding, Runtime polymorphism, super keyword, final keyword

Interfaces: Abstract classes, declaring an interface, relationship between classes and interface, interface inheritance, implementing multiple inheritance using interface

Packages: what are packages, advantages of using packages, accessing package from another package.

UNIT - III

Exception Handling: what is exception handling, checked and unchecked exceptions, try-catch, try-multiple catch, try – finally, throw and throws

Multithreading: What is a thread, life cycle of a thread, creating a thread, sleeping a thread, joining a thread, thread priority

Creating GUI Applications using AWT: java awt packages, awt controls, Frame class, Buttons, Checkboxes, Choice, Lists, Scrollbar, Grid Layout

UNIT - IV

Input/Output: File input stream, File output stream, Buffered output stream, Buffered input stream.

Database connectivity: JDBC, JDBC drivers, steps to connect to the database, connectivity with MYSQL.

Java with AI: Introduction to Artificial Intelligence and Machine Learning, Data Handling, AI Libraries in Java, Linear Regression, Perceptron, K-Means, Naive Bayes.

References/Textbooks:

1. Tanenbaum, A.S., Computer Networks, Prentice Hall, 3010.
2. Stallings, W., Local Networks: An Introduction: Macmillan Publishing Co, 1990.
3. Stallings W., Data and Computer Communications, Prentice Hall, 3011.
4. Forouzan B., Data Communications and networking, McGraw Hill, 3007.

Note: The latest editions of the books should be followed.

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAL-5112
WEB DEVELOPMENT (FULL STACK DEVELOPMENT)

Course Outcomes:

After passing course the student will be able to:

CO1: Develop responsive webpage using Tailwind CSS.

CO2: Design the webpage using Bootstrap icons.

CO3: Implement Node.js code for back-end support and using Express code for managing HTTP responses, sessions, forms and database connectivity.

CO4: Develop user interface of single page website through React.

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAL-5112
WEB DEVELOPMENT (FULL STACK DEVELOPMENT)

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Tailwind CSS: Introduction, Importance, Colors, Margin and Padding, Different attributes of Tailwind CSS (width, height, size class, positions, container class, background class, filter class), Interactivity with Tailwind CSS, Grid in Tailwind CSS.

UNIT-II

Bootstrap: Introduction, features, colours and Typography, Buttons and Button Groups, Utility classes, breakpoints, Grid Layouts, Navbar, cards, Accordians, List Groups, Bootstrap icons, Forms in Bootstrap, Tooltips, Modals, Tabs and Dropdowns in Bootstrap

UNIT-III

NodeJS: Introduction to NodeJS, Creating a node server, Request and response, Parsing request, Event loop, NPM and Tools in Node JS, Error and Debugging

ExpressJS: Introduction to Express.js, express.js DeepDrive, Styling using Tailwind, Dynamic UI using EJS, MVC Architecture and Dynamic Path in EJS.

UNIT-IV

Reactjs: Intro to Reactjs, Roadmap to React, Understand the React flow and File structures, Creating your own Custom React Library and JSX, Hooks in React, useState, usecallback, useEffect, useRef in React Hooks, Custom Hooks, React router, Context API

References / Textbooks:

1. Jeffery C Jackson, "Web Technology- A Computer Science perspective", Pearson Education, 1st Edition, 3007.

2. Chris Bates, “Web Programming- Building Internet Applications”, Wiley India, 1st Edition, 3006.
3. Achyut S Godbole and Atul Kahate, “Web technologies”, Tata McGraw Hill, 1st Edition, 3008.
4. Web Technologies, Uttam K Roy, Oxford University Press, 1st Edition, 3010.
5. Kirupa Chinnathambi, Learning React, Addison-Wesley Professional, 1st Edition, 3019.

Note: The latest editions of the books should be followed.

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAL - 5113
OPERATING SYSTEM

Course Outcomes:

After passing course the student will be able to:

CO1: Describe, contrast and compare different types of Operating System.

CO2: Understand the process synchronization policies and CPU scheduling.

CO3: Describe and analyze the memory management and its allocation policies.

CO4: Comprehend about the application of virtual memory and disk scheduling.

