Dr. Rammanohar Lohia Avadh

University, Ayodhya-224001, UP, India.

Faculty of Commerce and Management
Syllabus for BCA
(Regulations in accordance with National Education Policy to be implemented from Academic Year (2024-25)

(Subject to the modifications that will be made from time to time)

7/3/24 07.03.2024 7/3/24

BCA (2024-25) NEP Syllabus

1st Year

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
I	Major 01	BCA101 T	Programming Principles Using Python	4			3	(46 Credits) Certificate in Computer Application
	Major 02	BCA102 T	Computer System Architecture	4			3	
	Major 03	BCA103	Foundation of Mathematics for Computer Applications	3	1		4	
	Minor 1	BCA108	Programming Principles Using Python (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments/ Subjects.	4			4	
	Vocational 1		Within Faculty/other department				3	
	AECC 1		Food, Nutrition and Hygiene	3	1		2	
		BCA101 P	Practical Lab for Programming Principles Using Python			4	2	
		BCA102 P	Practical Lab for Computer System Architecture			4	2	
							23	

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits
II	Major 04	BCA201 T	Object Oriented Programming Using C++	4			3
	Major 05	BCA202 T	Concepts of Data Structure	4			3
	Major 06	BCA203	Discrete Mathematics	3	1		4
	Minor 2	BCA208	Data Analysis and Visualization using Python (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments / Subjects.	4			4
	Vocational 2		Within Faculty/other department				3
		AECC 2	First Aid and Health	3	1		2
		BCA201 P	Practical Lab for Object Oriented Programming Using C++			4	2
		BCA202 P	Practical Lab for Data Structure			4	2
							23

2nd Year

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
III	Major 07	BCA301 T	JAVA Programming and Dynamic Web Design	4			3	(92 Credits) Diploma in Computer Application
	Major 08	BCA302 T	Operating System	4			3	
	Major 09	BCA303	Numerical Methods	3	1		4	
	Minor 3	BCA308	Introduction to DBMS (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments / Subjects.	4			4	
	Vocational 3		Within Faculty/other department				3	
	AECC 3	BCA305	Human Values and Environmental Studies	3	1		2	
		BCA301 P	Practical Lab for Java Programming			4	2	
		BCA302 P	Practical Lab for Operating System			4	2	
							23	

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits
IV	Major 10	BCA401 T	Introduction to DBMS	4			3
	Major 11	BCA402 T	Design and Analysis of Algorithm	4			3
	Major 12	BCA403	Software Engineering	3	1		4
	Minor 4	BCA408	Java Programming and Dynamic Web Page Designing (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments / Subjects.	4			4
	Vocational 4		Within Faculty/other department				3
		AECC 4	Physical Education and Yoga	3	1		2
		BCA401 P	Practical Lab for DBMS			4	2
		BCA402 P	Practical Lab for DAA			4	2
							23

3rd Year

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
V	Major 13	BCA501 T	Computer Graphics & Animation	4			3	(132 Credits) Bachelor of Computer Application
	Major 14	BCA502 T	Web & Internet Technologies	4			3	
	Elective-01	BCA511	Artificial Intelligence	3	1		4	
	AECC 5		Analytic Ability and Digital Awareness	3	1		2	
		BCA505	Minor Project		1	2	3	
		BCA506	Viva-Voce on Summer Traing			2	1	
		BCA501 P	Practical Lab for Computer Graphics & Animation			4	2	
		BCA502 P	Practical Lab for Web & Internet Technologies			4	2	
							20	

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits
VI	Major 15	BCA601	Information Security	4			4
	Major 16	BCA602	Theory of Computation	3	1		4
	Elective-02	BCA612	Machine Learning	3	1		4
	AECC 6		Communication Skill and Personality Development				2
		BCA603	Major Project		3	6	5
		BCA604	Presentation/Seminar based on Major Project				1
							20

4th Year

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
VII	Major 17	BCA701	Research Methodology	4			4	(184 Credits) Bachelor of Computer Application (Research)
	Elective-03	BCA711	Introduction to Soft Computing	3	1		4	
	Elective-04	BCA712	Cloud Computing	3	1		4	
	Elective-05	BCA713	Advanced Software Engineering	3	1		4	
	Minor 05	BCA708	Artificial Intelligence (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments / Subjects.	4			4	
	Research Project	BCA702	Research Project (Conceptual)		3	6	6	
							26	

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits
VIII	Major 18	BCA801	Business Intelligence	4			4
	Elective-06	BCA811	Digital Image Processing	3	1		4
	Elective-07	BCA812	Advanced DBMS	3	1		4
	Elective-08	BCA813	Data Mining	3	1		4
	Minor 06	BCA808	Machine Learning (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments/ Subjects.	4			4
	Research Project	BCA802	Research Project		3	6	6
							26

BCA 1st Year

BCA (2024-25) Syllabus semester wise with Marks Break-up											
Sem	Subject	Paper Code	Paper Name	External Marks	Internal Marks	Total Marks	L	T	P	Credit	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
I	Major 01	BCA101 T	Programming Principles Using Python	75	25	100	4			3	(46 Credits) Certificate in Computer Application
	Major 02	BCA102 T	Computer System Architecture	75	25	100	4			3	
	Major 03	BCA103	Foundation of Mathematics for Computer Applications	75	25	100	3	1		4	
	Minor 1	BCA108	Minor 1	75	25	100	4			4	
	Vocational 1		Vocational 1			100				3	
	CC 1		Food, Nutrition and Hygiene	75	25	100	3	1		2	
		BCA101 P	Practical Lab for Programming Principles Using Python			50			4	2	
		BCA102 P	Practical Lab for Computer System Architecture			50			4	2	
	Total					700				23	
	Subject	Paper Code	Paper Name	External Marks	Internal Marks	Total Marks	L	T	P	Credits	
II	Major 04	BCA201 T	Object Oriented Programming Using C++	75	25	100	4			3	
	Major 05	BCA202 T	Concepts of Data Structure	75	25	100	4			3	
	Major 06	BCA203	Discrete Mathematics	75	25	100	3	1		4	
	Minor 2	BCA208	Minor 2	75	25	100	4			4	
	Vocational 2		Vocational 2			100				3	
	CC 2		First Aid and Health	75	25	100	3	1		2	
		BCA201 P	Practical Lab for Object Oriented Programming Using C++			50			4	2	
		BCA202 P	Practical Lab for Data Structure			50			4	2	
	Total					700				23	

BCA 2nd Year

BCA (2024-25) Syllabus semester wise with Marks Break-up											
Sem	Subject	Paper Code	Paper Name	External Marks	Internal Marks	Total Marks	L	T	P	Credit	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
III	Major 07	BCA301 T	JAVA Programming and Dynamic Web Design	75	25	100	4			3	(92 Credits) Diploma in Computer Application
	Major 08	BCA302 T	Operating System	75	25	100	4			3	
	Major 09	BCA303	Numerical Methods	75	25	100	3	1		4	
	Minor 3	BCA308	Minor 3	75	25	100	4			4	
	Vocational 3		Vocational 3			100				3	
	AECC 3	BCA305	Human Values and Environmental Studies	75	25	100	3	1		2	
		BCA301 P	Practical Lab for Java Programming			50			4	2	
		BCA302 P	Practical Lab for Operating System			50			4	2	
	Total					700				23	
	Subject	Paper Code	Paper Name	External Marks	Internal Marks	Total Marks	L	T	P	Credits	
IV	Major 10	BCA401 T	Introduction to DBMS	75	25	100	4			3	
	Major 11	BCA402 T	Design and Analysis of Algorithm	75	25	100	4			3	
	Major 12	BCA403	Software Engineering	75	25	100	3	1		4	
	Minor 4	BCA408	Minor 4	75	25	100	4			4	
	Vocational 4		Vocational 4			100				3	
		AECC 4	Physical Education and Yoga	75	25	100	3	1		2	
		BCA401 P	Practical Lab for DBMS			50			4	2	
		BCA402 P	Practical Lab for DAA			50			4	2	
	Totsl					700				23	

BCA 3rd Year

BCA (2024-25) Syllabus semester wise with Marks Break-up											
Sem	Subject	Paper Code	Paper Name	External Marks	Internal Marks	Total Marks	L	T	P	Credit	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
V	Major 13	BCA501 T	Computer Graphics & Animation	75	25	100	4			3	(132 Credits) Bachelor of Computer Application
	Major 14	BCA502 T	Web & Internet Technologies	75	25	100	4			3	
	Elective-01	BCA511	Artificial Intelligence	75	25	100	3	1		4	
	AECC 5		Analytic Ability and Digital Awareness	75	25	100	3	1		2	
		BCA505	Minor Project			50		1	2	3	
		BCA506	Viva-Voce on Minor Project	75	25	50			2	1	
		BCA501 P	Practical Lab for Computer Graphics & Animation			50			4	2	
		BCA502 P	Practical Lab for Web & Internet Technologies			50			4	2	
	Total					600				20	

	Subject	Paper Code	Paper Name	External Marks	Internal Marks	Total Marks	L	T	P	Credits
VI	Major 15	BCA601	Information Security	75	25	100	4			4
	Major 16	BCA602	Theory of Computation	75	25	100	3	1		4
	Elective-02	BCA612	Machine Learning	75	25	100	3	1		4
	AECC 6		Communication Skill and Personality Development	75	25	100				2
		BCA603	Major Project			150		3	6	5
		BCA604	Presentation/Seminar based on Major Project			50				1
	Total					600				20

BCA 4th Year

BCA (2024-25) Syllabus semester wise with Marks Break-up											
Sem	Subject	Paper Code	Paper Name	External Marks	Internal Marks	Total Marks	L	T	P	Credit	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
VII	Major 17	BCA701	Research Methodology	75	25	100	4			4	(184 Credits) Bachelor of Computer Application (Research)
	Elective-03	BCA711	Introduction to Soft Computing	75	25	100	3	1		4	
	Elective-04	BCA712	Cloud Computing	75	25	100	3	1		4	
	Elective-05	BCA713	Advanced Software Engineering	75	25	100	3	1		4	
	Minor 05	BCA708				100	4			4	
	Research Project	BCA702	Research Project (Conceptual)			200		3	6	6	
						700				26	
	Total										
	Subject	**Paper Code**	**Paper Name**	**External Marks**	**Internal Marks**	**Total Marks**	**L**	**T**	**P**	**Credits**	
VIII	Major 18	BCA801	Business Intelligence	75	25	100	4			4	
	Elective-06	BCA811	Digital Image Processing	75	25	100	3	1		4	
	Elective-07	BCA812	Advanced DBMS	75	25	100	3	1		4	
	Elective-08	BCA813	Data Mining	75	25	100	3	1		4	
	Minor 06	BCA808	Minor 06			100	4			4	
	Research Project	BCA802	Research Project			200		3	6	6	
	Total					700				26	

BCA (2024-25) NEP Syllabus Draft
1st Year

Sem	Subject	Paper Code	Paper Name	L	T	P	Credits	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
I	Major 01	BCA101 T	Programming Principles Using Python	4			3	(46 Credits) Certificate in Computer Application
	Major 02	BCA102 T	Computer System Architecture	4			3	
	Major 03	BCA103	Foundation of Mathematics for Computer Applications	3	1		4	
	Minor 1	BCA108	Programming Principles Using Python (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments/Subjects.	4			4	
	Vocational 1		Within Faculty/other department				3	
	AECC 1		Food, Nutrition and Hygiene	3	1		2	
		BCA101 P	Practical Lab for Programming Principles Using Python			4	2	
		BCA102 P	Practical Lab for Computer System Architecture			4	2	
							23	

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits
II	Major 04	BCA201 T	Object Oriented Programming Using C++	4			3
	Major 05	BCA202 T	Concepts of Data Structure	4			3
	Major 06	BCA203	Discrete Mathematics	3	1		4
	Minor 2	BCA208	Data Analysis and Visualization using Python (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments / Subjects.	4			4
	Vocational 2		Within Faculty/other department				3
		AECC 2	First Aid and Health	3	1		2
		BCA201 P	Practical Lab for Object Oriented Programming Using C++			4	2
		BCA202 P	Practical Lab for Data Structure			4	2
							23

BCA I Semester

Course Code	Course Name	L	T	P	Credit
BCA101 T	Programming Principles Using Python	4			3

Unit-I

Computer Fundamentals and Problem Solving: Basic Computer Organization: CPU, memory, I/O Units. Problem Solving using Computation, notion of an algorithm, Number Systems, Types of Number Systems.

Unit-II

Introduction to Python Programming: Python interpreter/Python shell, indentation; identifiers and keywords; literals, numbers and strings; operators (Arithmetic, Relational, Boolean, Assignment, Ternary and Bitwise) and expressions.

Creating Python Programs: Input and output statements, control statements (conditional statements, loop control statements, break, continue and pass, exit), defining functions, default arguments, errors and handling exceptions.

Unit-III

Strings and Lists: String class, built-in functions for string, string traversal, string operators and operations; Lists creation, traversal, slicing and splitting operations, passing list to a function.

Unit-IV

Object Oriented Programming: Introduction to Object, Class and Method, Standard Libraries, File handling through libraries.

Unit V

Built-in data structures: Tuples, Sets, Dictionary, Stacks, and Queues; Sorting and Searching.

Text Books:

1. Downey, A.B., (2015), Think Python–How to think like a Computer Scientist, 3rd edition. O' Reilly Media.
2. Guttag, J.V. (2016), Introduction to computation and programming using Python. MIT Press.
3. Liang, Y.D. (2013), Introduction to programming using Python. Pearson Education.
4. Brown, M. C. (2001). The Complete Reference: Python, McGraw Hill Education.

BCA I Semester

Course Code	Course Name	L	T	P	Credit
BCA102 T	Computer System Architecture	4			3

Unit-I

Data Representation and Basic Computer Arithmetic: Number systems, complements, fixed and floating-point representation, addition, subtraction, magnitude comparison, multiplication and division algorithms for integers, Logic gates, Boolean algebra, combinational circuits, circuit simplification, flip-flops and sequential circuits, decoders, multiplexers, registers, counters.

Unit-II

Basic Computer Organization and Design: Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.

Unit-III

Central Processing Unit: Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture.

Unit-IV

Memory Organization: Cache memory, Associative memory, mapping.

Unit V

Input-Output Organization: Input / Output- External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.

Text Books:

1. M. Mano, Computer System Architecture, Pearson Education 1992.
2. Digital Design, M.M. Mano, Pearson Education Asia, 2015.
3. W. Stallings, Computer Organization and Architecture Designing for Performance, 8th Edition, Prentice Hall of India, 2009.

BCA I Semester

Course Code	Course Name	L	T	P	Credit
BCA103	Foundation of Mathematics for Computer Applications	3	1		4

Unit-I

Basic concepts of set theory, Operations on sets: power set, Venn diagram Cartesian product, relations, functions, types of functions, composition of functions.

Unit-II

Mathematical logic-introduction, statements, connectives, negation, conjunction, disjunction, statement formulas and truth tables, conditional and bi-conditional statements, tautology, contradiction, equivalence of formulas, duality law-Predicates and Quantifiers, Arguments.

Unit-III Matrix algebra: Types of matrices, matrix operations, transpose of a matrix, determinant of matrix, inverse of a matrix, Cramer's rule, Matrix: Rank of a matrix, normal form, echelon form, Cayley-Hamilton theorem, Eigen values, Eigen Vectors.

Unit-IV

Differential calculus: Functions and limits, Simple Differentiation of Algebraic Functions, Evaluation of First and Second Order Derivatives, Maxima and Minima,

Unit V

Integral Calculus: Integral as Limit of Sum, Fundamental Theorem of Calculus (without proof.), Indefinite Integrals, Methods of Integration Substitution, By Parts, Partial Fractions, Reduction Formulae for Trigonometric Functions, Gamma and Beta Functions (definition).

Text Books:

1. B.S. Grewal, —Elementary Engineering Mathematicsl, 34th Ed., 1998.
2. Shanti Narayan, —Integral Calculusl, S. Chand & Company, 1999
3. H.K. Dass, —Advanced Engineering Mathematicsl, S. Chand & Company, 9th Revised Edition, 2001.
4. Shanti Narayan, —Differential Calculusl, S. Chand & Company, 1998.

BCA I Semester

Course Code	Course Name	L	T	P	Credit
BCA108	Introduction to Innovation and Entrepreneurship	4			4

Unit-I

Introduction to Entrepreneurship: Entrepreneurs; entrepreneurial personality and intentions - characteristics, traits and behavioral; entrepreneurial challenges.

Unit-II

Entrepreneurial Opportunities: Opportunities. discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering.

Unit-III

Entrepreneurial Process and Decision Making: Entrepreneurial ecosystem, Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, Effectuation and Causation.

Unit-IV

Crafting business models and Lean Start-ups: Introduction to business models; Creating value propositions-conventional industry logic, value innovation logic; customer focused innovation; building and analyzing business models; Business model canvas, Introduction to lean startups, Business Pitching.

Unit-V

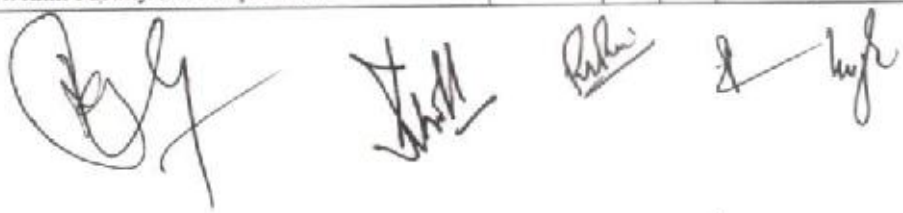
Organizing Business and Entrepreneurial Finance: Forms of business organizations; organizational structures; Evolution of Organisation, sources and selection of venture finance options and its managerial implications. Policy Initiatives and focus; role of institutions in promoting entrepreneurship.

Text Books:

1. Ries, Eric (2011), The lean Start-up: How constant innovation creates radically successful businesses, Penguin Books Limited.
2. Bagchi, Subroto, (2008), Go Kiss the World: Life Lessons for the Young Professional, Portfolio Penguin
3. Verstraete, T. and Laffitte, E.J. (2011). a Business Model of Entrepreneurship, Edward Elgar Publishing
4. Innovation and Entrepreneurship – by Peter Drucker, Harper Collins

BCA I Semester

Course Code/Course Name	Course Name	L	T	P	Credit
Vocational 1	Within Faculty/other department				3



BCA I Semester

Course Code/Course Name	Course Name	L	T	P	Credit
AECC 1	Food, Nutrition and Hygiene	3	1		2

BCA I Semester

Course Code/Course Name	Course Name	L	T	P	Credit
BCA101 P	Practical Lab for Programming Principles Using Python			4	2

Internal/External Examiners for Practical Exams will be appointed by University on the recommendation of Board of Studies.

Practical will be based on the Paper Programming Principles Using Python. On whole Syllabus

BCA I Semester

Course Code/Course Name	Course Name	L	T	P	Credit
BCA102 P	Practical Lab for Computer System Architecture			4	2

Internal/External Examiners for Practical Exams will be appointed by the University on the recommendation of Board of studies.

Practical will be based on the Paper Computer System Architecture. On whole Syllabus.

BCA II Semester

Course Code/Course Name	Course Name	L	T	P	Credit
BCA201 T	Object Oriented Programming Using C++	4			3

UNIT-I

Introduction: Introducing Object – Oriented Approach, Relating to other paradigms {Functional, Data decomposition}.

Basic terms and ideas: Abstraction, Encapsulation, Inheritance, Polymorphism, Review of C, Difference between C and C++ - cin, cout, new, delete, operators.

UNIT-II

Classes and Objects: Encapsulation, information hiding, abstract data types, Object & classes, attributes, methods, C++ class declaration, State idendity and behaviour of an object, Constructors and destructors, instantiation of objects, Default parameter value, object types, C++ garbage collection, dynamic memory allocation, Metaclass / abstract classes.

UNIT-III

Inheritance and Polymorphism: Inheritance, Class hierarchy, derivation – public, private & protected, Aggregation, composition vs classification hierarchies, Polymorphism, Categorization of polymorphism techniques, Method polymorphism, Polymorphism by parameter, Operator overloading, Parameteric Polymorphism.

UNIT-IV

Generic function: Template function, function name overloading, Overriding inheritance methods, Run time polymorphism, Multiple Inheritance.

UNIT-V

Files and Exception Handling: Streams and files, Namespaces, Exception handling, Generic Classes.

Referential Books:

1. A. R. Venugopal, Rajkumar, T. Ravishanker —Mastering C++, TMH, 1997.
2. S. B. Lippman & J. Lajoie, — C++ Primerl, 3rd Edition, Addison Wesley, 2000.
3. R. Lafore, —Object Oriented Programming using C++I, Galgotia Publications, 2004
4. D. Parasons, —Object Oriented Programming using C++I, BPB Publication.

BCA II Semester

Course Code/Course Name	Course Name	L	T	P	Credit
BCA202 T	Concepts of Data Structure	4			3

UNIT-I

Introduction to Data Structure and its Characteristics Array: Representation of single and multidimensional arrays; Sparse arrays – lower and upper triangular matrices and Tridiagonal matrices with Vector Representation also.

UNIT-II

Stacks and Queues: Introduction and primitive operations on stack; Stack application; Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion between prefix, infix and postfix, introduction and primitive operation on queues, D- queues and priority queues.