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAL-5113
OPEARTING SYSTEM

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT – I

Introduction: Definition, Batch Processing, Multi programming, Time Sharing Systems, Multitasking, multiprocessing, Parallel Systems, Distributed Systems, Real-time Systems.

Cloud Based System, Mobile Based System, OS Architecture (Monolithic, Microkernel, Hybrid)

Processes: Process Concepts, Process Scheduling, Threads.

UNIT - II

CPU–Scheduling: Basic concepts, Scheduling Criteria, Scheduling Algorithms, Algorithm Evaluation: Response Time, Turnaround Time, Waiting Time, Throughput, Multilevel Queue

Process Synchronization: Critical-section problem, semaphores and its Types (Binary and Counting), Mutex, Monitors, Classical problems of synchronization and their solutions.

UNIT – III

Deadlocks: System Model, Deadlock characterization, Methods for handing deadlocks, Deadlocks Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Approach to Deadlock handling.

Memory Management: Background, Logical v/s Physical Address Space, Swapping, Continuous Allocation, Paging, Segmentation.

UNIT – IV

Virtual Memory: Background, Page Fault, Demand Paging, Page Replacement, Page Replacement Algorithms, Thrashing.

Secondary Storage Structures: Disk structures, Disk scheduling, SSD vs HDD

References/Textbooks:

1. Avi Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, Wiley, 3013.
2. Charles Crowley, Operating Systems: A Design-Oriented Approach, Tata McGraw Hill, 3001.
3. Deitel, An Introduction to Operating Systems, Second Edition, Addison Wesley, 1990.
4. William Stallings, Operating Systems: Internals and Design Principles, Pearson Education Limited, 3014.

Note: The latest editions of the books should be followed.

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAL-5114
MACHINE LEARNING

Course Outcomes:

After passing this course the student will be able to:

CO1: Understand key concepts and terminology in machine learning.

CO2: Apply supervised and unsupervised learning algorithms to datasets.

CO3: Utilize machine learning libraries and tools for implementation.

CO4: Analyze real-world problems and propose machine learning solutions.

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAL-5114
MACHINE LEARNING

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT - I

Introduction to Machine Learning, Definition and history of machine learning, Types of machine learning: Supervised, unsupervised, and reinforcement learning, Applications of machine learning in various fields

Key Concepts and Terminology: Features, labels, training, and testing datasets, Overfitting vs. underfitting, Bias-variance tradeoff

UNIT - II

Data Pre-processing: Importance of data pre-processing, Techniques: Data cleaning, normalization, and transformation, Handling missing data and categorical variables
Supervised Learning: Regression Algorithms: Linear regression: Theory and implementation, Evaluation metrics: Mean squared error, R^2 score, Regularization techniques: Lasso and Ridge regression

UNIT - III

Supervised Learning: Classification Algorithms- Logistic regression and its applications, Decision trees and random forests, **Model Evaluation and Selection:** Train-test split and cross-validation, Confusion matrix and classification metrics (precision, recall, F1 score), Hyperparameter tuning and model selection techniques

UNIT - IV

Dimensionality Reduction: Introduction to dimensionality reduction techniques, Principal component analysis (PCA)

Unsupervised Learning: Clustering Algorithms: K-means clustering: Theory and implementation, Hierarchical clustering and DBSCAN, Evaluation of clustering results

References/Textbooks:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow
3. Tom Mitchell, Machine Learning, McGraw Hill
4. Kamalkant Hiran, Dr. Ruchi Doshi, Ritesh Kumar Jain, Dr. Kamlesh Lakhwani. Machine Learning,
5. BPB publications.
6. Dr. Amit Dua and Umair Ayub, Beginning with Machine Learning, BPB publications.
7. Saikat Dutt , Subramanian Chandramouli , Amit Kumar Das, Machine Learning, Pearson Education
8. Vinod Chandra , Anand Hareendran S., Machine Learning : A Practitioner's Approach, PHI Learning

Note: The latest editions of the books should be followed.

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAP-5115
LAB ON OBJECT ORIENTED PROGRAMMING-II

L-T-P: 0-0-2

Credits: 2

Examination Time: 3 Hours.

Max. Marks: 50

Practical: 35

CA: 15

Lab Based on Object Oriented Programming - II

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAP-5116
LAB ON FULL STACK DEVELOPMENT

L-T-P: 0-0-2

Credits: 2

Examination Time: 3 Hours.

Max. Marks: 50

Practical: 35

CA: 15

Lab Based on Web Development (Full Stack Development).

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAI-5117
INTERNSHIP

L-T-P: 0-0-2
Credits: 2

Max. Marks: 50

Internship with Local / Public / Private Industry / Business organization / MOOCs / Online Internship / Certifications from the recognized organization.

Important points to be considered:

- MOOCs tenure should not be less than 8 weeks.
- The tenure of the Online Certification must be more than 60 hours.
- Online / Offline Internship tenure should be 6-8 weeks.
- The requisite certificate and Internship report to be submitted to HOD in print form by the third week of November.

Bachelor of Computer Applications Semester – V
(Session 2026-27)

COURSE CODE: BCAM-5110
SERVER-SIDE PROGRAMMING

(Theory)

L-T-P: 2-0-1

Credits: 3

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 40

Practical: 30

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (8 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT - I

Introduction: Overview of web application architecture (client-server model), Difference between client-side and server-side programming, server-side programming and its role in web applications, Introduction to HTTP and web protocols

Setting up the Development Environment: Installing and configuring a web server (e.g., Apache, Nginx)

Introduction to Programming Languages: Overview of server-side programming languages (e.g., Python, Node.js, Java, PHP), choosing the right language for specific applications, Basics of syntax and structure of Python

UNIT - II

Working with Frameworks: Introduction to popular frameworks (Express for Node.js, Flask for Python, spring for Java), Setting up a project using Flask for Python framework, Understanding the MVC (Model-View-Controller) architecture

RESTful API Development: Principles of REST architecture, Designing and implementing RESTful APIs, Handling CRUD operations with API endpoints

UNIT - III

Database Interaction: Connecting to databases (SQL and NoSQL), Performing CRUD operations with a database (using an ORM), Managing database migrations

Authentication and Authorization: Understanding user authentication and session management, implementing authentication strategies (JWT, OAuth), Protecting routes and resources

Error Handling and Debugging: Common error types in server-side applications, Best practices for error handling, Debugging techniques and tools

UNIT - IV

Web Security: Overview of common security vulnerabilities (SQL injection, XSS, CSRF), Implementing security measures (input validation, output encoding), Using HTTPS and securing APIs

Deployment and Hosting: Overview of cloud platforms (AWS, Heroku, Digital Ocean), Setting up and deploying a server-side application, managing server resources and scaling applications

References / Textbooks

1. David I. Schneider "Server-Side Programming with Java: A Comprehensive Guide" by Miguel Grinberg
2. "Flask Web Development" by Leonard Richardson and Sam Ruby, RESTful Web APIs
3. "WEB TECHNOLOGIES A Computer Science Perspective" by Jeffrey C. Jackson
4. "Learning PHP, MySQL & JavaScript: A Step-By-Step Guide to Creating Dynamic Websites" by Robin Nixon (BPB Publications)

Bachelor of Computer Applications Semester – V
(Session 2026-27)
COURSE CODE: BCAM-5110
SERVER-SIDE PROGRAMMING

L-T-P: 2-0-1

Credits: 3

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 40

Practical: 30

CA: 30

Lab Exercises based on:

- Setting Up a Flask Project and Implementing MVC Architecture in Flask
- Designing and Testing RESTful APIs
- Connecting to a SQLite or NoSQL Database and performing CRUD operations
- Implement user registration and login features using Flask-Login
- Use JWT for user authentication and Secure certain routes in the Flask application
- Best practices for error handling, Debugging techniques and tools
- Implementing security measures (input validation, output encoding), Using HTTPS and securing APIs
- Setting up and deploying a server-side application,
- Managing server resources and scaling applications

Bachelor of Computer Applications Semester – VI
(Session 2026-27)
COURSE CODE: BCAL - 6111
INFORMATION SECURITY AND THREATS

Course Outcomes:

After passing course the student will be able to:

CO1: Comprehend essential terminology of cyber security and its importance.