UNIT-III

Lists Introduction to linked lists; Sequential and linked lists, operations such as traversal, insertion, deletion searching, two way lists and Use of headers.

UNIT-IV:

Trees: Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion; Binary Search Tree.

UNIT-V

B-Trees: Introduction, the invention of B-Tree; Statement of the problem; Indexing with binary search trees; a better approach to tree indexes; B-Trees; working up from the bottom; Example for creating a B-Tree, Sorting Techniques- Insertion sort, selection sort, merge sort, heap sort, searching Techniques: linear search, binary search and hashing.

Referential Books:

1. E. Horowiz and S. Sahani, — Fundamentals of Data structures, Galgotia Book source Pvt. Ltd., 2003.
2. R.S. Salaria, — Data Structures & Algorithmsl , Khanna Book Pblishing Co. (P) Ltd..,2002.
3. Y. Langsam et. Al., — Data Structures using C and C++, PHI, 1999.

BCA II Semester

Course Code/Course Name	Course Name	L	T	P	Credit
BCA203	Discrete Mathematics	3	1		4

Unit – I

Set Relation and Function: Sets & subsets, set operation, power set, Cartesian product of two sets composition of relation, type of relation, mapping, mathematical function, exponential & logarithmic functions.

Group & fields: Group, sub group, Finite & infinite group, cyclic group, permutation group, homomorphism, isomorphism, automorphism, endomorphism, coset, Field, sub field & Ring.

Unit – II

Mathematical Logic: Statement & Notations, connectives, Normal forms, Theory of inference for the statement calculus, Predicate calculus.

Unit – III

Basic concept of Graph: Basics of Graph, Pseudograph, Multigraph, Simple graph, Bipartite graph and Complete Bipartite graph, Hand Shaking Lemma, Sub graphs, Operations on graph, Walk, Path and Circuits and their properties. Shortest Path Problem.

Unit - IV

Eulerian and Hamiltonian Graph: Unicursal and Eulerian graph, Randomly Eulerian graph, Fleury's Algorithm, Chinese Postman Problem, Hamiltonian Graph, Necessary and Sufficient conditions, Traveling Salesman Problem.

Unit – V

Trees and Spanning Trees: Tree, Properties of tree, Distance, Radius, Diameter of a tree, Spanning tree, Fundamental Circuit, Cayley's Formula for number of spanning tree, Minimal spanning tree: Kruskal's and Prim's Algorithm, Connectivity and Separability.

Text Books:

1. C.L. Liu & Mahopatra, Elements of Discrete mathematics, 2nd Sub Edition 1985, Tata McGraw Hill
2. Rosen, Discrete Mathematics and Its Applications, Sixth Edition 2006
3. J. L. Hein, Discrete Structures, Logic, and Computability, Jones and Bartlett Publishers, 3rd Edition, 2009

BCA II Semester

Course Code/Course Name	Course Name	L	T	P	Credit
BCA208	Business Communication	4			4

UNIT-I

Means of Communication: Meaning and Definition – Process – Functions – Objectives – Importance – Essentials of good communication – Communication barriers, 7C's of Communication.

UNIT-II

Types of Communication: Oral Communication: Meaning, nature and scope – Principle of effective oral communication – Techniques of effective speech – Media of oral communication (Face-to-face conversation – Teleconferences – Press Conference – Demonstration – Radio Recording – Dictaphone – Meetings – Rumour – Demonstration and dramatization – Public address system – Grapevine – Group Discussion – Oral report – Closed circuit TV). The art of listening – Principles of good listening.

UNIT-III

Written Communication Purpose of writing, Clarity in Writing, Pricinciple of Effective writing, Writing Techniques, Electronic Writing Process.

UNIT-IV

Business Letters & Reports: Need and functions of business letters – Planning & layout of business letter – Kinds of business letters – Essentials of effective correspondence, Purpose, Kind and Objective of Reports, Writing Reports.

Drafting of business letters: Enquiries and replies – Placing and fulfilling orders – Complaints and follow-up Sales letters Circular letters Application for employment and resume.

UNIT-V

Information Technology for Communication: Word Processor – Telex – Facsimile (Fax) – E-mail – Voice mail –Internet – Multimedia – Teleconferencing – Mobile Phone Conversation – Video Conferencing –SMS – Telephone Answering Machine – Advantages and limitations of these types. **Topics Prescribed for workshop/skill lab** Group Discussion, Mock Interview, Decision Making in a Group.

Referential Books:

1. Business Communication – K.K. Sinha – Galgotia Publishing Company, New Delhi.
2. Media and Communication Management – C.S. Rayudu – Hikalaya Publishing House, Bombay.

3. Essentials of Business Communication – Rajendra Pal and J.S. Korlhalli- Sultan Chand & Sons, New Delhi.
4. Business Communication (Principles, Methods and Techniques) Nirmal Singh -Deep &Deep Publications, New Delhi.
5. 5) Business Communication – Dr. S.V. Kadvekar, Rawal and Kothavade- Diamond Publications, Pune.
6. Business Correspondence and Report Writing – R.C. Sharma, Krishna Mohan – TMH, New Delhi.
7. Modern Business Correspondence – L. Gartside – The English Language Book Society and Macdonald and Evans Ltd.
8. 8) Business Communication – M. Balasubrahmanyan –Vani Education Books.

BCA II Semester

Course Code/Course Name	Course Name	L	T	P	Credit
Vocational 2	Within Faculty/other department				3

BCA II Semester

Course Code/Course Name	Course Name	L	T	P	Credit
AECC 2	First Aid and Health	3	1		2

BCA II Semester

Course Code/Course Name	Course Name	L	T	P	Credit
BCA201 P	Practical Lab for Object Oriented Programming Using C++			4	2

Internal/External Examiners for Practical Exams will be appointed by the University on the recommendation of Board of Studies.

Practical will be based on the Paper Object Oriented Programming Using C++. On whole Syllabus.

BCA II Semester

Course Code/Course Name	Course Name	L	T	P	Credit
BCA202 P	Practical Lab for Data Structure			4	2

Internal/External Examiners for Practical Exams will be appointed by the University on the recommendation of Board of Studies.

Practical will be based on the Paper Concepts of Data Structure. On whole Syllabus.

2nd Year

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
III	Major 07	BCA301 T	JAVA Programming and Dynamic Web Design	4			3	(92 Credits) Diploma in Computer Application
	Major 08	BCA302 T	Operating System	4			3	
	Major 09	BCA303	Numerical Methods	3	1		4	
	Minor 3	BCA308	Introduction to DBMS (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments / Subjects.	4			4	
	Vocational 3		Within Faculty/other department				3	
	AECC 3	BCA305	Human Values and Environmental Studies	3	1		2	
		BCA301 P	Practical Lab for Java Programming			4	2	
		BCA302 P	Practical Lab for Operating System			4	2	
							23	

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits
IV	Major 10	BCA401 T	Introduction to DBMS	4			3
	Major 11	BCA402 T	Design and Analysis of Algorithm	4			3
	Major 12	BCA403	Software Engineering	3	1		4
	Minor 4	BCA408	Java Programming and Dynamic Web Page Designing (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments / Subjects.	4			4
	Vocational 4		Within Faculty/other department				3
		AECC 4	Physical Education and Yoga	3	1		2
		BCA401 P	Practical Lab for DBMS			4	2
		BCA402 P	Practical Lab for DAA			4	2
							23

BCA III Semester

Course Code	Course Name	L	T	P	Credit
BCA301 T	JAVA Programming and Dynamic Web Design	4			3

UNIT-I

Java Programming: Data types, control structured, arrays, strings, and vector, classes (inheritance, package, exception handling) multithreaded programming.

UNIT-II

Java applets, AWT controls (Button, Labels, Combo box, list and other Listeners, menu bar) layout manager, string handling (only main functions).

UNIT-III

Networking (datagram socket and TCP/IP based server socket) event handling, JDBC: Introduction, Drivers, Establishing Connection, Connection Pooling.

UNIT-IV

HTML: use of commenting, headers, text styling, images, formatting text with <FONT>, special characters, horizontal rules, line breaks, table, forms, image maps, <META> tags, <FRAMESET> tags, file formats including image formats.

Java Servlets: Introduction, HTTP Servlet Basics, The Servlet Lifecycle, Retrieving Information, Sending HTML Information, Session Tracking, Database Connectivity.

UNIT-V

Java Server Pages: Introducing Java Server Pages, JSP Overview, Setting Up the JSP Environment, Generating Dynamic Content, Using Custom Tag Libraries and the JSP Standard Tag Library, Processing Input and Output.

Referential Books:

1. Patrick Naughton and Herbertz Schildt —Java-2 The Complete Reference 1999, TMH.
2. Shelley Powers—Dynamic Web Publishing 2nd Ed. Techmedia, 1998.
3. Ivor Horton —Beginning Java-2, SPD Publication.
4. Jason Hunter, —Java Servlet Programming, O' Reilly
5. Shelley Powers, —Dynamic Web Publishing, 2nd Ed. Techmedia, 1998
6. Hans Bergsten. —Java Server Pages. 3rd Ed. O' Reilly

BCA III Semester

Course Code	Course Name	L	T	P	Credit
BCA302 T	Operating System	4			3

UNIT-I

Introduction, what is an operating system, Simple Batch Systems, Multi-programmed Batch systems, Time- Sharing Systems, Personal – Computer Systems, Parallel systems, Distributed systems, Real- Time Systems.

Memory Management: Background, Logical versus physical Address space, swapping, Contiguous allocation, Paging, Segmentation.

Virtual Memory: Demand Paging, Page Replacement, Page- replacement Algorithms, Performance of Demand Paging, Allocation of Frames, Thrashing, Other Considerations.

UNIT-II

Processes: Process Concept, Process Scheduling, Operation on Processes.

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple – Processor Scheduling.

Process Synchronization: Background, The Critical – Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization.

UNIT-III

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT-IV

Device Management: Techniques for Device Management, Dedicated Devices, Shared Devices, Virtual Devices; Input or Output Devices, Storage Devices, Buffering, Secondary Storage Structure: Disk Structure, Disk Scheduling, Disk Management, Swap- Space Management, Disk Reliability.

UNIT-V

Information Management: Introduction, A Simple File system, General Model of a File System, Symbolic File System, Basic File System, Access Control Verification, Logical File System, Physical File system File – System Interface; File Concept, Access Methods, Directory Structure, Protection, Consistency Semantics File – System Implementation: File – System Structure, Allocation Methods, Free- Space Management.

Referential Books:

1. Silbersachatz and Galvin — Operating System Conceptsl, Person, 5th Ed. 2001.
2. Madnick E., Donovan J. — Operating Systems.Tata McGraw Hill,2001.
3. Tannenbaum. —Operating Systemsl, PHI, 4th Edition, 2000.

BCA III Semester

Course Code	Course Name	L	T	P	Credit
BCA303	Numerical Methods	3	1		4

UNIT-I

Roots of Equations: Bisections Method, False Position Method, Newton's Raphson Method, Rate of convergence of Newton's method.

UNIT-II

Interpolation and Extrapolation: Finite Differences, The operator E, Newton's Forward and Backward Differences, Newton's dividend differences formulae, Lagrange's Interpolation formula for unequal Intervals, Gauss's Interpolation formula, Starling formula, Bessel's formula, Laplace- Everett formula.

UNIT-III

Numerical Differentiation Numerical Integration: Introduction, direct methods, maxima and minima of a tabulated function, General Quadratic formula, Trapezoidal rule, Simpson's One third rule, Simpson's three- eight rule.

UNIT-IV

Solution of Linear Equation: Gauss's Elimination method and Gauss's Siedel iterative method.

UNIT-V

Solution of Differential Equations: Euler's method, Picard's method, Fourth-order Runge–Kutta method.

Referential Books:

1. Scarbourogh, —Numerical Analysis.
2. Gupta & Bose S.C. —Introduction to Numerical Analysis. —Academic Press, Kolkata.
3. S.S. Shashtri, — Numerical Analysis, PHI.

BCA III Semester

Course Code	Course Name	L	T	P	Credit
BCA308	Elements of Statistics	4			4

UNIT-I

Population, Sample and Data Condensation: Definition and scope of statistics, concept of population and simple with Illustration, Raw data, attributes and variables, classification, frequency distribution, Cumulative frequency distribution.

UNIT-II

Measures of Central Tendency: Concept of central Tendency, requirements of a good measures of central tendency, Arithmetic mean, Median, Mode, Harmonic Mean, Geometric mean for grouped and ungrouped data.

UNIT-III Measures of Dispersion: Concept of dispersion, Absolute and relative measure of dispersion, range variance, Standard deviation, Coefficient of variation.

UNIT-IV

Permutations and Combinations: Permutations of 'n' dissimilar objects taken 'r' at a time (with or without repetitions). $nPr = n!/(n-r)!$ (without proof). Combinations of 'r' objects taken from 'n' objects. $nCr = n!/(r!(n-r)!)$ (without proof). Simple examples, Applications.

UNIT-V

Probability Theory: Experiments and random experiments, Ideas of deterministic and non-deterministic experiments; Definition of sample space, discrete sample space, events; Types of events, Union and intersections of two or more events, mutually exclusive events, Complementary event, Exhaustive event; Simple examples. Classical definition of probability, Addition theorem of probability without Proof (up to three events are expected). conditional probability, independence of two events.

Statistical Quality Control Introduction, control limits, specification limits, tolerance limits, process and product control

Referential Books:

1. S.C. Gupta - Fundamentals of statistics - Sultan Chand & sons, Delhi.
2. D.N. Elhance - Fundamentals of statistics - Kitab Mahal, Allahabad.
3. Montogomery D.C. – Statistical Quality Control - John Welly and Sons
4. Goon, Gupta And Dasgupta - Fundamentals of statistics - The world press private ltd., Kolkata.
5. Hogg R.V. and Craig R.G. – Introduction to mathematical statistics Ed 4 (1989) – Macmillan Pub. Co. Newyork.
6. Gupta S.P. – Statistical Methods, Pub – Sultan Chand and sons New Delhi.

BCA III Semester

Course Code	Course Name	L	T	P	Credit
Vocational 3	Within Faculty/other department				3

BCA III Semester

Course Code	Course Name	L	T	P	Credit
BCA305	Human Values and Environmental Studies	3	1		2

Unit-I

Human Values- Introduction- Values, Characteristics, Types, Developing Value system in Indian Organisation, Values in Business Management, value based Organisation, Trans – cultural Human values in Management. Swami Vivekananda's philosophy of Character Building, Gandhi's concept of Seven Sins, APJ Abdul Kalam view on role of parents and Teachers. Human Values and Present Practices – Issues: Corruption and Bribe, Privacy Policy in Web and Social Media, Cyber threats, Online Shopping etc.

Unit-III

Remedies UK Bribery Act, Introduction to sustainable policies and practices in Indian Economy. Principles of Ethics Secular and Spiritual Values in Management- Introduction- Secular and Spiritual values, features, Levels of value Implementation. Features of spiritual Values, Corporate Social Responsibility- Nature, Levels, Phases and Models of CSR, Corporate Governance. CSR and Modern Business Tycoons Ratan Tata, Azim Premji and Bill Gates.

Unit-III

Holistic Approach in Decision making- Decision making, the decision-making process, The Bhagavad Gita: Techniques in Management, Dharma and Holistic Management.

Discussion through Dilemmas – Dilemmas in Marketing and Pharma Organisations, moving from Public to Private – monopoly context, Dilemma of privatisation, Dilemma on liberalization, Dilemma on social media and cyber security, Dilemma on Organic food, Dilemma on standardization, Dilemma on Quality standards.

Unit-IV

Ecosystem: Concept, structure & functions of ecosystem: producer, consumer, decomposer, food web, food chain, energy flow, Ecological pyramids Conservation of Biodiversity- In-situ & Ex- situ conservation of biodiversity, Role of individual in Pollution control, Human Population & Environment, Sustainable Development India and UN Sustainable Development, Goals Concept of circular economy and entrepreneurship.

Unit-V

Environmental Laws?, International Advancements in Environmental, Conservation Role of National Green Tribunal, Air Quality Index, Importance of Indian Traditional knowledge on environment, Bio assessment of Environmental, Quality Environmental Management System, Environmental Impact, Assessment and Environmental Audit.

Suggested Readings:

1. A foundation course in Human Values and Professional Ethics by RR. Gaur, R. Sangal et.al
2. JUSTICE: What's the Right Thing to Do? Michael J. Sandel.
3. Human Values by A. N. Tripathi New Age International.
4. Environmental Management by N.K. Uberoi.
5. https://www.un.org/sustainabledevelopment/sustainable-development-goals/
6. https://www.india.gov.in/my-government/schemes
7. https://www.legislation.gov.uk/ukpga/2010/23/contents
8. Daniel Kahneman, Thinking, Fast and Slow; Allen Lane Nov 2011 ISBN: 9780141918921.

BCA III Semester

Course Code	Course Name	L	T	P	Credit
BCA301 P	Practical Lab for Java Programming			4	2

Internal/External Examiners for Practical Exams will be appointed by the University on the recommendation of Board of Studies.

Practical will be based on Paper Java Programming & Web Design: on Whole Syllabus

BCA III Semester

Course Code	Course Name	L	T	P	Credit
BCA302 P	Practical Lab for Operating System			4	2

Internal/External Examiners for Practical Exams will be appointed by the University on the recommendation of Board of Studies.

Practical will be based on the Paper Operating System. On whole syllabus.

BCA IV Semester

Course Code	Course Name	L	T	P	Credit
BCA401 T	Introduction to DBMS	4			3

UNIT-I

Introduction: Characteristics of database approach, data models, DBMS architecture and data independence.

E-R Modeling: Entity types, Entity set, attribute and key, relationships, relation types, roles and structural constraints, weak entities, enhanced E-R and object modeling, Sub classes; Super classes, inheritance, specialization and generalization.

UNIT-II

File Organization: Indexed sequential access files; implementation using B & B++ trees, hashing, hashing functions, collision resolution, extendible hashing, dynamic hashing approach implementation and performance.

UNIT-III

Relational Data Model: Relational model concepts, relational constraints, relational algebra **SQL:** SQL queries, programming using SQL.

UNIT-IV

EER and ER to relational mapping: Data base design using EER to relational language.

UNIT-V

Data Normalization: Functional Dependencies, Normal form up to 3rd normal form. Concurrency Control: Transaction processing, locking techniques and associated, database recovery, security and authorization. Recovery Techniques, Database Security.

Referential Books:

1. Abraham Silberschatz, Henry Korth, S. Sudarshan, —Database Systems Concepts, 4th Edition, McGraw Hill, 1997.
2. Jim Melton, Alan Simon, —Understanding the new SQL: A complete Guide, Morgan Kaufmann Publishers, 1993.
3. A.K. Majumdar, P. Bhattacharya, —Database Management Systems, TMH, 1996.
4. Bipin Desai, —An Introduction to database systems, Galgotia Publications, 1991.

Course Code	Course Name	L	T	P	Credit
BCA403	Software Engineering	3	1		4

UNIT-I

Software Engineering: Definition and paradigms, A generic view of software engineering. **Requirements Analysis:** Statement of system scope, isolation of top-level processes and entitles and their allocation to physical elements, refinement and review. Analyzing a problem, creating a software specification document, review for correctness, consistency, and completeness.

UNIT-II

Designing Software Solutions: Refining the software Specification; Application of fundamental design concept for data, architectural and procedural designs using software blue print methodology and object-oriented design paradigm; Creating design document: Review of conformance to software requirements and quality.

UNIT-III

Software Implementation: Relationship between design and implementation, Implementation issues and programming support environment, Coding the procedural design, Good coding style and review of correctness and readability.

UNIT-IV

Software Maintenance: Maintenance as part of software evaluation, reasons for maintenance, types of maintenance (Perceptive, adoptive, corrective), designing for maintainability, techniques for maintenance.

UNIT-V

Comprehensive examples using available software platforms/case tools, Configuration Management.

Referential Books:

1. K.K. Aggarwal & Yogesh Singh —Software engineeringl, 2nd Ed., New Age International 2005.
2. I. Sommerville, —Software Engineeringl, Addison Wesley, 2002.
3. James Peter. W. Pedrycz. —Software Engineering: An Engineering Approachl John Wiley & Sons.

BCA IV Semester

Course Code	Course Name	L	T	P	Credit
BCA408	Computer Network	4			4

UNIT-I

Basic Concepts: Components of data communication, distributed processing, standards and organizations. Line configuration, topology, Transmission mode, and categories of networks.

OSI and TCP/IP Models: Layers and their functions, comparison of models. Digital Transmission: Interfaces and Modems: DTE-DCE Interface, Modems, Cable modems.

UNIT-II

Transmission Media: Guided and unguided, Attenuation, distortion, noise, throughput, propagation speed and time, wavelength, Shannon capacity, comparison of media.

UNIT-III

Telephony: Multiplexing, error detection and correction: Many to one, one to many, WDM, TDM, FDM, Circuit switching, packet switching and message switching. Data link control protocols: Line discipline, flow control, error control, synchronous and asynchronous protocols, character and bit-oriented protocols, Link access procedures.

Point to point controls: Transmission states, PPP layers, LCP, Authentication, NCP. **ISDN:** Services, Historical outline, subscriber's access, ISDN Layers and broadcast ISDN.