CO2: Comprehend various security measures for security at web and operating system level.

CO3: Identify various Information security threat and its countermeasures.

CO4: comprehend hosting at different platforms, virtualization, firewall deployment and digital certificates.

Bachelor of Computer Applications Semester – VI
(Session 2026-27)
COURSE CODE: BCAL - 6111
INFORMATION SECURITY AND THREATS

L-T-P: 4-0-0

Max. Marks: 100

Credits: 4

Examination Time: 3 Hours

Theory: 70

CA:30

Instructions for Paper Setter -

Eight questions of equal marks (14 marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT - I

Essential terminology, Hardware, Software, Malware, Defining security, Need for security Cybercrime vs Computer based crime, Information Security statistics, Three pillars of Security, Security myths, Identity of a Web Site, http vs https.

UNIT - II

Operating System fingerprinting, Hardening operating system, updates, patches, Host based firewall vs Network based firewall, deploying firewall, sniffing network traffic.

UNIT - III

Recognizing Security Threats and attacks, Phishing and its countermeasures, Virus, Trojan horse, Worms, Spyware, Adware, Keylogger, Social engineering, Denial of Service, Spamming, Port Scanning, Password cracking

UNIT - IV

Creating isolated network presence using virtualization, NMAP, netcat using tcpdump and Wireshark, Digital certificates, understanding CAs.

References / Textbooks:

1. Atul Kahate, Cryptography and Network Security, McGraw Hill, 3010.
2. Mark S. Merkow, Jim Breithaupt, Information Security: Principles and Practices, Pearson Prentice Hall, 3006.

3. Michael E Whitman, Herbert J Mattord, Principles of Information Security, Cengage Learning, 3018.
4. Christopher T. Carlson, How to Manage Cybersecurity Risk, Universal-Publishers, 3019.

Note: The latest editions of the books should be followed.

Bachelor of Computer Applications Semester – VI
(Session 2026-27)
COURSE CODE: BCAL - 6112
SOFTWARE ENGINEERING

Course Outcomes:

After passing course the student will be able to:

CO1: Identify and evaluate various process model used for development of software.

CO2: Analyze gathered data to form requirement specifications and formulate design from this requirement specifications.

CO3: Comprehend activities involved in software project management.

CO4: Apply testing techniques on basic building blocks and control structure of a software.

Bachelor of Computer Applications Semester – VI
(Session 2026-27)
COURSE CODE: BCAL - 6112
SOFTWARE ENGINEERING

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT – I

Introduction to Software: Definition, Software characteristics, Software Components, Software Applications.

Introduction to Software Engineering: Definition, Software Engineering Paradigms, Waterfall Model, Prototyping Model, Incremental Model, Spiral Model.

UNIT – II

Requirement, Analysis and Specifications – Problem Analysis, Requirement Gathering Tools (Questionnaire, Interview, Group Discussion, and Observation), SRS Document and its Characteristics, Structured Analysis: Data Flow Diagram, Data Dictionaries.

Software Design – Characteristics, Structure Chart, Coupling, Cohesion.

UNIT – III

Project Management – SPMP Document, Size Estimation (LOC, Function Point), COCOMO (Basic, Intermediate and Complete COCOMO), Effort Estimation, Development Time Estimation, Project Scheduling (Work Breakdown Structure, Activity Network, Critical Path Method, Gantt Chart, PERT Chart), Staffing.

Risk management and Control, software Maintenance and its types, Software Reuse, Software Reliability.

UNIT – IV

Testing - Test Case Design, Unit Testing, Black Box Testing (Equivalence Class Partitioning, Boundary Value Analysis), White Box Testing (Statement, Branch, Condition, Path Coverage),

Cyclomatic Complexity, Integration Testing, System Testing (Alpha, Beta, Acceptance), Validation And Verification, Performance Testing.