UNIT-IV

Devices: Repeaters, bridges, gateways, routers, The Network Layer; Design issues, Routing algorithms, Congestion control Algorithms, Quality of service, Internetworking, Network-Layer in the internet.

UNIT-V

Transport and upper layers in OSI Model: Transport layer functions, connection management, functions of session layers, presentation layer and application layer.

Referential Books:

1. A.S. Tanenbaum —Computer Networksl; Pearson Education Asia, 4th Ed. 2003.
2. Behrouz A. Forouzan —Data Communication and Networking, 3rd Ed. Tata McGraw Hill, 2004.
3. William Stallings —Data and computer communications, Pearson education Asia, 7th Ed., 2002.

BCA IV Semester

Course Code	Course Name	L	T	P	Credit
Vocational 4	Within Faculty/other department				3

BCA IV Semester

Course Code	Course Name	L	T	P	Credit
AECC 4	Physical Education and Yoga	3	1		2

Unit-I

Physical Education: Meaning, Definition, Aim and Objective, Misconception About Physical Education, Need, Importance and Scope of Physical Education in the Modern Society, Physical Education Relationship with General Education, Physical Education in India before Independence, Physical Education in India after Independence.

Unit-II

Concept of Fitness and Wellness: Meaning, Definition and Importance of Fitness and Wellness, Components of Fitness, Factor Affecting Fitness and Wellness.

Weight Management: Meaning and Definition of Obesity, Causes of Obesity, Management of Obesity, Health problems due to Obesity.

Lifestyle: Meaning, Definition, Importance of Lifestyle, Factor affecting Lifestyle, Role of Physical activity in the maintains of Healthy Lifestyle.

Unit-III

Yoga and Meditation: Historical aspect of yoga, Definition, types scopes & importance of yoga, Yoga relation with mental health and value education, Yoga relation with Physical Education and sports, Definition of Asana, differences between asana and physical exercise, Definition and classification of pranayama, Difference between pranayama and deep breathing.

Practical: Asana, Suraya-Namaskar, Bhujang Asana, Naukasana, Halasana, Vajrasan, Padmasana, Shavasana, Makrasana, Dhanurasana, Tad Asana. Pranayam: Anulom, Vilom.

Unit-IV

Traditional Games of India: Meaning, Types of Traditional Games-Gilli, Danda, Kanche, Stapu, Gutte, etc. Importance/ Benefits of Traditional Games. How to Design Traditional Games.

Unit-V

Recreation in Physical Education: Meaning, Definition of Recreation, Scope and Importance of Recreation, General Principles of Recreation, Types of Recreational Activities, Aerobics and Zumba, (Fir India Movement).

Suggested Readings:

1. Singh, Ajmer, Physical Education and Olympic Abhiyan, "Kalayani Publishers", New Delhi, Revised Addition, 2006
2. Patel, Shri krishna, Physical Education, "Agrawal Publishers", Agra, 2014-15
3. Panday, Preeti, Sharirik Shiksha Sankalan, " Khel Sanskriti Prakashan, Kanpur

4. Kamlesh M.L., "Physical Education, Facts and foundations", Faridabad P.B. Publications.
5. B.K.S. Yengar, "Light and Yog. Yoga Deepika", George Allen of Unwin Ltd., London,1981.
6. Braj Bilari Nigam, Yoga Power "TheKpath of Personal achievement" Domen and Publishers, New Delhi, 2001.
7. Indira Devi, "Yoga for You", Gibbs, Smith Publishers, Salt Lake City, 2002 Domenand Publishers, New Delhi - 2001.
8. Jack Peter, "Yoga Master the Yogic Powers", Abhishek Publications, Chandigarh, 2004.
9. Janice Jerusalim, "A Guide To Yoga" Parragon Bath, Baiihe-2004.

BCA IV Semester

Course Code	Course Name	L	T	P	Credit
BCA401 P	Practical Lab for DBMS			4	2

Internal/External Examiners for Practical Exams will be appointed by the University on the recommendation of Board of studies.

Practical will be based on the Paper Introduction to DBMS. On whole Syllabus.

BCA IV Semester

Course Code	Course Name	L	T	P	Credit
BCA402 P	Practical Lab for DAA			4	2

Internal/External Examiners for Practical Exams will be appointed by the University on the recommendation of Board of studies.

Practical will be based on the Paper Design and Analysis of Algorithm. On whole Syllabus.

3rd Year

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
V	Major 13	BCA501 T	Computer Graphics & Animation	4			3	(132 Credits) Bachelor of Computer Application
	Major 14	BCA502 T	Web & Internet Technologies	4			3	
	Elective-01	BCA511	Artificial Intelligence	3	1		4	
	AECC 5		Analytic Ability and Digital Awareness	3	1		2	
		BCA505	Minor Project		1	2	3	
		BCA506	Viva-Voce on Summer Training			2	1	
		BCA501 P	Practical Lab for Computer Graphics & Animation			4	2	
		BCA502 P	Practical Lab for Web & Internet Technologies			4	2	
							20	

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits
VI	Major 15	BCA601	Information Security	4			4
	Major 16	BCA602	Theory of Computation	3	1		4
	Elective-02	BCA612	Machine Learning	3	1		4
	AECC 6		Communication Skill and Personality Development				2
		BCA603	Major Project		3	6	5
		BCA604	Presentation/Seminar based on Major Project				1
							20

BCA V Semester

Course Code	Course Name	L	T	P	Credit
BCA501 T	Computer Graphics & Animation	4			3

UNIT-I

Introduction: Advantage of Computer Graphics and Areas of Applications, Hardware and Software for Computer Graphics. (Hard Copy, Display Technologies), Random Scan Display System, Video Controller, Random Scan Display Processor, Raster Graphics, Scan Conversion Algorithms (Line, Circle, Ellipse), Area Filling (Rectangle, Ellipse), Clipping (Lines, Circle, Ellipse), Clipping Polygons.

UNIT-II

Two dimensional and three-dimensional transformations: 2-Dimensional transformation, 2-D Translation, Rotation, Scaling, Homogeneous Coordinates, Reflection, Shear transform, 3-dimensional transformation, 3-D Translation, Rotation Scaling, Reflection, Shear.

UNIT III

The Physical Layer: Functions of Physical Layer, Data and Signals: Analog and Digital signals, Transmission Impairment, Data Rate Limits, Performance, Data Transmission Media: Guided Media, Unguided Media and Satellites, Bandwidth Utilization: Multiplexing and Spreading, switching: Circuit switching, Message switching & Packet switching, Telephone, Mobile and Cable network for data Communication.

UNIT-IV

Clipping: Window to view port transformation, Clipping, line clipping, Cohen —Sutherland line clipping, Polygon clipping, Sutherland and Gary Hodgman polygon clipping algorithm.

Visible Surface Determination and computer graphics algorithm: Image space and object space techniques, Hidden Surface removal—Depth comparison, Z-Buffer Algorithm, Back-Face Removal, The Painter's Algorithm, Scan-Line Algorithm, Light and Color and different color models (RGB, CMY, YIQ).

UNIT-V

Animation and virtual reality: Basic Principles of Animation and Types of Animation, Introduction to the flash interface, Setting stage dimensions, working with panels, panel layouts, Layers & Views, Shaping Objects – Overview of shapes, Drawing & Modifying Shapes, Bitmap Images & Sounds, Animation -Principles, Frame by frame animation, tweening, masks, Introduction to virtual reality.

Text Books:

1. Foley, Van Dam, Feiner, Hughes, Computer Graphics Principles& practice,2000.
2. D. Haran & Baker, Computer Graphics Prentice Hall of India,1986.
3. D.J. Gibbs & D.C. Tsichritzs: Multimedia programming Object Environment& Frame work, 2000.

BCA V Semester

Course Code	Course Name	L	T	P	Credit
BCA502 T	Web & Internet Technologies	4			3

Unit-I

Introduction: Network address translation, Subnet Masking, Difference between Intranet and Internet, Working of Internet, Dynamic and Static Routing, Domain Name Server, networking tools - ipconfig, ping, netstat, traceroute.

Unit-II

Introduction to Internet Protocols: HTTP, HTTPS, FTP, SMTP, IMAP, POP3, VoIP.

Unit-III

Web Servers: Introduction, Working, Configuring, Hosting and Managing a Web server, Proxy Servers: Introduction, Working, Type of Proxies, setting up and managing a proxy server Client-side Technologies, Server-side Technologies and hybrid technologies.

Unit-IV

Javascript, jQuery, JSON, NODE.js, BOOTSTRAP, Introduction to forums, blogging, portfolio, developing a responsive website, Combining Web Applications and Mobile Applications.

Unit-V

Search Engines - components, working, optimization, Crawling, BOTS. Introduction to cookies and sessions, Introduction to e-commerce websites and e-carts.

Text Books:

1. DComer. (2018). The Internet Book: Everything You need to know about Computer networking and how the internet works. 5th edition. CRC Press.
2. Patel, B & Barik, L.B. Internet & Web Technology, Acme Learning Publisher
3. Bayross, I. (2013). Web enabled commercial application development using HTML, JavaScript, DHTML and PHP. 4th edition. BPB Publication.
4. Godbole, A. S.& Kahate A (2008). Web Technologies. Tata McGraw-Hill.

BCA V Semester

Course Code	Course Name	L	T	P	Credit
BCA511	Artificial Intelligence	3	1		4

Unit-I

Introduction: Introduction to artificial intelligence, background and applications, Turing test, rational agents, intelligent agents, structure, behavior and environment of intelligent agents, Ethics in AI.

Unit-II

Knowledge Representation: Propositional logic, first order predicate logic, resolution principle, unification, semantic nets, conceptual dependencies, frames, scripts, production rules, conceptual graphs.

Unit-III

Reasoning with Uncertain Knowledge: Uncertainty, non-monotonic reasoning, truth maintenance systems, default reasoning and closed world assumption, Introduction to probabilistic reasoning, Bayesian probabilistic inference, introduction to fuzzy sets and fuzzy logic, reasoning using fuzzy logic.

Unit-IV

Problem Solving and Searching Techniques: Problem characteristics, production systems, control strategies, breadth first search, depth first search, hill climbing and its variations, heuristics search techniques: best first search, A* algorithm, constraint satisfaction problem, means-end analysis.

Unit-V

Game Playing: introduction to game playing, min-max and alpha-beta pruning algorithms. Prolog Programming: Introduction to Programming in Logic (PROLOG), Lists, Operators, basic Input and Output.

Text Books:

1. Russell, S.J. & Norvig, P. (2015) Artificial Intelligence - A Modern Approach. 3rd edition. Pearson Education
2. Rich, E. & Knight, K. (2012). Artificial Intelligence. 3rd edition. Tata McGraw Hill.
3. Patterson, D.W. (2015). Introduction to Artificial Intelligence and Expert Systems. 1st edition. Pearson Education.
4. Bratko, I. (2011). Prolog Programming for Artificial Intelligence. 4th edition. Pearson Education

BCA V Semester

Course Code	Course Name	L	T	P	Credit
AECC 5	Analytic Ability and Digital Awareness	3	1		2

Unit-I

Alphabet test, Analogy, Arithmetic Reasoning, Blood relations, Coding and Decoding, Inequalities, Logical Venn diagram, Seating Arrangements, Puzzles and Missing numbers.

Unit-II

Syllogism, Pattern completion and figure series, Embeded Figure and counting of figures, Cube & Dice, Paper cutting and folding, Data sufficiency, Course of Action, Critical Reasoning, Analytical and decision making.

Unit-III

Computer Basics: Block diagram of Digital Computer, Classification of Computers, Memory System, Primary storage, Auxiliary memory, Cache memory, Computer Software (System/Application Software).

MS Word Basics: The word screen, getting to word documents, typing and Revising text, Finding and Replacing, Editing and Proofing tools, Formatting text characters, Formatting Paragraph, Document templates., Page set up, tables, Mail Merge, Macros, protecting documents, printing a document.

Unit-IV

MS-Excel: Introduction, Worksheet basics, Creating worksheet, Heading information, Data & Text, Date & Time, Alphanumeric values, Saving & quitting worksheet, Opening and moving around in an existing worksheet, Toolbars and Menus, Excel shortcut and function keys, Working with single and multiple workbook, Working with formulae & cell referencing, Auto sum, coping formulae, Absolute & relative addressing, Worksheet with ranges, Formatting of worksheet, Previewing & Printing worksheet, Graphs and charts, Database, Creating and using macros, Multiple worksheets- concepts Introduction of Open Source Applications: LibreOffice, OpenOffice and Google Docs etc.

Unit-V

Web Surfing: An Overview: working of Internet, Browsing the Internet, E-Mail, Components of E-Mail, Address Book, Troubleshooting in E-Mail, Browsers: Netscape Navigator, Microsoft Internet Explorer, Google Chrome, Mozilla Firefox, Tor, Search Engines lik Google, DuckDuckGo etc., visiting web sites: Downloading, Cyber Security: Introduction to Information System, Type of information system, CIA model of Information Characteristics, Introduction to Information Security, Need of Information Security, Cyber Security, phishing,

spamming, fake news, general issues related to cyber security, Business need, Ethical and Professional issues of security.

Books

1. Sharma, A., "How to prepare for Data Interpretation and Logical Reasoning for the CAT" McGraw Hill Education Pvt. Ltd., New Delhi, India, 2011, Ed. 5, ISBN 978 2007 070 481.
2. Aggarwal, R.S., "A Modern Approach to Verbal and Non-verbal Reasoning" S. Chand Publishers New Delhi, India, 2010, ISBN 10: 8121905516.
3. Madan, Sushila, Introduction to Essential tools, Jain Book Agency, New Delhi/India, 2009, 5th ed. 4. Goel, Anita, Computer Fundamentals, Pearson Education, India, 2012.
4. Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security," Sixth Edition, Cengage Learning, 2017.

Note: Course Books published in Hindi may be prescribed by the Universities.

BCA V Semester

Course Code	Course Name	L	T	P	Credit
BCA505	Minor Project		1	2	3

Evaluation will be based on Minor Project/Summer Training held after fourth semester and will be conducted by the Internal and External Examiner appointed by University.

BCA V Semester

Course Code	Course Name	L	T	P	Credit
BCA506	Viva-Voce on Summer Training			2	1

Evaluation will be based on Minor Project/Summer Training held after fourth semester and will be conducted by the Internal and External Examiner appointed by University.

BCA V Semester

Course Code	Course Name	L	T	P	Credit
BCA501 P	Practical Lab for Computer Graphics & Animation			4	2

Internal/External Examiners for Practical Exams will be appointed by the University on the recommendation of Board of Studies.

Practical will be based on the Paper Computer Graphics & Animation. On whole Syllabus.

BCA V Semester

Course Code	Course Name	L	T	P	Credit
BCA502 P	Practical Lab for Web & Internet Technologies			4	2

Internal/External Examiners for Practical Exams will be appointed by the university on the recommendation of Board of Studies.

Practical will be based on the Paper Web & Internet Technologies. On whole Syllabus.

BCA VI Semester

Course Code	Course Name	L	T	P	Credit
BCA601	Information Security	4			4

Unit-I

Introduction: Security Concepts, Challenges, Security architecture, Security attacks, security services, security mechanisms.

Unit-II

Error detecting/correction: Block Codes, Generator Matrix, Parity Check Matrix, Minimum distance of a Code, Error detection and correction, Standard Array and syndrome decoding, Hamming Codes.

Unit-III

Cryptography: Encryption. Decryption, Substitution and Transposition, Confusion and diffusion, Symmetric and Asymmetric encryption, Stream and Block ciphers, DES, cryptanalysis. Public-key cryptography, Diffie-Hellman key exchange, man-in-the-middle attack Digital signature, Steganography, Watermarking.

Unit-IV

Malicious software's: Types of malwares (viruses, worms, trojan horse, rootkits, bots), Memory exploits - Buffer overflow, Integer overflow.

Unit-V

Security in Internet-of-Things: Security implications, Mobile device security - threats and strategies.

Text Books:

1. Stallings, W. (2018). Cryptography and network security. 7th edition. Pearson Education.
2. Pfleeger, C.P., Pfleeger, S.L., & Margulies, J. (2015). Security in Computing. 5th edition. Prentice Hall
3. Whitman M.E., & Mattord H.J. (2017). Principle of Information Security. 6th edition. Cengage Learning.

BCA VI Semester

Course Code	Course Name	L	T	P	Credit
BCA602	Theory of Computation	3	1		4

Unit-I

Languages: Alphabets, string, language, basic operations on language, concatenation, union, Kleene star.

Unit-II

Regular Expressions and Finite Automata: Regular expressions, Deterministic finite automata (DFA).

Unit-III

Regular Languages: Non-deterministic Finite Automata (NFA), relationship between NFA and DFA, Transition Graphs (TG), properties of regular languages, the relationship between regular languages and finite automata, Kleene's Theorem.

Unit-IV

Non-Regular Languages and Context Free Grammars: Pumping lemma for regular grammars, Context-Free Grammars (CFG),

Unit-V

Context-Free Languages (CFL) and PDA: Deterministic and non-deterministic Pushdown Automata (PDA), parse trees, leftmost derivation, pumping lemma for CFL, properties of CFL.

Unit-VI

Turing Machines and Models of Computations: Turing machine as a model of computation, configuration of simple Turing machine, Church Turing Thesis, Universal Turing Machine, decidability, halting problem.

Text Books:

1. Cohen, D. I. A. (2011). Introduction to Computer Theory. 2nd edition. Wiley India.
2. Linz, P. (2016). An Introduction to Formal Languages and Automata.6th edition. Jones and Bartlett Learning.
3. Lewis & Papadimitriou (1997). Elements of the theory of computation – 2nd Edition PHI.

BCA VI Semester

Course Code	Course Name	L	T	P	Credit
BCA612	Machine Learning	3	1		4

Unit-I

Introduction to Machine Learning: What is human learning? What is Machine Learning? Human learning versus machine learning, Types of machine learning, Applications of machine learning, Tools for machine learning, Preparing to Model.

Feature Engineering: Machine Learning activities, Basic Types of data in Machine Learning, Structures of data, Data Quality and Remediation, Data Pre-Processing, Introduction to Feature Engineering, Feature Transformation, Feature Subset Selection

Unit-II

Introduction: Basic definitions, Hypothesis space and inductive bias, Bayes optimal classifier and Bayes error, Occam's razor, Curse of dimensionality, dimensionality reduction, feature scaling, feature selection methods.

Unit-III

Regression: Linear regression with one variable, linear regression with multiple variables, gradient descent, logistic regression, over-fitting, regularization. performance evaluation metrics, validation methods.

Unit-IV

Classification: Decision trees, Naive Bayes classifier, k-nearest neighbor classifier, perceptron, multilayer perceptron, neural networks, back-propagation algorithm, Support Vector Machine (SVM), Kernel functions.

Unit-V

Clustering: Approaches for clustering, distance metrics, K-means clustering, expectation maximization, hierarchical clustering, performance evaluation metrics, validation methods.

Text Books:

1. Mitchell, T.M. (2017). Machine Learning. McGraw Hill Education.
2. Flach, P. (2015). Machine Learning: The Art and Science of Algorithms that Make Sense of Data. Cambridge University Press.
3. Haykins, S.O. (2010). Neural Networks and Learning Machines. 3rd edition. PHI.

BCA VI Semester

Course Code	Course Name	L	T	P	Credit
AECC 6	Communication Skill and Personality Development				2

Unit-I

Introduction to communication, process of communication, Importance of communication, 7c's of Communication, Essentials of effective communication.

Unit-II

Different forms of communication: Verbal communication, Non-verbal communication, Intrapersonal communication, Interpersonal communication, group communication, mass communication, new media communication.

Unit-III

Developing skills: Listening, Speaking, Reading and Writing skill.

Essential Soft skills: group discussion, Presentation skills, Decision-making, Team work, Innovation, Creative thinking, Time-management.

Unit-IV

Personality Development: concept of personality, dimensions of personality and dimensions of personality.

Unit-V

Attitude and Motivation: concept of motivation, positive attitude, negative attitude, ways to develop a positive attitude, concept of motivation and importance of self-motivation.

Books

1. Raman and Sharma, Technical Communications, OUP, New Delhi, 2017.
2. Lata and Kumar, Communication Skills, OUP, New Delhi, 2018.
3. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 2014. 4. Sherfield, Montgomery and Moody, Cornerstone: Developing Soft Skills, UP, 2009.
4. Lesikar R V, Flatley M E, Rentz K and Pandey Business Communication: Making Connections in a Digital World 2009: New Delhi, Tata McGrow Hill.

BCA VI Semester

Course Code	Course Name	L	T	P	Credit
BCA603	Major Project		3	6	5

Evaluation will be based on ~~Minor~~ Major Project/~~Summer Training~~ held ~~after~~ in ~~fourth~~ Sixth semester and will be conducted by the Internal and External Examiner appointed by University.

BCA VI Semester

Course Code	Course Name	L	T	P	Credit
BCA604	Presentation/Seminar based on Major Project				1

Evaluation will be based on ~~Minor Project/Summer Training held after fourth~~ Presentation/Seminar on major Project held in Sixth semester and will be conducted by the Internal and External Examiner appointed by University.