Software Engineering in AI Systems: Difference between traditional software and AI systems, AI system lifecycle vs SDLC, Emerging Trends in AI - Concept of generative AI, AI in software testing and automation, Future scope of AI in software engineering

References / Textbooks:

1. Roger S. Pressman, Software Engineering, McGraw-Hill series (2014) , 8th Edition.
2. Pankaj Jalote, A concise introduction to Software Engineering, Wiley (2008).
3. Rajib Mall, Fundamentals of Software Engineering, PHI Learning (2018), 5th Revised Edition
4. Kogent Learning Solutions Inc., Software Engineering, Dreamtech Press (2012)
5. Bruce R. Maxim, Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill Education (2019), Eighth edition
6. David A. Gustafson, Schaum's Outline of Software Engineering, McGraw Hill (2020), 1st Edition

Bachelor of Computer Applications Semester – VI
(Session 2026-27)
COURSE CODE: BCAL - 6113
COMPUTER GRAPHICS

Course Outcomes:

After passing this course the student will be able to:

CO1: Comprehend the background mechanism involved in display devices like CRT, LCD, LED, etc.

CO2: Comprehend basic concepts involved in drawing basic shapes.

CO3: Implement various algorithms and techniques to clip and transform various objects and viewports.

CO4: Identify the importance of viewing and projections.

Bachelor of Computer Applications Semester – VI
(Session 2026-27)
COURSE CODE: BCAL - 6113
COMPUTER GRAPHICS

L-T-P: 4-0-0

Credits: 4

Examination Time: 3 Hours.

Max. Marks: 100

Theory: 70

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (14 marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT – I

Overview of Graphics System: Computer Graphics and their applications.

Display Devices: CRT Monitors, Random Scan, Raster Scan, LED & LCD Monitors, Virtual Reality and Workstation.

UNIT – II

Elementary Drawing: Points and various line drawing Algorithms and their comparisons and Circle & Ellipse Generating Algorithms.

UNIT – III

Two Dimensional Transformations: Basic Transformations - Translation, Rotation, Scaling, Reflection and Shearing. Matrix representation of Basic Transformations, Homogenous Coordinates and Composite transformations.

Windowing and Clipping: Windowing Concepts, Clipping and its Algorithms and Window-to-View Port Transformations.

UNIT - IV

Three Dimensional concepts: 3D Coordinate Systems, 3D Transformations - Translation, Rotation, Scaling, Reflection and Shearing,

Projection: Parallel Projections, Perspective Projection, Vanishing Point, View Confusion and Topological Distortion.

References / Textbooks:

1. Hearn D, Baker P, Computer Graphics, PHI Eastern Economy (2002), 2nd Edition.
2. Zhigang Xiang, Plastock R, Kalley G, Computer Graphics, McGraw Hill Education (2006), 2nd Edition.

3. Rajesh K. Maurya, Computer Graphics with Virtual Reality System, Wiley (2018), 3rd Edition
4. Udit Aggarwal, Computer Graphics, SK Katria and Sons (2013), Reprint 2013 Edition
5. Padeep K. Bhatia, Computer Graphics, Dreamtech Press (2019)
6. Andries Van Dam, Foley, Steven, John, Computer Graphics Principles and Practice, Peson Education India (2002), 2nd Edition

Bachelor of Computer Applications Semester – VI
(Session 2026-27)
COURSE CODE: BCAP - 6114
LAB ON GRAPHICS DESIGNING

L-T-P: 0-0-2

Credits: 2

Examination Time: 3 Hours.

Max. Marks: 50

Practical: 35

CA: 15

Exercises to be implemented (in Adobe Photoshop)

1. Image Manipulation
2. Transform & Distort images
3. Color adjustment of those images (Photo Retouching), creating / restore old images
4. Designing movie posters or music album posters
5. Create logos
6. Graphics for Social media platforms

Syllabus to be covered for the practical:

UNIT- I

Graphic designing and its objective, difference between raster and vector graphics

Photoshop: Introduction to Photoshop and its interface, navigation and all tools, working with basic selections, advanced selections, Working with Layers.

Rectangular Marquee Tool , Move Tool , Polygon Lasso Tool , Magic Wand Tool , Crop Tool, Spot Healing Brush Tool , Healing Brush Tool ,Content aware tool , Patch tool, Brush Tool , Clone Stamp Tool ,Eraser Tool , Gradient Tool (, Blur Tool , Smudge tool , Dodge Tool ,Burn tool , Path Selection Tool , Text Type Tool , Pen Tool ,Rectangle Tool ,Notes Tool , Red eye tool,

UNIT- II

Color Balance, Hue Saturation, Save Selection & Load selection. Transformation tools (Distort, skew, perspective, warp), Vanishing point

Color Modes, Color Correction, Advanced color correction techniques (levels, Curves, Hue, Saturation etc.) Layers & Layer Blending Modes. Photoshop filters – Smart Filters, Filter Gallery, Create images for the web: Exporting images from Photoshop

UNIT - III

FIGMA Fundamentals: Introduction, What is FIGMA, Creating a new file, Importing, Saving your work, Frames, Spacing & Alignment, Groups, Scaling, Components, Anatomy of a FIGMA File, Styles, FIGMA Keyboard Shortcuts

FIGMA Interface: Browser app vs Desktop App, The Start Screen, Introduction to the interface, Importing and Exporting Files, Using Templates, The Toolbar, The Layers and

Pages Panel, The Assets Panel, The Design Panel, The Prototype Panel, The Code Panel, The Canvas, Using Keyboard Shortcuts, Working with the Version History

Setting up a New Project: Creating a New Project and File, Importing Sketch Files, Working with Templates

UNIT - IV

Add and Edit Content: Working with Frames, Working with Shapes, Drawing Icons using the Pen Tool, Drawing Shapes Using the Pencil Tool, Working with Text, Masking Images and Shapes, Importing Icons and other Graphics, Working with Color, Working with Styles, Setting up Components, Using Constraints for Responsive Design, Working with Version Control

Completing the Design: Designing a Slide-out Menu, Designing an on-screen Overlay, Designing a comments section, Designing Multiple Artboard States, Give this design its own unique personality.

Reference / Textbooks:

1. Caplin Steve, "How to Cheat in Photoshop CC: The art of creating realistic photomontages", Focal Press
2. Danae Lisa, "Adobe Photoshop CC Bible", Wiley
3. Faulkner Andrew, "Adobe Photoshop CC Classroom in a Book", Pearson Education
4. The Ultimate Figma for UI/UX Design, Aditi Sharma.
5. Figma User Guide: The Comprehensive Handbook to Understand this Web-Based Interface Design Tool, by BURT P. SOUZA

Bachelor of Computer Applications Semester – VI
(Session 2026-27)
COURSE CODE: BCAD - 6115
PROJECT

Course Outcomes:

After passing this course the student will be able to:

CO1: Apply software engineering paradigms like Process Model, Analysis, Design, Testing, etc.

CO2: Work within defined time and resource constraints while developing real world application.

CO3: Address the Real World Problems and find the required solution.

CO4: Demonstrate an ability to work in teams and manage the conduct of the research study.

CO5: Formulate and propose a plan for creating a solution.

Bachelor of Computer Applications Semester – VI
(Session 2026-27)
COURSE CODE: BCAD - 6115
PROJECT

L-T-P: 0-0-8

Credits: 8

Examination Time: 3 Hours.

Max. Marks: 200

Practical: 140

CA: 60

General Instructions:

1. A software module based on the work done in the entire course is to be developed.
2. Candidates have to submit one hard copy and two CDs/DVDs of documentation which shall be kept with the HoD in the college only. Further, supervisor/guide shall forward one copy of DVD/CD containing all the documentation files of the students (file name to be saved as Rollno_of_the_student.pdf) to the COE Office. The Covering letter (duly signed by the guide and Head of the department) should contain the following information: Candidate name, Candidate Roll no, Project Title of the student and .pdf file name of her project documentation.
3. The software module / website maybe developed in groups, consisting of at most two students in a group.
4. The college shall depute guide(s)/supervisor(s) under whose supervision the software module shall be developed. The guide/supervisor shall clarify that the work done is original and authenticated. The certificate found to be incorrect at any stage shall attract the proceedings against all the stakeholders, as per rules.
5. The evaluation of the module shall be done as per the common ordinance of UG/PG under semester system.