4th Year

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits	(Cumulative Minimum Credits) Required for Awards of Certificate /Diploma/Degree
VII	Major 17	BCA701	Research Mythologies	4			4	(184 Credits) Bachelor of Computer Application (Research)
	Elective-03	BCA711	Soft Computing	3	1		4	
	Elective-04	BCA712	Cloud Computing	3	1		4	
	Elective-05	BCA713	Advanced Software Engineering	3	1		4	
	Minor 05	BCA708	Artificial Intelligence (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments / Subjects.	4			4	
	Research Project	BCA702	Research Project (Conceptual)		3	6	6	
							26	

Sem.	Subject	Paper Code	Paper Name	L	T	P	Credits
VIII	Major 18	BCA801	Business Intelligence	4			4
	Elective-06	BCA811	Digital Image Processing	3	1		4
	Elective-07	BCA812	Advanced DBMS	3	1		4
	Elective-08	BCA813	Data Mining	3	1		4
	Minor 06	BCA808	Machine Learning (for other Department's students) BCA Students may opt the Generic/Interdisciplinary Elective Course from the list of courses offered by other Departments / Subjects.	4			4
	Research Project	BCA802	Research Project		3	6	6
							26

BCA VII Semester

Course Code	Course Name	L	T	P	Credit
BCA701	Research Methodology	4			4

Unit-I

Philosophical Underpinnings of Research:

Introduction to Research: Novelty, Originality, Organized Method of Investigation, and Communication of Problem, Data, Method, and Results for Peer Group Verification; Paradigm and paradigm shift.

Types of Research: Theoretical, Empirical, Experimental, and Design and Characterization of New Materials, Components, Processes, and Systems.

Broad Objectives of Research: Problem-oriented—Defining Problems and Problem Issues, Analyzing Data, Predicting, and Designing; Technique-oriented-Improving Performance and Expanding Scope.

Modes of Inquiry and Inquiring Systems: Hypothetical-deductive and Empirical-inductive modes; Scientific Method, and Inquiring Systems of Locke, Kant, Leibnitz, Hegel, and Singer, Continuum of Connections among Facts, Data, Laws, Hypotheses, Theory, Models, and Experiments; Criteria of a Theory, Research Topic, Problem, Questions, Objectives, and Scope, Methodology, Methods, Tools, and Techniques, Research Ethics, Plagiarism, and Their Prevention.

Unit-II

Measurement, Data, and Analytics, Structured and Unstructured Data, Scales of Measurement, Population and Sample, Descriptive Statistics, Data Visualization, Probability and Random Variables, Sampling and Estimation, Hypothesis Testing, ANOVA, Correlation, and Regression. Data Analytics: Elements of Association, Clustering, and Classification.

Unit-III

Elements of Theoretical Research, Model and Model Building: Classification of Models, Exogenous and Endogenous Variables, Variable Relationships, Model Boundary, and Predictive and Prescriptive Models.

Unit-IV

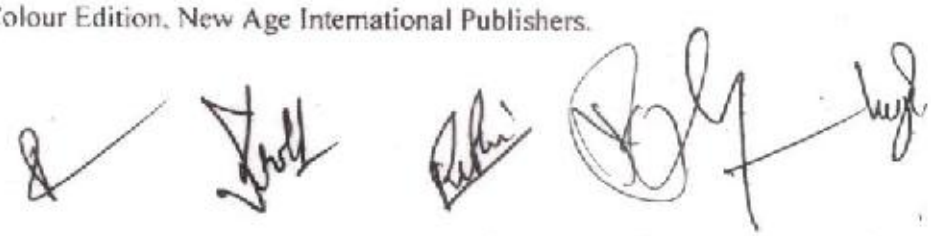
Research Methods for Computer Science, Formal Methods: Formal Specification, Algorithm, and Complexity, Building Artefacts: Proof of Performance, Proof of Concept, and Proof of Existence, Process Methodology: Methods for Software Engineering and Human-Computer Interaction, Cognitive Processes, Interactive Games, Social Networks, and Web Analytics.

Unit-V

Research Documentation, Elements of Preparing a Paper and a Thesis: Title, Abstract, Keywords, Acknowledgements, Symbols and Abbreviations, Introduction, Literature Review, Materials and Methods, SI Units, Mathematical Materials, Graphical and Tabular Presentation, Results and Discussion, Conclusion, Interpretation, Generalization, Scope for Future Work, Citations and List of References, and Appendixes, Elements of Good English Writing: Signposts, Paraphrasing—Unity, Coherence, and , and Topic Sentence, and Transitions.

Books

1. Kothari, C. R. and G. Garg (2019), Research Methodology: Methods and Techniques, Fourth MultiColour Edition, New Age International Publishers.



BCA VII Semester

Course Code	Course Name	L	T	P	Credit
BCA711	Introduction to Soft Computing	3	1		4

Unit-I

Introduction: Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion. Fuzzy Membership functions, interference in Fuzzy Logic, Fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzification & De-Fuzzification, Fuzzy Controller, Industrial applications.

Unit-II

Introduction & Architecture: Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions.

Unit-III

Neural network architecture: Single layer and Multilayer feed forward networks, Recurrent networks. Learning techniques. Perception and Convergence rule, Auto-associative and hetero-associative memory.

Unit-IV

(Back propagation networks) Architecture: perceptron model, solution, single layer artificial neural network, Multilayer perceptron model; back propagation learning methods, effect of learning rule co-efficient; back-propagation algorithm, factors affecting back-propagation training, applications.

Unit-V

Genetic Algorithm (GA) Basic concepts, Working principle, Procedures of GA, Flow chart of GA, Genetic representations. (encoding) Initialization and selection, Genetic operators, Mutation. Generational Cycle, Applications.

Text Books:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, —Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applicationsl Prentice Hall of India.
2. N. P. Padhy, IArtificial Intelligence and Intelligent Systemsl Oxford University Press.
3. Simon Haykin, INeural Networksl Prentice Hall of India
4. Timothy J. Ross, —Fuzzy Logic with Engineering Applicationsl Wiley India.
5. Kumar Satish, —Neural Networksl Tata McGraw Hill.

BCA VII Semester

Course Code	Course Name	L	T	P	Credit
BCA712	Cloud Computing	3	1		4

UNIT-I Computer Networks, basics of networking, Architectures of networking, topologies, types of Networks, LAN, WAN, MAN, Network Components, Protocols, Communication aspects, basics of internet.

UNIT-II

Client-Server Computing, Cluster Computing, Grid Basics, Distributed Computing. Introduction to Cloud Computing, Introduction to Software as a Service (SaaS), Infrastructure as a Service (IaaS), and Platform as a Service (PaaS).

UNIT- III

Understanding Google Cloud, Google Apps, Google Compute Engine (GCE), Google App Engine. Amazon Services, Amazon Web Services, Amazon EC2.

UNIT-IV

IBM Cloud Computing with its PaaS, IBM as Saas and IBM as IaaS. Red hat Cloud Computing with its PaaS.

UNIT-V

Microsoft Azure Cloud Computing Service- Windows azure platform Services, Windows Azure storage, Windows Azure fabrics, Salesforce Cloud Computing Services Pass, SaaS and IaaS. Heroku and Force.com as PaaS.

Books:

1. Mastering Cloud Computing, Buyya, R., Vecchiola, C., Selvi, S.T., McGraw Hill Education: First edition (2017)
2. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra and Geoffrey Fox, Morgan Kaufmann, 2011.

BCA VII Semester

Course Code	Course Name	L	T	P	Credit
BCA713	Advanced Software Engineering	3	1		4

Unit-I

Introduction: FAQs about Software Engineering; Professional and Ethical Responsibility; Software Process: Models; Process Iteration, Specification, Software Design and Implementation: Verification & Validation; Software Evolution; Automated Process Support. **Project Management:** Management Activities, Project Pl Software Project Management and Requirements Project Management: Management Activities, Project Planning, Project Scheduling, Risk Management; Software Requirements: Functional and Non-Functional Requirements, User Requirements, System Requirements, Requirements Document; Requirements Engineering Process: Feasibility Studies, Requirements Elicitation and Analysis, Requirements Validation, Requirements Management.

Unit-II

Architectural Design; System Models, Software Prototyping and Specifications System models: Context, Behavioral, Data, and Object models, CASE Workbenches; Software Prototyping: Prototyping in the Software Process, Rapid Prototyping Techniques, User Interface Prototyping; Specifications: Formal Specification in the Software Process, Interface Specification, Behavioral Specification.

Advanced Design: Introduction: System Structuring; Control Models; Modular Decomposition; Domain- Specific Architectures; Distributed Systems Architectures: Multiprocessor Architectures; Client-Server Architectures, Distributed Object Architectures; CORBA (Common Object Request Broker Architecture).

Unit-III

Software Design: Object Oriented Design: Objects and Object Classes, Object-Oriented Design Process, Design Evolution; Real Time Software Design: Systems Design, Real-Time Executives, Monitoring and Control Systems, Data Acquisition Systems; Design with Reuse: Component-Based Development, Application Families, Design Patterns; User Interface Design: Principles, User Interaction, Information Presentation, User Support, Interface Evaluation.

Unit-IV

Verification, Validation and Testing: Verification and Validation (V & V): Static and Dynamic V & V, V & V Goals, V & V vs. Debugging, Software Inspections / Reviews, Clean-

Room Software Development; Software Testing: Defect Testing, Integration Testing, Interface Testing, Object-Oriented Testing, Testing Workbenches.

Managing People: Introduction; Limits to Thinking; Memory Organization; Knowledge Modeling; Motivation; Group Working; Choosing and Keeping People; the People Capability Maturity Model.

Unit-V

Software Cost Estimation and Quality Management: Software Cost Estimation: Productivity, Estimation Techniques, Algorithmic Cost Modelling, Project Duration and Staffing. Quality Management: Quality Assurance and Standards, Quality Planning, Quality Control, Software Measurement and Metrics; Process Improvement: Process and Product Quality, Process Analysis and Modelling, Process Measurement, the SEI Process Maturity Model, and Process Classification.

Evolution: Legacy Systems: Structures, Design, and Assessment; Software Change: Program Evolution Dynamics, Software Maintenance, Architectural Evolution; Software Re-Engineering: Source Code Translation, Reverse Engineering, Program Structure Improvement, Program Modularization, Data Re-Engineering; Configuration Management.

Books

1. Software Engineering: An Engineering Approach, by J.F. Peters and W. Pedrycz, Publisher: John Wiley and Sons.
2. Software Engineering: A Practitioner's Approach by Roger Pressman, Publisher: McGraw-Hill.
3. Fundamentals of Software Engineering by Ghezzi, Jayazeri, and Mandrioli, Publisher: Prentice-Hall.
4. Software Engineering Fundamentals by Ali Behforooz, and Frederick J. Hudson, Publisher: Oxford University Press.

BCA VII Semester

Course Code	Course Name	L	T	P	Credit
BCA708 (Minor)	Computer Network	4			4

UNIT-I

Basic Concepts: Components of data communication, distributed processing, standards and organizations. Line configuration, topology, Transmission mode, and categories of networks. **OSI and TCP/IP Models:** Layers and their functions, comparison of models. Digital Transmission: Interfaces and Modems: DTE-DCE Interface, Modems, Cable modems.

UNIT-II

Transmission Media: Guided and unguided, Attenuation, distortion, noise, throughput, propagation speed and time, wavelength, Shannon capacity, comparison of media.

UNIT-III

Telephony: Multiplexing, error detection and correction: Many to one, one to many, WDM, TDM, FDM, Circuit switching, packet switching and message switching. Data link control protocols: Line discipline, flow control, error control, synchronous and asynchronous protocols, character and bit-oriented protocols, Link access procedures. **Point to point controls:** Transmission states, PPP layers, LCP, Authentication, NCP. **ISDN:** Services, Historical outline, subscriber's access, ISDN Layers and broadcast ISDN.

UNIT-IV

Devices: Repeaters, bridges, gateways, routers, The Network Layer; Design issues, Routing algorithms, Congestion control Algorithms, Quality of service, Internetworking, Network-Layer in the internet.

UNIT-V

Transport and upper layers in OSI Model: Transport layer functions, connection management, functions of session layers, presentation layer and application layer.

Books:

1. A.S. Tanenbaum, —Computer Networksl; Pearson Education Asia, 4th Ed. 2003.
2. Behrouz A. Forouzan, —Data Communication and Networkingl, 3rd Ed. Tata MCGraw Hill, 2004.
3. William stallings, —Data and computer communicationsl, Pearson education Asia, 7th Ed., 2002.

BCA VII Semester

Course Code	Course Name	L	T	P	Credit
BCA702	Research Project (Conceptual)		3	6	6

Evaluation of Internal/
~~Presentation/Seminar based on~~ Research Project will be evaluated by external examiner ~~only~~ appointed by the University on Recommendation of BOS.

BCA VIII Semester

Course Code	Course Name	L	T	P	Credit
BCA801	Business Intelligence	4			4

Unit-I

Business intelligence: Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence Decision support systems: Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system.

Unit-II

Mathematical models for decision making: Structure of mathematical models, Development of a model, Classes of models Data mining: Definition of data mining, Representation of input data . Data mining process, Analysis methodologies Data preparation: Data validation, Data transformation, Data reduction.

Unit-III

Classification: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines Clustering: Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models.

Unit-IV

Business intelligence applications: Marketing models: Relational marketing, Sales force management, Logistic and production models: Supply chain optimization, Optimization models for logistics planning, Revenue management systems. Data envelopment analysis: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices.

Unit-V

Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management Artificial Intelligence and Expert Systems: Concepts and Definitions of Artificial Intelligence, Artificial Intelligence Versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of

Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.

Books

1. Carlo Vercellis-Business Intelligence: Data Mining and Optimization for Decision Making, Wiley, 1st Edition, 2009.
2. Efraim Turban, Ramesh Sharda, Dursun Delen-Decision support and Business Intelligence Systems, Pearson, 9th Edition, 2011.
3. Grossmann W, Rinderle-Ma-Fundamental of Business Intelligence, Springer, 1st Edition, 2015.

BCA VIII Semester

Course Code	Course Name	L	T	P	Credit
BCA811	Digital Image Processing	3	1		4

Unit-I

Introduction: Digital Image Fundamentals: Brightness, Adaptation and Discrimination, Light and Electromagnetic Spectrum, Image Sampling and Quantization, Some Basic Relationships between Pixels Types of images.

Unit-II

Spatial Domain Filtering: Some Basic Intensity Transformation Functions, Histogram Equalization, Spatial Correlation and Convolution, Smoothening Spatial Filters: Low pass filters, Order Statistics filters; Sharpening Spatial Filters: Laplacian filter.

Unit-III

Filtering in Frequency Domain: The Discrete Fourier Transformation (DFT), Frequency Domain Filtering: Ideal and Butterworth Low pass and High pass filters, DCT Transform (1D, 2D).

Unit-IV

Image Restoration: Image Degradation/Restoration Process, Noise models, Noise Restoration Filters Image Compression: Fundamentals of Image Compression, Huffman Coding, Run Length Coding, JPEG.

Unit-V

Morphological Image Processing: Erosion, Dilation, Opening, Closing, Hit-or-Miss Transformation, Basic Morphological Algorithms. **Unit-VI Image Segmentation:** Point, Line and Edge Detection, Thresholding, Region Based Segmentation.

Books:

1. Gonzalez, R. C., & Woods, R. E. (2017). Digital Image Processing. 4th edition. Pearson Education.
2. Jain, A. K. (1988). Fundamentals of Digital Image Processing. 1st edition Prentice Hall of India.
3. Castleman, K. R. (1995.). Digital Image Processing. 1st edition. Pearson Education
4. Gonzalez, R. C., Woods, R. E., & Eddins, S. (2004). Digital Image Processing using MATLAB. Pearson Education Inc.

BCA VIII Semester

Course Code	Course Name	L	T	P	Credit
BCA812	Advanced DBMS	3	1		4

UNIT - I

History of Data base Systems. Data base System Applications, data base System VS file System. data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML. Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying/altering Tables and Views. Introduction of Object Database Systems. Structured Data types. operations on structured data, Encapsulation and ADTS, Inheritance.

UNIT – II

Database design for ORDBMS. ORBMS implementation and challenges, OODBMS, comparison of RDBMS. OODBMS and ORDBMS. (chapter 23 from text book 1) Introduction to Parallel databases, architectures for parallel databases, Parallel Query Evaluation – data partitioning and parallelizing sequential operator evaluation code, Parallelizing individual operations. and parallel Query optimization.

UNIT – III

Introduction to distributed databases; features of distributed databases vs centralized databases, Why distributed databases. DDBMS, levels of transparency- reference architecture for DDB, types of data fragmentation. distribution transparency for read-only and update applications, distributed database access primitives, Integrity Constraints in Distributed databases.

UNIT - IV

Distributed database design: framework for distributed database design, the design of database fragmentation. allocation of fragments; Distributed Query processing: Equivalence of transformations for queries. transforming global queries into fragment queries, distributed grouping and aggregation functions, parametric queries.

UNIT - V

A framework for query optimization, join queries and general queries. non-join queries in a distributed DBMS, joins in a distributed DBMS, cost-based query optimization. (chapter 5 and 6 from text book 2). DBMS Vs IR systems. Introduction to Information retrieval, indexing for text search. web search engine, managing text in a DBMS, a data model for XML, Querying XML data, and efficient evaluation of XML queries.

Books: 1. Raghuramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, TMH, 2006

1. S. Ceri and G. Pelagatti, "Distributed databases principles and systems", 1st Edition, TMH, 2008.

Course Code	Course Name	L	T	P	Credit
BCA813	Data Mining	3	1		4

Unit-I

Introduction to Data Mining: Applications of data mining, data mining tasks, motivation and challenges, types of data attributes and measurements, data quality. Data Pre-processing - aggregation, sampling, dimensionality reduction, Feature Subset Selection, Feature Creation, Discretization and Binarization. Variable Transformation.

Unit-II

Classification: Basic Concepts, Decision Tree Classifier: Decision tree algorithm, attribute selection measures, Nearest Neighbour Classifier, Bayes Theorem and Naive Bayes Classifier, Model Evaluation: Holdout Method, Random Sub Sampling, Cross-Validation, evaluation metrics, confusion matrix.

Unit-III

Association rule mining: Transaction data-set, Frequent Itemset, Support measure, Apriori Principle, Apriori Algorithm, Computational Complexity, Rule Generation, Confidence of association rule.

Unit-IV

Cluster Analysis: Basic Concepts, Different Types of Clustering Methods, Different Types of Clusters, K-means: The Basic K-means Algorithm, Strengths and Weaknesses of K-means algorithm.

Unit-V

Agglomerative Hierarchical Clustering: Basic Algorithm, Proximity between clusters, DBSCAN: The DBSCAN Algorithm, Strengths and Weaknesses.

Books:

1. Han, J., Kamber, M., & Jian, P. (2011). Data Mining: Concepts and Techniques. 3rd edition. Morgan Kaufmann
2. Tan, P.-N., Steinbach, M., & Kumar, V. (2005). Introduction to Data Mining. 1st Edition. Pearson Education.
3. Hand, D., & Mannila, H. & Smyth, P. (2006). Principles of Data Mining. Prentice-Hall of India.

BCA VIII Semester

Course Code	Course Name	L	T	P	Credit
BCA808 (Minor 06)	Data Centre Management	4			4

Unit-I

Data center Architecture. Data center Requirements, Data center prerequisites, Required Physical Area for Equipment and Unoccupied Space, required power to run all the devices, required cooling and HVAC Required weight, Required Network bandwidth, Budget Constraints. Selecting a Geographic Location Safety from Natural hazards, Safe from Manmade disaster.

Unit-II

Availability of local Technical talent, Abundant and Inexpensive Utilities, Selecting an Existing building, Data Center design, Characteristics of an Outstanding Design, Guidelines for Planning a Data Center. Data Center structures.

Unit-III

Raised Floor Design and Deployment. Design and Plan against Vandalism, Data center design case study. Modular Cabling Design. Points of Distribution, ISP Network Infrastructure, ISP WAN Links.

Unit-IV

Data Center Maintenance. Network Operations Center, Network Monitoring, Datacenter physical security. Data center Logical security, Data center Consolidation, Reasons for data center Consolidation. Consolidation opportunity, Server consolidation, Storage Consolidation, Network Consolidation. Service Consolidation, Process Consolidation, Staff Consolidation.

Unit-V

Data Consolidation phases. Data center servers, Sever Capacity Planning, System Management Best Practices. Server Cluster Best Practices, Data Storage Best Practices, Network Management Best Practices, Documentation Best Practices, Security Guidelines Internet security. Source Security Issues. Best Practices for System Administration, System Administration Work Automation. Device Naming, Naming Practices, NIS, DNS, LDAP, Load balancing, Terminology, Advantages, Types of load balancing, Implementing a Network with Load-Balancing Switches.

Books:

1. Mastering Data Centers Servers, Storage and Voice over IP. Kailash Jaisawal.
2. Data center fundamentals. Mauricio Arregoces, Maurizio Portol.

BCA VIII Semester

Course Code	Course Name	L	T	P	Credit
BCA802	Research Project		3	6	6

Evaluation of Internal/
~~Presentation/Seminar based on~~ Research Project will be evaluated by external examiner ~~only~~. appointed by the University on Recommendation of BOS.